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UNIVERSITY OF SOUTHAMPTON

**FACULTY OF SOCIAL AND HUMAN SCIENCES
SCHOOL OF EDUCATION**

**The Impact of Using Wiki Technology in Learning Biology among Al-Baha
University Students: Perceptions, Knowledge, E-learning Skills and Attitudes**

By

IBRAHEEM ALZHRANI

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ABSTRACT

FACULTY OF SOCIAL AND HUMAN SCIENCES

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

THE IMPACT OF USING WIKI TECHNOLOGY IN LEARNING BIOLOGY

AMONG AL-BAHA UNIVERSITY STUDENTS: PERCEPTIONS,

KNOWLEDGE, E-LEARNING SKILLS AND ATTITUDES

By

Ibraheem Abdullah Alzahrani

The use of e-learning in teaching and learning is seen as an alternative to traditional learning and produces knowledge through a variety of academic activities in many Higher Education institutions. The importance of this research arises from the need to provide a blueprint for future strategic developments in e-learning in Saudi universities, and thus improve policy and practice for the betterment of student learning. The present study aims to determine the impact of wiki technology on learning in the subject of biology among Al-Baha University (ABU) students through their interactions with each other.

The study was divided into three stages: before, during and after the use of the wiki. Collaborative learning and constructivist theory was applied in this study in relation to the learning environment for the participants and used the wiki platform as a learning tool (<http://wikibaha.wikispaces.com>). The strategy of the current study was based on the application of the case study as a research approach. The study focused on individuals and teams at ABU and sought to investigate the students' outcomes: their perceptions and knowledge about wiki, the extent of acquiring e-learning skills, achieving biological knowledge, and their attitudes towards the wiki. These five elements were measured through five different instruments. Mixed methods approaches were used to triangulate the results of the study and collect both quantitative and qualitative data from students. The qualitative and quantitative data were collected by using two types of questionnaire and weekly tests for the quantitative data, and by using interviews and e-comments to collect the qualitative data. The data in its entirety was analysed 'en masse' using a thematic framework. In order to integrate two different

types of data in one analytical approach, the researcher qualitised the quantitative data. This process of 'qualitising' followed the technique of Tashakorri and Teddlie (1998). Hesse-Biber and Leavy (2010), state that the term qualitising refers to the process of converting quantitative data that can be analysed qualitatively. Therefore, quantitative data in research questions 2, 3 and 4 were firstly analysed using the SPSS programme, before being subjected to qualitative analysis. The finding of the study showed that students had positive attitudes and perceptions toward the wiki; these perceptions and attitudes varied from one student to another because of the different experiences using the wiki. The findings also revealed that the use of the wiki helped students to acquire e-learning skills through the use of the Internet and other electronic sources. With respect to students' achievement of biological knowledge, the results revealed that the majority of students believed that the written and readable information on wiki pages had a major impact on improving their knowledge of biology. This reflects that students tended to learn biology using wiki pages more than by using the traditional learning method of a 'lecture'. Finally, the study aims to provide evidence that can help to implement change to improve conditions and learning opportunities in Saudi Arabian universities.

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Declaration of authorship

I, Ibraheem Alzahrani declare that the thesis entitled:

‘The Impact of Using Wiki Technology In Learning Biology Among Al-Baha University Students: Perceptions, Knowledge, E-learning Skills and Attitudes’ and the work presented in the thesis is both my own, and have been generated by me as the result of my own original research. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University;
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- Where I have consulted the published work of others, this is always clearly attributed;
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- None of this work has been published before submission.

Signed: Ibraheem Alzahrani.....

Date: 11/12/13.....

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Definitions and Abbreviations

ABU: Al-Baha University.

KAU: King Abdulaziz University.

KSU: King Saud University.

KKU: King Khalid University.

AOU: Arab Open University.

MoHE: Ministry of higher education.

LMS: Learning management system.

Web 2.0: A new version of the World Wide Web.

CLE: Collaborative learning environment.

CLT: Constructivism learning theory.

ZPD: The zone of proximal development.

IN (n): An acronym given to the students who participated in the interviews.

EC (n): An acronym given to the students who participated in the electronic comments.

WT (n): An acronym given to the students who participated in the weekly tests.

QM (n): An acronym given to the students who participated in the questionnaire multiple choices design.

QL (n): An acronym given to the students who participated in the questionnaire 5-point -point Likert scale

Chapter 1: Introduction

1.1 Background and statement of the problem

According to Aggarwal and Khurana (2009, p. 1) research has been defined as “a systematic method consisting of defining the problem, formulating a hypothesis, collecting data, analysing data and reaching conclusion in the form of solution of the problem or certain generalisation for some theoretical formulation”. The present study aims to determine the impact of wiki technology on learning biology among Al-Baha University (ABU) students through their interactions with each other, in order to discover their perceptions and attitudes towards wiki technology, and to find out the extent to which they acquire e-learning skills and knowledge. The Ministry of Higher Education (MoHE) in Saudi Arabia was established in 1975 (Algahtani, 2011) to be responsible for supervising, planning and coordinating the Kingdom’s higher education needs, in order to provide specialised national cadres in the areas of management and the scientific interests of national development goals. The MoHE takes into account the increasing number of students who enrol in the Saudi universities. The demand for higher education in Saudi Arabia has been and remains extremely high (Al-Arfaj, 2011) and Dr Khalid Al Anqari, the Minister of Higher Education explained that the number of students who will study in higher education institutions during the academic year 2013-14 is approximately 420,000 (The MoHE Portal, 2011). Thus, to meet the increase in the number of students, the MoHE has recently established new universities (‘Emergence Universities’) in the cities of the Kingdom. Dr Ali Sulaiman Al-Attiyah, adviser at the Ministry of Higher Education, said the number of Saudi universities has increased over the last ten years to accommodate the demands of Saudi citizens to attend higher education institutions, from seven public universities to twenty eight (Al-Arfaj, 2011). As a result of the increases in the number of enrolled students in Saudi institutions of higher education, efforts had to be made to increase the number of faculty staff members in order to maintain quality in the educational process (Observatory on Higher Education, 2010).

In conjunction with the emergence of the problems related to universities’ facilities, some e-learning centres have been established in Riyadh, Jeddah and Dammam. One of these centres is the National Centre for e-learning and Distance Learning. The custodian

of the two Holy Mosques, King Abdullah, has issued a decree to establish a national plan for the utilisation of information technology. According to Thompson (2011, p. 3) “the plan recommends the implementation of e-learning and distance learning and all their prospective applications in higher education”. This centre, like other e-learning centres in the Kingdom, provides training courses in the field of e-learning for faculty members in Saudi universities. In the period from 2008 until 2010, several workshops took place in ABU for the purpose of training the faculty members of the university to use e-learning in teaching. E-learning is an important part of the variety of teaching and learning methodologies used to enhance student teaching (Spencer, 2008).

Many schools and universities have begun to utilise e-learning systems within their curriculum, since e-learning has many benefits and is a very effective method for teaching students. For example, e-learning saves time and effort for both teachers and students (Mishra and Panda, 2007; Mehra and Omidian, 2012). E-learning, also facilitates the transfer of information to the learner in an interesting and easy way (SAMDI, 2007). Simultaneously, there are some disadvantages that the applications of e-learning in schools face. For example, students may feel isolated from their classmates or teachers; there may be slow Internet connections; and students/teachers may have weak skills in terms of using computers and the Internet. Without computer skills with programs such as word processing, Internet browsers, and e-mail, it is not possible for the student to succeed in e-learning (Cavanaugh et al., 2004).

Currently the most popular use of the Internet in education is Web 2.0 applications (Garoufallou, 2012). Web 2.0 technologies have a significant influence on the higher education sector as well as on libraries around the world (Arif and Mahmood, 2010). The term Web 2.0 was coined in 1999 by Darcy DiNucci and was popularised by Tim O' Reilly (Anderson, 2007). The researcher defines Web 2.0 as a set of online applications such as blogs, wikis, Really Simple Syndication (RSS) and social bookmarking services such as LinkedIn and Twitter, which allow Internet users to deal with the web pages in more interactive ways. These activities include editing, listening, talking, and so on. Table 1.1 illustrates the definitions and the logos for the applications mentioned above.

Application	Definition	Application Logo
Blog	A personal page on the website constructed by the user allows others to see the content without making any changes in the content.	
Wiki	Social interactive pages on the website created by more than one user; consists of several pages.	
RSS	Really Simple Syndication or Rich Site Summary. A way to easily follow the update of the content of sites that you frequently visit.	
LinkedIn	A business-oriented social networking site intended for professionals (Lederman, 2011).	
Twitter	Where viewers can post short messages, called tweets. Twitter is considered a micro blog, because the user cannot enter more than 140 characters in each post (Junco et al., 2012).	

Table 1-1: The most popular of Web 2.0 applications

There are a number of web-based services and applications that demonstrate the fundamentals of the Web 2.0 concept. For instance, the best known are YouTube, Blogs, Wikis and Social Networking sites like MySpace and Facebook (Reynolds, 2007). In the field of education, for example, these applications may be utilised by both learners and teachers to achieve the aims and objectives of education such as building knowledge, developing e-learning skills, and enhancing collaborative learning skills (Redecker et al., 2009).

‘Wikis’ are therefore applications that can help achieve some of these educational requirements. For example, wikis can be used in class projects, and are particularly suited to the incremental accretion of knowledge by a group, or the production of collaboratively edited material, including material documenting group projects. Franklin and Harmelen (2007, p. 5) state that “students can flag areas of the wiki that need attention, and provide feedback on each other’s writing”. The current study will concentrate on the collaborative learning between students to construct the content of the biology curriculum as a means to identify their perceptions of wikis, attitudes toward using wiki technology in learning, and the extent to which they acquire e-learning skills and to measure the biological knowledge as a result of engaging with this technology.

1.2 Significance of the study

The significance of this study comes from the need to find an alternative and more interactive method of learning to the traditional style which relies on didactic methods and indoctrination (Section 2.3.2). Cox et al. (2003, p. 16) suggested that “the use of technology may help to change teaching from a traditional teacher-centred approach to one that is more pupil centred”. Through the application of e-learning at ABU, and the desire of the MoHE to improve the level of performance for both faculty staff members and students by using the Internet in learning and teaching. Furthermore, one of the justifications for conducting this study is that the researcher is one of the faculty members at ABU and he found some obstacles to learning at the University related to the unsuitability of classrooms for learning in terms of classroom equipment, attendance in the classroom and the increasing numbers of students annually. According to Albalawi (2007, p. 7) “the challenge to Saudi universities to meet the educational needs of a growing student population who desire to attend universities increases from year to year”. Moreover, this research can be useful for students to encourage them to research and build their knowledge through collaborative learning. Finally, the geographical characteristics of Al-Baha City sometimes hinder the access of students to the University. Al-Baha City is mountainous and sprawling. Sadagah (2009, p. 191) mentioned that “Al-Baha is characterised by harsh territories and sharp cliffs, where elevation reaches up to 2,200 metres above sea level”. In addition, the weather of Al-Baha city in winter becomes rainy and severely foggy (AbouZied, 2010) and as a result of this, there is congested traffic that impedes the access of students to the University. These geographic factors (climate and topography) are taken into account as a catalyst for conducting the study. The use of wikis can assist the learners at ABU to continue studying while at home when the weather is inclement. The study’s findings could help to provide a blueprint for future strategic developments in e-learning in Saudi universities, and thus improve policy and practice for the betterment of student learning. The work is based on the desire and interest of the researcher to improve conditions and learning opportunities in Saudi Arabian universities and the desire to provide evidence that can help to implement change. Therefore, the researcher hopes that the results of this study will help students to continue their education without interruption, whether it is from their houses or from any other place which provides Internet service through the use of wiki technology.

1.3 The aims of the study

This study addresses the use of wiki technology to enhance university students' experience of learning biology in Saudi Arabia. The use of wikis enables students to learn collaboratively in class and out of the class, at their houses, with friends or anywhere the students can access the Internet. This research investigated the impact of wiki technology on students' learning at ABU through the following means:

- 1- Predetermination of the students' perceptions of wiki technology.
- 2- Investigating the extent of students' knowledge about wiki technology.
- 3- Identifying the impact of wikis on students' knowledge of biology through achievement tests.
- 4- Determining the extent of students' acquisition of e-learning skills.
- 5- Understanding students' attitudes towards using wikis as a learning tool.

1.4 Research questions

The main research question is: What is the impact of using wiki technology in learning biology among ABU students? This question is underpinned by five sub-questions:

- 1- What are students' perceptions of using wiki technology?
- 2- What is the extent of students' knowledge about wiki technology?
- 3- What is the impact of using wiki technology on the students' biological knowledge?
- 4- To what extent do the students' acquire e-learning skills during construction of the biology content via wiki pages?
- 5- What are students' attitudes toward using wiki technology?

1.5 Scope of the study

There are several considerations affecting the scope of the study. According to education policy in the Kingdom of Saudi Arabia (KSA), genders are separated and the study sample consists of males only. The students worked collaboratively to construct the content of the topics of the biology curriculum, both in and out of the classroom, and the data collected via mixed qualitative and quantitative methods.

1.6 Organisation of the thesis

The following thesis is presented in 6 chapters. This introductory chapter consists of background information about higher education in the KSA and the relationship between the learning process in higher education institutions and the use of e-learning in Saudi universities. Furthermore, the chapter includes a review of the significance of the study, the purposes, the research questions, and scope of the study. The chapter ends by defining the key terms used in this study (Appendix 31).

Chapter 2 is a literature review dealing firstly with the literature on the use of wikis in learning, and a review of the aims and objectives of higher education in the KSA. In the second section of this chapter the history of e-learning in general and the needs of e-learning in education in the KSA will be taken into account. Moreover, this chapter illustrates the relationship between wiki characteristics and the learning process. This chapter ends with a review of wiki definitions and the current status of the use of wikis and other Web 2.0 applications in Saudi education.

Chapter 3 provides details of the conceptual framework, addressed in the five main phases of the study: learning theory, learning environment, learning activities, activities outcomes and finally learning community. Overall, this chapter describes how participants in the present study and those who are students at ABU will learn via wiki pages through working collaboratively to construct the content of the subject of biology.

Chapter 4 is the methodology. This chapter contains information on the methods employed to gather and analyse the data on which this research is based. The chapter starts with the introduction and an overview of the research design and research methodology. The section on research methodology addresses in detail the research approaches and the importance of these approaches. The section of research strategy outlines the case study as a research approach and the justifications of using this kind of approach. Data gathering and the instrument types are taken into account in the section on the research instruments and the reasoning behind the choice of these instruments. The section on the pilot study looks at the pilot study in terms of its aims and the key findings obtained. The last two sections focus on the research community, the population and sample and finally the key ethical issues related to this study.

Chapter 5 consists of the findings and data analysis. Usually, the results chapter of any dissertation is one of the most important components of the study, where the statistical analysis must be performed and findings reported and clearly explained.

Chapter 6 discusses the results obtained in order to find out the extent of achievement of the research objectives. This chapter ends with the limitations of the study and recommendations for higher education in the KSA and for further studies.

Chapter 2: Literature Review

2.1 Introduction

Education systems are fundamental elements in the provision of formal education in modern societies (Daniels et al., 2012). The role of an education system is not merely to provide information and resources for students, but also to display this information and evaluate it. An education system is a complex organisation of communications between interdependent bodies, groups and individuals, all aimed at the achievement of a country's educational goals (Okochi, 2008). E-learning supports the viewpoint of 'student-based education' with the student as a hub of the educational process, where there are several tools available to them such as: email, electronic resources, chat rooms, multimedia, etc., while traditional education is more didactic in nature and focuses on the lecturer. More recently, the use of e-learning in higher education has created an interactive and positive learning environment with the participants' construction of knowledge and exchange of ideas and information among students and their teachers (Solans and Mezcuca, 2003).

E-learning provides a contemporary web-based means to overcome temporal and spatial boundaries (Almezher, 2006). As a result, MoHE in Saudi Arabia adopted the application of e-learning in a number of educational institutions, and e-learning is gaining increasing acknowledgment and interest among Saudi Arabia's academic institutions (Mirza, 2008). In the case of ABU, the University is one of the new universities in the KSA and there is an urgent need for staff members and students to keep up with the use of technology in education, as advocated by the MoHE.

This chapter focuses on the research that is relevant to the most important elements in the current study. This includes an overview of higher education in Saudi Arabia and the policy of teaching and learning in higher education. Moreover, this chapter presents the relationship between education and the importance of applying e-learning in Saudi universities to keep pace with technological developments in the field of education. In addition, in order to identify the concept of wikis as a learning tool for the present study, the chapter provides a detailed explanation regarding wiki definitions, a brief history of the wiki and local and global studies about wikis.

2.2 Higher education in the Kingdom of Saudi Arabia (KSA)

In KSA, higher education corresponds to the educational stage that follows high school (i.e., secondary level). The students who enrol in the institutions of higher education are at least 18 years old. Higher education can be divided into two stages: university education which leads to a first degree in a specific subject (i.e., undergraduate) and the postgraduate level which involves a specialisation in one or more aspects of the undergraduate studies. During higher education, students specialise in all aspects of knowledge and are granted bachelor, diploma, masters or doctoral degrees in their respective fields.

Although the research was conducted at ABU, its status as a public university in KSA means the following subsection reflects some of the most important aspects of higher education in Saudi Arabia. This is intertwined with the goal of this study, and will serve as a prelude for the discussion to come.

2.2.1 Higher education policy in the KSA

KSA first adopted an educational policy in 1969. Al-Qahtani (2009) defines the educational policy as a set of operations which are expressed in the form of precise statements in order to organise the nation's educational process. The goal of the policy is to meet and achieve the objectives of the individuals and groups of the society through all the levels and elements of the teaching and learning process. Al-Almaei (2010) clarified that the most important feature of the higher education policy in KSA is that it is comprehensive and standardised to accommodate - in its entirety - the Kingdom's past, present and future aspirations. The Saudi higher education policy combines originality and innovation, achieving the demands of growth and development in the near and long terms. Furthermore, the education policy has an emphasis on giving the opportunity for the gifted students to pursue postgraduate studies in any discipline. According to the national report issued by the MoHE (2011) the policy also plays a positive role in encouraging scientific research in Arts, Science, and Technological inventions. Saudi higher educational policy also stresses that the development of public education is the basis of progress and the real evolution of the nation and its people (Almotery, 2009). Additionally, the policy of education in Saudi Arabia highlights the importance of e-learning. This was emphasised in several articles in the official Saudi

educational policy such as Alkhalaf et al. (2011); Mirza (2008) and Albalawi (2007) which clearly call on using technology, including e-learning, in the educational process. It also emphasises establishing a communications network of e-learning covering all regions of KSA to serve and deploy e-learning.

2.2.2 The privacy of higher education in the KSA with regard to gender

This section gives a brief introduction to the policy of education in the KSA related to gender. Education policy in KSA has four special characteristics: an emphasis on Islam, separate education for women and men, a centralised educational system, and state financial support (Al-Abbas, 2010). The privacy requirements throughout the educational system in KSA in general, and throughout the higher education sector in particular necessitates the separation between genders during the educational process. Thus, in higher education in KSA, there are separate lecture halls for the female students. Male students are taught by male teachers, and female students are taught by female teachers. In some cases, closed circuit television transmission is used to contact the female students if a female lecturer is not available (Al-Khalifa, 2009). The Saudi educational policy is derived from two sources: the Islamic religion, and research results that were conducted in KSA and throughout the world. In accordance with the principles of Islamic religion, Islamic values advocated for the separation between the sexes. Thus, in order to reconcile the educational policies in the KSA with regard to gender, and to face the increase in the number of students at ABU, there must be a suitable way of learning from which students can benefit without the need for them to be present together in a classroom. For this reason, wiki technology can be used as a leaning tool in or out of the classroom, anytime and anywhere, equipment and technology permitting. Moreover, wiki technology has the characteristic which enables both genders to communicate and to benefit from each other through a synchronous and asynchronous communication system.

2.2.3 The Ministry of Higher Education (MoHE)

KSA is experiencing a comprehensive renaissance and development in all fields of education and at different levels. Higher education is one of the main foundations of the development process of any country (Martin, 2005). The MoHE was established by Royal Decree No. 1/236 in 1975 (Algahtani, 2011) to overlook the implementation of

the educational policy of KSA in higher education. Thus, the MoHE is responsible for implementing government policy in the field of university education. University education has received generous financial support from the government, and this was represented by the establishment of new universities and colleges and the huge funds allocated in the country's budget (Albalawi, 2007). Currently, there are 21 public universities, 6 private universities and 18 community colleges in KSA. They offer courses and degrees in Science and Humanities, and the MoHE has pursued the addition of new courses and modernising the existing curricula (Alsenany, 2007). Those working in the higher education sector in KSA have noticed the rapid changes facing this sector from the financial allocations, foreign competition and the changing labour market requirements. Thus, they have realised first-hand the importance of planning for the future and dealing with those variables through well-structured plans for expansion, self-evaluation, adopting programmes and establishing institutions whose activities help in the face of global and local challenges (The Ministry of Economy and Planning, 2010).

2.2.4 Al-Baha University (ABU)

Al-Baha city is one of the western cities of the KSA; it is surrounded by a number of cities, including Taif, Beesha, Abha as well as Red Sea (Figure2.1). The climate in Al-Baha is greatly affected by its varying geographic features. The temperatures ranging between 12-23 Degrees Celsius due to its location at 2500 meters above sea level (The Saudi Net, 2011).



Figure 2-1: The location of Al-Baha City on South West of the KSA

There is one university only in Al-Baha which is called Al-Baha University (ABU). ABU is one of the emerging universities in KSA. It was established through a Royal Decree in 2006. In the following, a brief overview of the development stages of ABU is presented.

Higher education started in the area in 1981 by opening an intermediate education college which was later developed into a university educational college with a four year study system. In 1988, the Teachers College was opened. It awards bachelor degrees after studying for four years and it is dedicated to male students only. Since then, many colleges have been opened to accommodate the increasing number of students who are applying to study. Currently, there are eleven colleges which have 52 departments. These colleges award Master's degrees in three disciplines: Information and Communication Technology in Education, Educational Leadership and Special Education for the Gifted. They also award Bachelor degrees and diplomas in all the other disciplines. There are 13637 students, and 266 faculty members (ABU portal 2013). Three colleges will be added in the near future: The College of Clinical Pharmacology, The College of Dentistry and The College of Computer Science and Information Technology. The current buildings of the university colleges are sited on a rented estate, however, the new campus has been in construction for ten years to meet the administrative and academic needs of the growing university. That is why one of the motivations of the researcher in this study is to attempt to find solutions for the

problems currently facing the university administration due to the large number of students and the inadequate classrooms. As mentioned above, the new campus will contain the latest equipment for e-learning, providing a good opportunity to teach students through the Internet and to use wiki technology as an e-learning tool. Moreover, with the new campus the number of students will increase gradually and a new way of learning will be an urgent necessity.

2.3 Learning biology in higher education in the KSA

Biology is a compulsory subject in most of the KSA universities and colleges. Studying biology allows the interested students to further pursue this subject by enrolling in one of the biology departments in the College of Science to obtain a bachelor degree in biological sciences. On average, a class for teaching biology involves traditional lecturing in the classroom and conducting experiments in the laboratory. This section describes the main points for studying biology in the institutions of higher education in KSA, because biology is the selected subject that will be taught to students of ABU using wiki technology when implementing the research in this study. There are several reasons to select biology for the present study, and several reasons behind the use of wiki to teach the students biology. For example, teaching biology through traditional passive lectures has been found to make learning difficult and also understanding conceptual materials more difficult (Silva, 2012). Replacement by interactive learning coupled with more practical inquiry-based and small group-learning sessions can help to increase student engagement and interest in the subject (Liu and Lee. 2013).

First, there is no research conducted at ABU to study the impact of wikis on learning biology. Secondly, most of the studies in the KSA related to biology have concentrated on the use of computer software such as the PowerPoint programme and computer laboratories (e.g. Alzahrani, 2008, and Alshahrani, 2009). Thirdly, when the researcher was studying as a student in the College of Education at ABU he found that teaching biology was a limited process, occurring only in two places of University ‘the classroom and the laboratory’ that resulted in a sense of boredom and lack of desire to learn, especially for lessons that take a period of time of more than four hours.

Finally, the researcher conducted an exploratory study to find out the teaching style among the biology teachers at Saudi universities. The exploratory study included 19

teachers (12 male and 7 female) from 14 universities. The data was collected through questionnaires that had been emailed to them. The findings (Figure 2.2) indicated that 52.6 % only adopted a ‘traditional teaching style’ when teaching biology, while 21.1% used ‘e-learning’ in their teaching biology and 26.3% used the two types of teaching (i.e., ‘blended learning’). These findings confirm that the teaching style adopted in most of the Saudi universities is the traditional method.

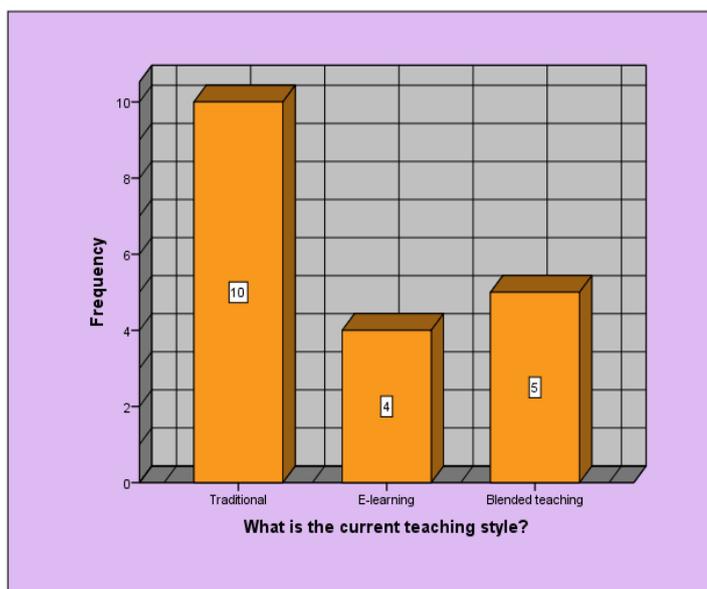


Figure 2-2: Teachers’ responses related to their current teaching style when teaching biology at Saudi universities

2.3.1 Aims of learning the biology curricula in higher education

The MoHE in KSA determined a set of biology learning objectives. These objectives cover the teacher, the student, and the entire educational process (the Department for Planning and Statistics in KSA 2010, and King Abdulaziz University portal, 2012). In science education, the students are engaged in several processes such as observing, comparing, contrasting and hypothesizing (Cuevas et al., 2005). These activities serve as a source of developing science-based processing skills. In addition, the term ‘inquiry’ has figured prominently in science education, which can be broken down into three distinct categories of activities: what scientist do, how students learn, and the pedagogical approach that teachers employ (Minner, 2010). The final goal of these objectives is to teach students the content of the biology curriculum and link it to life

around them. The following are the main objectives of teaching biology according to MoHE (2011):

1- Familiarise and encourage the students with discussion, research, and logical thinking, so that they can arrive at scientific facts and concepts. In other words, develop and nurture the scientific spirit of the students.

2- Provide the students with facts and scientific concepts that help them understand and explain the phenomena using scientific methods such as observation and experimentation.

3- Introduce the students to the environment around them and the natural phenomena to harness science and inventions in order to develop and maintain this environment.

4- Encouraging students to achieve the positive attitudes towards the learning of biology. Attitude according to Seifert and Sutton (2009) is the acquisition of certain feelings about something or someone, either positive or negative, that influences his/her choice of action in a consistent way. That something may be a concept/subject like biology. Consequently, a student who shows positive attitude to biology makes many choices favouring biology such as: attending biology lessons, being eager to undertake biology assignments, liking the biology teacher and loving nature (Nwagbo, 2006). A combination of some of these factors would constitute his/her attitude to biology. However, both high achievement in and favourable attitude to biology are indicators of the success of the teaching style used in biology.

In addition, the researcher believes that the aim of learning biology via wiki technology provides a possible alternative teaching style to that currently undertaken (i.e., lectures), and to encourage students to learn collaboratively in groups and thus help students to benefit from each other's knowledge (Barton and Cummings, 2009, and Chen, 2008). Student-centred approaches using discussion-based science teaching engages students in the investigative nature of science (Balanay and Roa, 2013). Inquiry involves activities and skills that focus on the active search of knowledge and the understanding of different scientific phenomena (Ketpichainarong et al., 2002). Furthermore, learning biology through wikis and accessing the Internet can facilitate the discovery of scientific information related to biology.

2.3.2 Brief history of learning biology in the past

In the past, universities and colleges adopted traditional methods in the teaching of biology. For example, at the establishment of the first Saudi university in 1957, the University of King Saud, students were studying the material inside the lecture hall in a classroom style of recitation and memorisation (King Saud University portal, 2011). The lecturer would explain the material to them and the students would take notes or consult their books or other references available in the university library. In this case, the teaching process is centred on the lecturer who is the reciter of the content and the students are mere recipients. Thus, there is little connection between the teacher and the learner; in other words, the lesson depends entirely on didactic methods of 'transferring' the information into the students' minds (Ballard and Bates, 2008). The conventional teacher-centred approach is focused on the teacher, where the teacher talks and the students just listen. This teaching style usually ends with the teacher asking the students if they have any questions, and this is the most commonly used teaching method in schools and universities in many countries (Fry, 2009). However, with the student-centred approach the students are exposed to as well as other teacher hands-on activities thus, they will gain first-hand experience, and they will also know how to use all their senses. The trend to move away from teacher-centred to a more student-centred approach gives students more opportunity to reflect on their own learning, gain deeper understanding of scientific concepts and develop critical thinking skills (Bain et al., 2005).

2.3.3 Learning the biology curriculum in the present time

By the end of the twentieth century, teaching biology had become more vibrant, and the interaction between the students and the lecturer/teacher increased (Cochran-Smith et al., 2008). With the development of higher education in Saudi Arabia, teachers (of biology or other subjects) have started to use teaching aids such as computer programmes, the Internet websites, and other educational means to facilitate the learning process. Also in order to enhance the learning environment, the new technologies have been introduced to schools, universities and other educational institutions to achieve this purpose (enhancing the learning environment) and to establish a better understanding of the concept of learning. According to Van Rooy (2012, p. 65):

“The presence of digital technologies in schools makes it possible to enhance students’ understanding and exploration of biological concepts and phenomena. The emergence of new understanding in molecular genetics, for example, with its reliance on information and communication technology (ICT), implicates two issues: multimodal ways of knowing and representing and more open-ended, experimental, exploratory investigations”.

These teaching aids are usually displayed by the teacher, but often he/she might need the help of other students to demonstrate to the rest of the class. In this case, the role of the learners become to observe and conclude and to link with the theoretical explanation (Shulman, 2009, and Brophy, 2009).

Colleges teaching biology now have well-equipped laboratories which help both the students and the lecturer achieve their goals. Such laboratories often contain fixed and animated models, samples of living organisms, and other visual aids such as movies and animations of animal and plant organisms. Given the global trend of employing modern technology in education and communication such as using computers and the Internet, Morrell (1992) and Owusu, et al., (2010) stated that since computers were used in the classroom in the early 1960s they have added almost endless opportunities for the teachers’ instructional strategies and enrichment of the learner’s experiences. For science education in particular, the computer appears to be a technology which, when effectively integrated into instruction, could lead to improvement in student motivation and learning. Over the last few years, computers have attracted widespread interest as teaching tools in the biological sciences. Computer science education, information and communication technology (ICT) are at present becoming one of the most important elements defining the basic competences of students. In science and biology education there increasingly used for the computers and the Internet in teaching, showing the student the world in a holistic manner (Skrzypek et al., 2011). The use of computers in learning of biology for example offers opportunities to study biology in new and exciting ways, helping to answer questions like: How can we organize, share or visualize vast amounts of biological data? What can we learn by simulating and modelling complex life processes? How do cells, human populations and other complicated biological systems behave under a variety of conditions? Pevzner and Shami (2009). Also computers are used in many aspects of teaching biology; they may

be used to present biological information and concepts, to simulate complex situations, develop generic skills, to graph and manipulate data, and to assess students (Chambers, 2005). Saudi universities are still in the early stages of using this technology in their university education through e-learning (Xu and Quaddus, 2010). Perhaps the most innovative attempts by some universities are to teach biology using virtual labs, but the current teaching of biology generally lacks the services provided by contemporary technology.

There are many studies underlining the importance of using technology in teaching biology. For example, Al-Khayat and Ajmi (2001) concluded that the use of technology helps in achieving the educational goals, makes the students interested, attracts their attention to the lesson, makes them aware of the subject matter, and improves their attitude towards the subject as a whole. This supports the importance of using modern technology in the teaching of biology. As Keengwe (2007) reported, educational technology can help to improve the education of students of all ages and levels, save a lot of effort in teaching, reduce the burden on the teacher, and overall improve the quality of teaching.

2.4 The concept of e-learning

‘E-Learning’ is an abbreviation for electronic learning. The beginning of e-learning in education began 50 years ago (Cox 2012), since then it has evolved in different ways in business, education and the training sectors (Nicholson, 2007). E-learning is a wide term that generally indicates any kind of learning done with a computer or computer with the Internet or CD-ROM (Hinkle, 2010), and it is designed to build knowledge and skills related to individual or organisational goals (Clark, 2002). According to Abd El-Gawad and Woollard (2009, p. 5), “One of the most important benefits of e-learning system is its ability to flyover the boundaries of time, place, and nationalities. It can provide teaching with a true sense of internationalisation”. The main functions of e-learning are to enhance the learning and teaching process, access to accurate information in an easily interpreted form, and to develop educational skills among the learners. Moreover, e-learning is the use of electronic means to deliver content from educators to learners or to users in general. This type of learning refers to the use of the computer itself; individually as learning through a virtual learning environment, or a

computer with the Internet via websites such as web 2.0 technologies of wikis, forums, blogs etc. According to Naidu (2006, p.11)

“The term e-learning comprises a lot more than online learning, virtual learning, distributed learning, networked or web-based learning. As the letter “e” in e-learning stands for the word “electronic”, e-learning would incorporate all educational activities that are carried out by individuals or groups working online or offline, and synchronously or asynchronously via networked or standalone computers and other electronic devices”.

There are fundamentally two types of e-learning, asynchronous or self-paced, and synchronous or instructor-led or mentored (Zornada, 2005, and Lovelace, 1999). Some literature studies claim that there are more than two types of e-learning, but this division depends on several aspects such as delivery method, content and the degree and kind of interaction between learners. In addition, the effectiveness of e-learning depends on establishing two-way communication between teachers and learners, and learners themselves. The important matter in this type of learning is the use of technology to provide students with the information in a shorter time period with less effort and better understanding.

2.4.1 History of e-learning in the KSA

Distance education and e-learning in KSA has experienced dramatic national growth since the early 1980's (Al-Fahad, 2009). Distance learning was the first formal trial to use e-learning concepts and practices in the Saudi education system. Albalawi (2007, p .19) describes distance learning as learning which “takes place when a teacher and student(s) are separated by physical distance, and when technology (i.e., voice, video, data, or print) bridges that distance”. In recent years, some universities and educational institutions have provided commercial Learning Management Systems (LMS) such as Blackboard, Web Course Tools (WebCT), and Tadarus (which is an Arabic-language LMS) to facilitate online learning and teaching (Alebaikan, 2010). With the steady rise in the volume of the e-learning in Saudi Arabia, many Saudi governmental organisations are keen to take advantage of this technique. In this regard, a delegation from the MoHE of Saudi Arabia visited the United Kingdom in 2004 to explore the available opportunities in e-learning programs for use in the Kingdom of Saudi Arabia,

as the first attempt to benefit from the international experiences in the field of e-learning.

Later, in 2009, the Saudi Minister of Higher Education, Dr Khalid Al-Anqari, opened the first international conference on e-learning and distance learning in Riyadh. The event was organised and sponsored by the Saudi MoHE. The current e-learning initiatives are evidence of the seriousness of the governmental (education and non-educational) bodies in Saudi Arabia in the field of increasing the technical awareness among the various sectors of Saudi society. Applications of e-learning in the Saudi educational sector have passed through four stages:

- 1- Initial attempts to implement distance and e-learning started in 1980 (Aldraiby, 2010).
- 2- Students started to learn using personal computers (as a stand-alone module) from 1985.
- 3- Internet based-teaching was initiated in Saudi Arabia from 1994. Access to the Internet was then available to the public. According to Al-Subaihi (2008, p. 125) “Internet was officially made available to public in 1997 by a ministerial decision”.
- 4- Using e-learning applications, including Web 2.0 applications in Saudi educational institutions formally started in 2005.

Because of modern technologies have greatly influenced education (Ageel and Woollard, 2012) the Ministry of Education in Saudi Arabia has recently started applying e-learning curricula in schools through the implementation of a pilot project (electronic classroom: e-classroom) in five secondary schools in Riyadh. Moreover, the universities and colleges throughout Saudi have achieved great strides in the use of e-learning solutions. For instance, according to Al-Jarf (2005) King Saud University (KSU) in Riyadh is one of the first universities that have adopted and incorporated e-learning tools into their curricula through the adoption of learning management solutions (WebCT). Furthermore, King Abdul Aziz University was the first university that used e-learning curricula to serve the students who are enrolled in distance learning or regular classes. King Abdul Aziz University also has the largest electronic library in Saudi Arabia, containing more than 16000 e-books (Al-Khalifa, 2010). King Khalid University also started a pilot project for e-learning in 2005. The Arab Open University (AOU) offers courses according to e-learning systems using the First Place system

provided by the Open University in the United Kingdom. Saudi Aramco, the giant oil company, also has a very successful e-learning system which is used in its employee training centre. The present study comes as application of the concept of e-learning in Saudi universities in general and at ABU in particular through the use of one of the Web 2.0 applications: wiki technology.

2.4.2 The need of e-learning in Saudi Universities

Saudi Arabia is one of the 12 biggest countries in the world, covering approximately 868,730 square miles 2,250,000 square kilometres (Alexander, 2011; Alebaikan, 2010, and Jandt, 2009). The April 2010 census revealed a population figure of 27,136,977 including 18,707,576 Saudis (Kaukab, 2010). The population in the KSA is growing dramatically (Albalawi, 2007). As a result of the increases in population, the number of students has increased accordingly, leaving the institutions of higher education in Saudi Arabia with problems of how to deal with the increasing student population (Alqahtani, 2010), and therefore must find a style of education commensurate with the huge number of students wishing to enrol in universities. Moreover, some cities such as Al-Baha, Abha and Al-Taif are mountainous regions. Residents of these cities are spread away from the centre which is often where the universities and colleges are situated and thus students and faculty members take a long time to get to the universities, which may cause delays or absences. The need of e-learning can be found for students and faculty staff members in the big cities such as the capital city Riyadh, Jeddah and Dammam which are usually crowded with large numbers of cars, especially at peak times (Milaat et al., 2000). This causes difficulty to get to the universities. For these reasons, and the reasons that have been mentioned previously in Section 1.2, the need of a new method of learning and teaching such as e-learning is necessary to eliminate the above-mentioned problems. Moreover, the need for e-learning is to provide a blueprint for future strategic developments in e-learning in Saudi universities, and thus improve policy and practice for the betterment of student learning.

2.4.3 Institutions of e-learning in the KSA

In light of the revolution of information technology and communications, several institutions in the field of e-learning have recently emerged in KSA. King Abdullah has issued a royal decree to establish a national plan to exploit information technology (IT).

The plan strongly recommends the implementation of e-learning and distance learning in higher education. The following is a brief summary of the most important among these institutions.

First, in 2007 the MoHE established a National Centre for e-learning and Distance Learning (ELC). The ELC is the institution responsible for organising international conferences on e-learning, for example, the ELC organised three international conferences on e-learning in Riyadh in 2009, 2011 and 2013. This centre aims to support the creation of electronic educational material, and provide an electronic venue for faculty members of any Saudi university to utilise in creating e-courses through its own Learning Management System (LMS): Jusur (Mirza, 2008). Also the ELC provides training workshops for faculty members in Saudi universities in the field of e-learning. Finally, the ELC provides technical support as well as the tools and means necessary for the development and publishing of e-learning content (ELC portal, 2011).

Secondly, the Saudi government established the Knowledge International University (KIU) in 2007. This university was conceived as a platform for providing accurate and balanced knowledge to the widest possible audience via the Internet. Its main goal is to bring higher education to people who are unable to enrol in courses at conventional universities (KIU portal, 2011). In order to achieve this goal, KIU has gathered an international array of leading scholars of the highest reputation to supervise and deliver academically sound curricula in the various traditional disciplines of learning. KIU utilised the most modern and advanced teaching methods which are in use at the best international universities.

Thirdly, the government established e-learning centres in all Saudi universities (Al-Khalifa, 2010). These centres are an essential part of universities. The aim of these centres is to make the faculty members and students aware of the e-learning strategies and how to use e-learning in their learning. The centres work in coordination with the main centre for e-learning in the capital Riyadh, especially in holding training courses and national and international conferences. The level of activity and effectiveness of these centres varies from one university to another due to several factors such as the experience of the staff, the interest of the university administration in e-learning, and the response and support of the main centre in Riyadh to inquiries and requests of assistance from the individual university centres.

However, despite all these advances and attempts by the government, there is still a strong resistance to fully online distance education, especially from the national accreditation agency in KSA. The main concern is the quality of education offered; for example, degrees awarded by the AOU are still not recognised in KSA.

2.4.4 Web 2.0 applications as an aspect of e-learning

Technological advances have helped teachers to create lessons that involve learners in the process of learning by introducing several types of tasks and activities whose aim is to promote the interactions among the learners. In this regard and according to Liu and Lee (2013), e-learning is a powerful method of delivering information that can make a significant difference to how learners learn and quickly they master a skill; how easy it is to study; and, equally important, how much the students enjoy learning. The term ‘Web 2.0’ was coined in January 1999 by Darcy DiNucci in her article entitled ‘Fragmented Future’ (Bhuiyan, 2013). The term Web 2.0 did not resurface until 2002 (Smith, 2011). Then in 2004 Tim O’Reilly of O’Reilly Media and John Battelle of Media Live held the first ever Web 2.0 conference. The concept of Web 2.0 arose from a brainstorming session between O’Reilly and Media Live international. During their meeting O’Reilly and Battelle formulated an initial sense of Web 2.0 as shown in Table 2.1.

Web 2.0		Web 1.0
Google AdSense	→	DoubleClick
Flickr	→	Ofoto
BitTorrent	→	Akamai
Napster	→	mp3.com
Wikipedia	→	Britannica Online
Blogging	→	Personal webpages
upcoming.org ad EVDB	→	Evite
Search Engine Optimisation	→	Domain name speculation
Cost per click	→	Page views
Web services	→	Screen scraping
Participation	→	Publishing
Wikis	→	Content management systems
Tagging (folksonomy)	→	Directories (taxonomy)
Syndication	→	Stickiness

Table 2-1: Compare components of Web 1.0 with components of Web 2.0 (applications and technologies) O’Reilly (2005)

So far there is no precise definition of Web 2.0. Thereby, several authors defined Web 2.0 as a term that refers to a set of new technologies and web applications that led to the coexistence more effectively with the World Wide Web Internet. According to Perry (2009, p. 51)

“Web 2.0 is a category of Internet tools that effectively turn users into media contributors. The technology allows virtual communities to be built and opinion, knowledge and ideas can be shared. The potential for this has clear implications for not only social computing but also education, government and business. Wikis, second life, blogs and RSS feeds are examples of facilities offered by Web 2.0”.

Another definition mentioned by Ullrich et al. (2008) is the following: “the term Web 2.0 is used to describe applications that distinguish themselves from previous generations of software by a number of principles”.

Web 2.0 allows users to run software-applications entirely through a browser (Shah, 2009). There are other characteristics related to the ability of user with regard to regulating and managing their participation; i.e., their data. According to Jespersen (2008, p. 118), “users can own the data on a Web 2.0 site and exercise control over that data”. In addition, Web 2.0 is characterised by openness, freedom, collaborative work to build a Website and collective intelligence by way of user participation (Katsirikou, 2011).

Some of the Web 2.0 applications such are: wiki, blogs, forums, RSS and social networking platforms require the interaction between the users which leads to make them be content creators more than just being readers. These applications made Web 2.0 services more popular and easy to use. The main reason behind the popularity of Web 2.0 is that users can see, edit, delete, change, and create the Web 2.0 pages easily. These features are due to the containment of Web 2.0 of special techniques, such as Asynchronous JavaScript and XML (AJAX) technology.

2.4.5 Technology enhanced learning (TEL)

Technology enhanced learning is described by JISC 2010 (Joint Information Systems Committee, UK) as a culture where a broad range of learners are provided with a robust

technology environment that provides effective learning opportunities, wherever the learner chooses to learn. The term technology-enhanced learning (TEL) according to Kirkwood and Price (2013) is used to describe the application of information and communication technologies to teaching and learning. Enhancing the learning process can be considered as one of the main aims of the researchers in this field of education. However, in order to enhance, and to find the best ways of, learning for both the teachers and the learners, studies have found that using the technology in learning would help students to learn in less time, with less effort, fewer failures on the one hand and to achieve a high level of mastering the topics on other hand. For example, “Increasingly new technologies are supplementing and enhancing the learning process. These technologies can support new views of science teaching” Hartman. (2009, p. 175). The use of technology to enhance the learning process has been applied widely in most institutions of the higher education. Examples of these technologies are the computers and their applications and other electronic devices such as smartphones and e-book readers. The impact of these technologies in learning can be determined through the extent of the interaction and discussion between the teacher and the students and among the students themselves in collaborative learning environment. Higgins et al, (2012, p. 4) stated that “The use of computer and digital technologies is usually more productive when it supports collaboration and interaction, particularly collaborative use by learners or when teachers use it to support discussion, interaction and feedback”.

2.5 Wiki technology as an aspect of Web 2.0

Wiki technologies are one of Web 2.0 applications (figure 2.3) that can be used to improve learning methods and to engage students in learning with others in a collaborative environment (Parker and Chao, 2007).



<http://www.shabab-wayn.tv/wp-content/uploads/2009/10/web2.jpg>

Figure 2-3: The most common applications of Web 2.0 among the Web 2.0 users

With respect to the vitality of content of wiki compared to the other web 2.0 applications Franklin and Harmelen (2007) reported that in the Web 2.0 platform many people will create and modify content, which may lead to questions as to who owns the content. There are numerous participating parties and potential content owners, including the site owner, and people who created or contributed to any amendments of the content. With other Web 2.0 applications contribution are probable to be limited to additional comments, tags, and recommendations and are usually separate from the original content, but with a wiki the content is created more dynamically. Due to the previous features of wikis, Adie (2006) suggests that wikis are a key element of Web 2.0 compared to other Web 2.0 components.

2.5.1 What is a wiki?

To identify the concept of a wiki the researcher will review the main aspects related to wiki technology in terms of: history, objectives, definitions and the main components. Then by the end of this section, the researcher will attempt to give a perception of the meaning of wiki.

2.5.1.1 Historical brief

The story of the term 'Wiki' began when Ward Cunningham was in Honolulu International Airport. Cunningham explained that the term wiki was due to an experience he had in a Honolulu airport. While he was looking for a bus, the airport employee told him to take the so-called 'wiki wiki' shuttle bus line that runs between

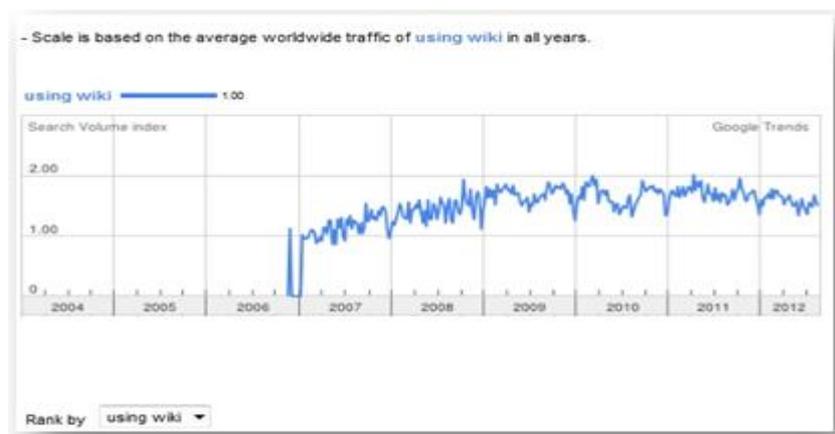
airport terminals (Safko, 2010). Cunningham later found that the term 'wiki wiki' meant fast in Honolulu (Barman, 2006).

Cunningham invented the wiki concept and implemented the first wiki engine, which was the first software of wiki. According to Cunningham (2008), wiki-wiki an alliterative substitute for 'quick' and thereby avoided naming this stuff quick-web.

WikiWikiWeb was the first wiki website that Cunningham started developing in 1994. On March 25, 1995 he installed it on the Internet domain c2.com to be called a wiki (Kurosu, 2011). Cunningham developed Vannevar Bush's ideas by allowing users to comment on and change one another's text. Barman (2006, p. 110) mentions "in the early 2000s, wiki was increasingly adopted in the enterprise as collaborative software. Common uses included project communication, intranet and documentation, initially for technical users".

The most famous wiki website called Wikipedia was launched on 15 January 2001 (Jordan and Hall, 2010). After 2001 the number of wiki websites and the wiki engines increased exponentially. In 2002 Social text (first wiki company) launched the first commercial open source wiki engine. Open source wikis such as KWiki, TWiki and MediaWiki, had over one million downloads by the year of 2004 reported on Source forge (Beermann, 2005, and Barman, 2006). There now exist thousands of wiki websites and hundreds of wiki engines.

Finally, according to Google Trends website (Figure 2.4), the users of wiki technology have increased gradually from 2006 until 2012. The ten countries most effectively using wiki: India 2. Singapore 3. Philippines 4. Malaysia 5. New Zealand 6. Australia 7. Ireland 8. South Africa 9. United Kingdom 10. Canada.



<http://www.google.com/trends/?q=wiki>

Figure 2-4: The upward trend for the number of wiki users from 2006 to 2012

2.5.1.2 Wiki definitions

Schneider et al. (2008, p. 131) concluded a general definition of wiki as “a Web site that is designed to allow multiple users to contribute content and edit existing content quickly”. The affordances of a wiki is to support collective work in which learners take responsibility for their participation (i.e., creating content), and in which individuals learn on other contributions (Grant, 2009). The concept of wiki has been described by several authors in terms of collaborative work, collaborative web space, collaborative writing, collaborative platform, collaborative Web tool, collaborative document, collaborative open notebook, collaborative authoring and collaborative encyclopaedia. Simply, “a wiki is an editable website that is created incrementally by visitors working collaboratively” (Cole, 2009, p. 142).

A semi-comprehensive definition for the meaning of wiki is given by Baird and Nye (2009, p. 4) who state that wiki is “a web page with an ‘edit’ button that anyone can click and begin writing and editing, without the need of a word processor or other software. Wiki is a web-based and as such, they make writing and editing text easy and collaborative”.

The researcher believes that the common definitions that have been repeated in most of the studies were as follows: According to its original creators Leuf and Cunningham (2001, p. 14), “a wiki is a freely expandable collection of interlinked webpages, a hypertext system for storing and modifying information – a database, where each page

is easily edited by any user with a forms-capable Web browser client". From the previous definitions a wiki can be defined as a collaborative work editing (creation - add - delete) between the group of users who have permission to access the site on the Internet. This website has special components that enable the users to deal with this website easily. A further discussion on these components is described in Section 2.5.4. The following wiki definition for the purposes of this thesis is: Wiki technology is a private website designed by the researcher which includes most of the wiki characteristics hosted by one of the wiki engines.

The present wiki allows students at ABU, College of Science to work collaboratively in groups and individually, in or out of the classroom, to construct the content of topics in the biology curriculum determined previously by the biology teacher. With this wiki, students communicate with each other via two communication systems: synchronous and asynchronous communication.

2.5.1.3 Goals of using wiki

The goals of using wiki vary depending on the purpose for which it was created. The purpose of wiki may be educational purpose, medical purpose, commercial purpose etc. In general, a wiki aims to provide a collaborative authoring environment to help users understand things he or she knows little or nothing about. Jones (2003, p. 15) stated that: "the goal of wiki sites is to become a shared repository of knowledge, with the knowledge base growing over time, and they are expected to have some degree of seriousness and permanence". However, the common goal that wiki provide an open platform for the wiki user is to collaborate together in order to create and to share updated knowledge (Ma and Yuen, 2008). Wang and Beasley (2008, p. 106) suggest a further goal of using wiki in terms of the editing feature; they say "the goal of wiki is providing a platform for people editing openly and freely. Moreover, West and West (2009, p. 52), emphasise "the goal for wiki group members is to engage in constructive editing. Constructive editing is aimed at improving the wiki outcomes while also maintaining collaboration and group cohesion". Finally, several studies in the field of learning and teaching via wiki (Section 2.5.2) used the terms such as enhancing, developing, and improving, to denote the purpose of using the wiki.

Therefore, with regard to the present study, the goal of using wiki does not depart from the goals stated in the course of this section. Thereby the goal of using wiki is to find a

pattern of learning at ABU in line with the modern technology age through identifying the use of wiki technology in learning biology.

2.5.1.4 The main components of wiki

Most wikis include the same components (icons and pages) with each component having a specific function. This section discusses the main components that the wiki technology usually includes and the importance of each one. Figure 2.5 illustrates the main four pages used in most wikis, these pages are 1- the main page, 2- the discussions page, 3- the comments page, and 4- the history page.



<http://commons.wikimedia.org>

Figure 2-5: The main icons used in most wiki pages

The three main functions supported by every wiki are the flexibility of using wiki components, the ability to edit the content includes ‘adding and/or deleting’ content, and the history function which enables the users to know the recent changes on any of the wiki pages. The main page or as it is called ‘Home page’ is the first page of the wiki. This page provides information about the content of the wiki, occasionally this page is editable through the edit button. Both editors and administrators can edit the content of any other writing of any page (Pattera et al., 2007).

Another page called ‘History Page’ is one of the most important pages in wikis. The feature of this page, according to Cubric (2007), allows a display of the version history of the any page of the wiki and selection of an arbitrary version for display. This function provides necessary safeguarding against any malicious edits or deletions. Thus, if any page suffers from an accident or vandalism by the users, the administrator can very usefully return to the ‘pre-vandalism’ version of the pages (Ramirez, 2009). Wiki platforms have a history and option to roll back if necessary which allows users to

restore a previous content (Malloch et al., 2010). This page also allows users to see what recent changes have been made to wiki in chronological order.

To improve the content of a wiki, each wiki has a discussion page. The discussion page (or talk page) is used in collaboration to talk about ways of improving the content of wiki pages, determine which content is appropriate, and propose future work on the subject. Discussion Pages facilitate debate and conversation among wiki users, opening their eyes to each other's backgrounds, goals, and points of view (Kuznetsov, 2006). Thus, collaboration via the discussion pages encourage users to work together, thereby causing them to meet other members with similar interests.

'Notify me' in some wikis this page is called 'Email Notifications' the function of notification is to alert or remind the users each time the page is changed through receiving an email. (Depending on how notification is configured). There are other functions and features that make a wiki more effective. These features are usually in one page called 'Manage Wiki', (Appendix 30) these features such as Members, Invite people, Permission, Wiki Statistic and so on. In order to help students using the wiki in good manner during the present study, a wiki tutorial was given to them before the use of wiki (Appendix 12).

2.5.2 Wikis in education, local and global studies

The following section highlights the studies that were conducted in the field of wiki use in education, in both the KSA and some other counties. Initially the studies were conducted locally in the KSA.

2.5.2.1 Local studies

Few studies in the KSA have addressed the use of wikis in education. However, there are studies carried out in the field of e-learning some mentioned wiki as part of these studies. For instance, the study of Al-Qahtani (2010) aimed to demonstrate how social software such as wikis, blogs, RSS and Social Bookmarking affect the e-learning competence in the community of practice of e-learning of the teaching staff in King Khalid University (KKU). To achieve the aim of the study an experimental method was applied in order to examine the effect of the independent variable (social software) on

the dependent variable (acquiring e-learning competence) related to learning in the community of practice of e-learning (COPE).

The study used an achievement test of the cognitive skills of e-learning, an observation sheet of performance, and a scale to measure attitudes towards learning. The results showed a statistically significant difference (at $p < 0.05$) between the average of the experimental group and that of the control group in the post-application of the achievement test and the observation sheet in favour of the experimental group.

However, there was no difference in the attitude scale. In the light of these results, the study presented some recommendations: social software has become so essential in sustaining COPEs, universities should encourage online COPEs supported with social software, they should be encouraged in other contexts than e-learning, and university sites should make such software available to help COPEs. Al-Qahtani recommended further studies of social software's effect on other learning aspects like the skills of e-learning, thinking and communication skills, and teachers' and students' COPEs.

Al-Ghamdi (2010) used wiki technology as a Web Content Management System (WCMS) as an electronic resource to teach 'secondary school female'. Al-Ghamdi employed the one-group quasi-experimental design. The sample comprised (18) secondary-school female-teachers. Al-Ghamdi conducted the pre-post measurement tests to examine participant subjects' knowledge and skills related to supporting online courses design using an academic knowledge-based test. Moreover, Al-Ghamdi employed an assessment checklist to examine supporting online courses designed by participant female-teachers. The results showed that all participants succeeded in mastering required knowledge and skills to design the online courses after used the proposed web-based e-training portfolio. Al-Ghamdi defers this result to the fact that participating female teachers have positive attitudes towards using e-learning advanced tools and innovations. The results also pointed out the extent of their adherence to upgrading their professional self-development and obtaining plausible support from their schools and the great convenience of the proposed web-based e-portfolio to take into consideration teachers' potentials and the ability to satisfy their various training needs.

Al-Amoudi (2009) from the Arab Open University (AOU) presented a paper at the First International Conference on e-learning and distance education in Riyadh. The paper

talked about the impact of social software in the system of Web based-learning. Moreover, the paper focused on the discussion of the shift in web-based e-learning to collaborative learning through using social software such as wiki and blogs. Al-Amoudi presented two reasons for the emergence of social software as being: 1- Steady developments in technology and technique, which imposes itself through network communications services and web video and audio. 2- Emphasis on the importance of community in building knowledge. Finally, Al-Amoudi presented a description of the social software including wikis. In addition, social software is the fastest sector of e-learning growth in recent years, such as blogs and wikis, discussion forums and social networks.

Al-Mohia (2008) attempted to measure the effect of e-learning 2.0 on collaborative learning skills at the teachers' college at KKU in Abha. The study community comprised (1874) students during the first semester of the academic year (2007-2008) and a sample of (51) students were randomly selected. The quasi-experimental method employed two groups post-test design; the (25) students in the experimental group were taught in collaborative learning style based on e-learning 2.0 tools that included mainly wiki and blogs. However, the (26) students control group were taught the same content but in collaborative learning style using traditional e-learning based on the learning management system (LMS). The study concluded that there was generally low level of collaborative learning among the two groups; hence there were no significant differences in collaborative learning among the e-learning 2.0 group and the traditional e-learning group. However, after analysing the results it was noticed that there were no significant differences at the first level 'Sharing/Comparing of Information' but there were significant differences at (0.01) in favour of the experimental group at the second level 'Discovery and Exploration of Dissonance or Inconsistency among Ideas' and the third level 'Negotiation of Meaning/Co-construction of Knowledge' of the collaborative learning. On the contrary, no participation was recorded at the fourth level 'Testing and Modification of Proposed Synthesis' and fifth higher level of collaborative learning 'Co-construction and Agreement Statement(s)/Application of Newly-Constructed Meaning'.

Al-Khalifa (2007) investigated the use of wiki platforms as a means of online collaboration among female students in KSU, Riyadh. The experiment was applied on a

group of 105 female students studying a course in ‘Operating Systems at Information Technology department’. The experiment was carried out over the course of a complete semester. Al-Khalifa has discussed the results of a pragmatic experiment using wiki platforms to leverage students’ classroom participation. It is evident from the results that most students accepted the idea of using wiki in classroom participation. However, some students suggested that the wiki participation should be a bonus instead of making it part of the course final grade. The wiki system used in this experiment was not capable of effectively and accurately monitoring students’ participation.

2.5.2.2 Global studies

This section deals with a range of studies that indicate that the aim of conducting studies on the use of wikis is multi-purpose, while the overall goal is to serve humanity in different areas, such as, for example, in the fields of education, medicine or engineering. With regard to the use of wikis for collaborative learning, “research studies on using wiki have been carried out for almost a decade and they revealed that wiki seems to be an effective tool for collaborative learning and writing” (Leung and Chu, 2009, p. 2). Several studies were conducted in this aspect. For instance:

Su and Beaumont (2010) evaluated essential aspects for the successful deployment of a wiki in a higher education setting using Salmon’s five-stage e-learning model: Stage 1: access and motivation, Stage 2: online socialisation, Stage 3: information exchange, Stage 4: knowledge construction, and Stage 5: development. They suggested that a wiki can promote effective collaborative learning and confidence in formative self and peer assessment by facilitating rapid feedback, vicarious learning through observing others’ contributions (i.e., the notion that students learn through being given access to the learning experiences of others. In these situations, one student is the focus of tutorial attention while others benefit from observing the interaction).

With regard to writing skills, in many different regions of the world, such as the United Kingdom, Brazil, Japan, United States and Hong Kong several studies have been conducted to examine the impact of using wiki in education to enhance and develop writing skills among students. Mak and Coniam (2008) conducted their study in one of secondary schools in Hong Kong. They used wiki platform to find out whether wiki can enhance and foster writing skills among students through so-called authentic writing. Students in English in year 7 at a secondary school worked together in four groups to

produce a wiki-based brochure about their new school. The findings suggest that wiki projects can promote the process of writing and the production of larger amounts of writing than normal. Analysis of the students' contributions to the wiki found that, while at first students simply added to the brochures, as the project progressed they began to revise each other's contributions and write more collaboratively, alternating between developing and expanding on the existing wiki content.

Wheeler and Wheeler (2007) from University of Plymouth, the United Kingdom, carried out a study to investigate undergraduate teacher trainees' use of wiki. This study focused on the use of wiki technology as a method that could promote higher quality academic writing skills for undergraduate and postgraduate students, writing as a social practice. Collaborative writing was limited due to the reluctance of students to change each other's work. Further the study focused on the use of shared spaces to communicate ideas and generate course specific content. They explored how students, through such activities, were able to improve their academic writing skills. Findings indicated that most students raised their skill level in writing as a result of using the wiki space. Moreover, students appreciated the shared environment to discuss the course. Students reported their academic writing skills improved through the use of wiki.

Franco (2008) used a creative way which is called peer-correction. Franco has designed a wiki to meet the needs of digital learners who spend most of the time connected to the Internet. The learners were able to have a better command of writing strategies. Students have already accepted wikis as a new method of writing and they would rather write using a wiki than writing on paper. The result revealed that wikis enable them to raise their awareness of the writing process. In addition, learners become less dependent on the teacher and share responsibility with their peers and take more responsibility for their own learning. Moreover, peer-correction can provide feedback to their peers by trying out new ways of becoming involved with the writing process. Overall, the results indicated that students' attitudes towards writing were positive.

Li et al. (2010) conducted their study with wikis in primary schools in four Chinese classrooms to find out attitudes and perceptions of students and teachers toward collaborative writing. The results of this study pointed out that students showed improvement in writing attitudes after engaging in collaborative writing with wiki. The

results also found that most students became more interested in writing after using collaborative writing approach with wiki. Both students' responses to the course feedback questionnaire and the interviews revealed that they perceived collaborative writing using a wiki as beneficial in facilitating motivation to write, heightened group interactions, and the potential audiences activated their writing interest.

Another study carried out by Leung and Chu (2009) investigated the wiki contents and the work patterns of undergraduate students using MediaWiki as a collaborative platform for communication and for working. The results indicated that students' perceptions of wiki were affected positively when they used wiki as a collaborative learning tool. Moreover, collaborative learning occurs through students' comments and edits of each other's contributions.

To evaluate student-generated content for collaborative learning Wheeler et al. (2008) examined four groups of education students who have been using open-content generation software. Students used the wiki regularly during their classroom sessions as a space to store and edit the work from their research exercises, and as a forum for discussion. During teaching sessions students were invited via the integrated discussion board to post their views on their use of the wiki. Participants were also invited to complete a post-module questionnaire via email. Students discovered that apportioning responsibilities to each individual enabled the majority to collaborate successfully in the construction of their knowledge repository. Several issues were observed during the use of the wiki space such as the problem of ownership and intellectual property. On the other hand some students indicated that the wiki activities did not suit the learning preferences of all students. Another problem was that students tended to copy directly from other websites such as Wikipedia to construct the wiki content. On a more positive note, students were able to develop their critical thinking skills through the use of the common spaces.

The study of both Hughes and Narayan (2009) was targeted to examine three aspects: understand students' perceptions of collaboration, evaluate the data regarding wiki ease-of-use, and student perceptions of writing when using wiki as a tool within their coursework. In order to examine wiki's potential role in collaboration, students were asked about their frequency of editing and contributions, and their perception of the wiki facilitating collaboration with peers. Because wiki primarily relies upon writing

text to share knowledge, students have been asked to perceive wiki writing in comparison to word processing. The study tried to find out the technical barriers relating to wiki technology. The results of the study indicated that students appeared to be more inclined toward collaborative co-construction of knowledge due to their reported higher frequency of wiki changes. The frequency of editing and changing wiki information occurred less often than posting original contributions. Regarding the use of wikis in terms of the wiki itself, the results also revealed that technical aspects of wiki technology have a strong influence on the students' perceptions of wikis for learning and collaboration.

Elgort et al. (2008) conducted their study with two postgraduates at Master's level. The study sought to find out whether wikis could facilitate collaborative learning and positively affect student attitudes to group work in the context of an evaluated group project (e.g., knowledge creation and sharing, collecting and organising information, encouraging individual student involvement in the project). The results highlight the fact that student attitudes were very positive about the contribution of the group assignment to their learning. In relation to group work, while most students agreed that doing group assignments was a valuable learning experience, significant numbers felt they could have done the assignment better on their own. Two thirds of the students thought that wiki was a good tool to collect and organise information for the assignment. Overall, students found wikis useful for arranging information and sharing knowledge, while instructors thought wikis made managing and marking group work easier and more effective.

Raman et al. (2005) conducted a case study to examine whether wiki technology was an effective tool to support knowledge sharing and construction in an academic environment. They used TikiWiki as a knowledge management tool with a face to face class of 20 students, and carried out in-depth follow up interviews with the students. The findings indicated that most students used the wiki for between 3 and 5 hours per week; however they tended to use it in a limited way. The wiki was mostly used as a tool to create and extract knowledge directly relevant to the class, for example summaries of recommended readings, however there was very limited use of wiki to facilitate collaborative knowledge creation and sharing. The wiki was used mainly to follow up on the content covered in the face to face class, and only two students used it

to facilitate team discussions. The researchers concluded that wiki was most useful as a tool to manage and update existing knowledge, but of limited use to collaboratively create new knowledge.

The notion of an autonomous environment in which students can collaboratively construct meaning without any teacher intervention is appealing and may contribute to autonomy through increased opportunities for practice. Kessler (2009) tried to explore the degree to which the participants in the study could correct their own and others' grammatical errors in a long-term collaborative task by using wikis. The results suggest that students were able to meet the knowledge and skills subcomponents of ability within an autonomy framework, but lacked the motivation and/or confidence subcomponents of willingness. The nature of peer-edits also suggests that students were not afraid to critique one another. Students in this study demonstrated the ability to correct and learn from their own and classmates' form errors, but not the willingness to do so when working in an online context, engaged in a task that they recognised as primarily focused on the creation of meaning.

Students' perceptions of Wikipedia was investigated by Lim (2009), and LaFrance and Calhoun (2012). Students tended to use Wikipedia for quickly checking facts and finding information. Various aspects of using Wikipedia examined including ways of accessing Wikipedia, purposes of use, frequency of use and information needs. The participants' perceptions of wiki were investigated before and after the use of wiki, students' responses varied from one to another. Overall, students' perceptions before the use of wiki were negative to some extent because of the information in Wikipedia was not perceived to be accurate as the students noted. Students tended to have positive past experiences with Wikipedia, but did not have comparably positive perceptions of Wikipedia's information quality, which is one of the most interesting findings of the study.

Woo et al. (2011) examined how wiki's key affordances such as educational, social collaborative and technological affordances might help in scaffolding students during their collaborative writing projects including critical thinking and creative problem-solving. The study found that students were positive in their perceptions of using a wiki. Students enjoyed using the wiki, and the overall perception was that it helped foster teamwork and improved writing. The tracking functionality of the wiki gave in-depth

information about the types of edits the students were making and helped the teacher to provide necessary support and feedback, scaffolding their editing process.

2.5.3 The Current use of wiki in Saudi Education

The use of wikis in Saudi education is considered as relatively weak. There are no more than ten studies carried out in terms of using wiki in education up to 2012. Most of the attention in using e-learning in the Saudi education institutions concentrates on the use of distance learning through commercial programmes. According to Alebaikan and Troudi (2010, p. 52) “in 2010, some universities and institutions have provided different commercial learning management systems, such as Blackboard, Web CT, and Tadarus (an Arabic-based learning management system) to facilitate learning and teaching online”. Accordingly, the current status of the use of wikis in the Saudi education was one of the reasons behind conducting the current study.

2.5.4 The educational characteristics of wiki and their role in education

According to Neumann and Hood (2009) and Ebersbach et al. (2008) a wiki allows the user to change the content of its pages. Wiki enables all users to add, edit or delete the content without any difficulties (i.e., no need to be familiar with the programming language HTML). In the field of education “wikis enable instructors to construct interactive activities for their students, and to present course information such as resources, external links, project information, and frequently asked questions” Schwartz et al. (2003, p. 2). Furthermore, through using wiki as a collaborative learning tool, it can be ideal way for building communities of practice by establishing a collective repository of expertise in a subject area which is refined over time by the contributions and to facilitate problem-solving status of interested individuals (Jones, 2003). In addition, wiki pages allow users to participate in collaboratively building resources.

Wikis also can help students overcome shyness or uncertainty about their views (Ozok and Zaphiris, 2009). Another characteristic of a wiki is that it can be used as a repository of knowledge, information and to manage meetings. According to Pegler et al. (2007) “the use of a wiki in universities and colleges can range from a repository for agreeing meeting notes and setting meeting agendas to experimental instructional approaches”. Franklin and Harmelen (2007) pointed out the use of wiki for both

teachers and students for the creation of annotated reading lists, incremental accretion of knowledge, and to documenting group projects. Wiki can be used by teachers to supply scaffolding for writing activities and then provide feedback on student generated content, and in the provision of feedback for each other's writing. Wiki is increasingly used in education, whilst the use of wiki as an educational method still comparatively new idea to the public (Wang and Beasley, 2008). Therefore, "wikis have become an integral part of education, especially in secondary and higher education" Ozok and Zaphiris (2009, p. 472). Finally, wikis can be used in educational contexts to facilitate asynchronous communication and online group collaboration.

2.6 The main educational aspects of wikis as a learning tool

According to the present study, there are three key elements which characterise the learning environment using wiki pages. These elements are: e-learning skills, learning pattern, and learning theory. These elements are essential in creating a learning environment with students at ABU. The next sections deal with a detailed explanation of each one of these elements.

2.6.1 The concept of e-learning skills

People often use the terms skill, strategy, method, and technique, interchangeably (Murdoch and Wilson, 2004). However, these terms are quite different in their meaning (Afflerbach et al., 2008). The term 'skill' has actually been taken from the Old Norse Language as meaning 'knowledge' (Flieger, 2002). The term 'skilja' is still being used in the present day Icelandic language to denote the process of knowing or to know. However, 'skill' has a different connotation when used in the English language, where it commonly refers to abilities stemming from knowledge, practice, aptitude to do something well, or to a competent excellence in performance, execution, workmanship, the practice of an art, etc. (Emery and Brewster, 1959).

The skill that ensures that an individual learns from the environment is called 'learning skill'. Thus, the environment in the present study is the wiki learning environment. According to Wenden (1987, p. 160) learning skills refer to "strategies that can be used to regulate learning". Learning skill can be broken down into 4 Cs which are Critical thinking, Creativity, Communication and Collaboration (Bronson and Merryman,

2010). The combination of these 4Cs ensures that students learn from their environment so it is really helpful in the academic context. The current study focuses primarily on the last 2 Cs of the 4 Cs mentioned above namely Communication and Collaboration. These two terms will address in detailed in chapter 3 ‘Conceptual Framework’ includes the justification behind the selection of these two Cs.

The first skill is ‘Communication Skill’. The activity by which we transmit a message or thought to another and receive a message is called ‘communication’. According to Talloo (2007, p. 153) “the term communication has been derived from the Latin word “communis”. Communication is the “bridge” to exchange ideas, thoughts, values, facts, opinion, emotion and information between two or more people for the purpose of creation of mutual understanding and confidence (Debasish and Das, 2009). Therefore, the activity of communication helps individuals in getting synchronised with each other resulting in much better coordination. Communications skills are of three types as shown in Figure 2.6.

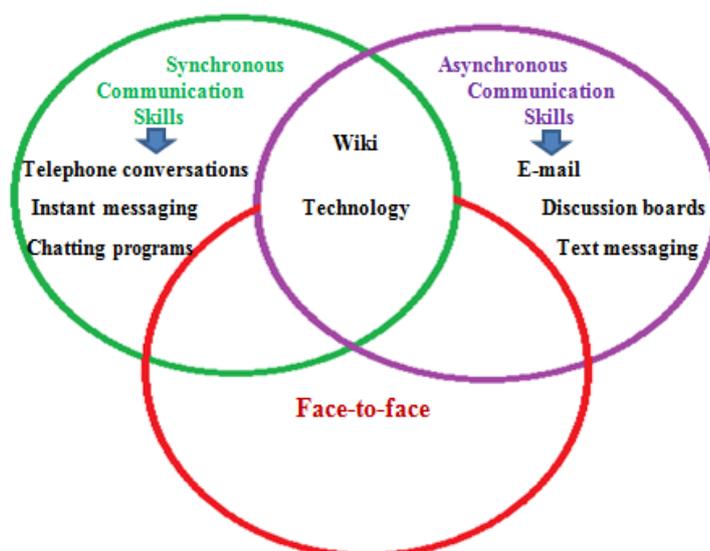


Figure 2-6: Communication skills

The present study includes the factor of communication as the students are seen to use synchronous, as asynchronous and face to face communication techniques. The wiki facilitates students to gather information and knowledge regarding the topic of biology by allowing them to come in contact with each other through electronic mail or discussion pages or face to face in the classroom.

The second skill is 'Collaboration skill'. The activity of working with each other to ensure the attainment of a particular result is called 'collaboration' (Honda, 2000). There are various traits that need to be present in an individual to ensure smooth collaboration (Ekins et al., 2011). The skill of communication with one's peers and collaborating with them to work on a project are the two most important skills that a person in the 'learning' phase can use (Turner, 2008). The next section and Section 3.3.1 addresses in details the collaborative learning environment (CLE) and how students work collaboratively in wiki class to acquire the collaboration skills necessary to work within teams.

2.6.2 Collaborative learning

Collaborative learning has taken on many forms, but the principles remain the same. Findley (1989) began development Collaborative Networked Learning (CNL), in this, learning occurs via electronic dialogue between self-directed co-learners and learners and experts. Findley focuses in this approach on the online interactive among group of learners (synchronous interaction). Another collaborative learning approach is 'Computer-Supported Collaborative Learning'. (CSCL) is an emerging branch of the learning sciences concerned with studying how people can learn together with the help of computers (Stahl et al., 2006). This kind of learning is characterised by the sharing and construction of knowledge among participants using a computer or the Internet as their primary means of communication or as a common resource. CSCL can be implemented in online and classroom learning environments and can take place synchronously or asynchronously.

A (CLE) is the learning pattern that will be used in the present study. Collaborative learning refers to a learning structure in which students form groups in which they work together to achieve a particular goal (Shibley, 2005, and Roberts, 2004). This way, students are to work to increase their own learning level as well as of their group mates. In other words, a collaborative learning technique ensures the notion that students are working together to build their understanding, increase their own learning level and work towards their unified objective. This technique can be shown in the present study through the students' activities where students work collaboratively to learn the biology curriculum with the new teaching style 'wiki technology'.

Supporters of collaborative learning assert that, the process of transmission and reception of thoughts and messages while working in teams leads to increased interest among the group members. There is evidence that students working together in groups manage to attain better thinking patterns and are able to recall information than their peers who work alone. According to Totten et al. (1991) the activity of working in groups facilitates the students to share ideas, debate possibilities, take ownership, and become self-motivated to establish their own pattern of thought. Section 3.3.1 addresses the CLE in relation to the present study.

2.6.3 Learning theories

To understand the reasons behind the selection of constructivist learning theory, at the outset, should be highlighted the main types of the learning theories. According to (Corchado et al., 2010, and Kridel, 2010) there are three key categories or philosophical frameworks under which is possible to classify learning theories, namely: behaviourism, cognitivism, and constructivism. Firstly behaviourism, Woodson (2007, p. 1) describes the behaviourist theory as follows:

“Behaviourism is considered a psychological theory rather than a philosophy. It is based on environmental conditions and has been given much attention and acceptance in education. Behaviourism is the way a person behaves because of their individual thinking processes. The nature of a person’s thinking can be affected through a variety of rewards and consequences”.

The theory concentrates on two axes related to behaviour: response and stimulus. It also focuses on the study of overt behaviours that can be observed and measured (Good and Brophy, 1990). In behaviourism, the view of the learning process is concentrated on a change in the behaviour of the learners (Kridel, 2010, and Jacobs and Hundley, 2010). As a result of this quick brief of the behaviourist theory, it can be said that, this theory cannot be applied to students who are working together to build the biological knowledge through their presence in groups. Moreover, the behaviourist advocates observing the people or the animal under the effect of a stimulus factor whether the stimulus is positive (reward) or negative (punishment). Finally, learning according to behaviour theory mostly depends on the repetition of the attempt to achieve the desired behaviour. However, the present study does not seek to observe or to change the

behaviour of the learners, but to investigate the impact of wiki technology on their learning.

The second theory is cognitivism. This theory emphasises the active internal nature of higher mental processes such as, analysing, memorising, recalling, thinking and other forms of mental representation (Basavanna, 2000, and Uljens, 1997). The role of cognitive theory stated by Fan et al. (2011, p. 174) is:

“The cognitive theory focus on the conceptions inside people’s minds, not factors such as roles in the outside world. The basic idea behind cognitive theory is that mental conceptions (i.e., cognitions) give us a framework both for interpreting experiences and for shaping our action”.

To discuss the ability of using this theory with the present study, it can be said that the cognitive theory concentrates on the individual result of the mental process which is represented in the mental functions such as, thinking, remembering, analysing etc. Moreover, the teacher in the cognitive classroom plays an important role with the students in terms of repetition, motivation, and explanation of the information during the session. The following section addresses the application of constructivist theory to the present study.

2.6.3.1 Constructivist learning theory (CLT)

Many psychologists such as Vygotsky, Piaget and Dewey worked to develop constructivist theory. This theory focuses on the belief that solving problems helps individuals in thinking, learning, and development. Problem-solving helps individuals in taking their own unique experiences and expertise to find a solution and, once they do, they all extract unique lessons from it (Bauer, 2010). In order to understand the constructivist theory in the context of the present study, there are some questions that need to be answered. What does constructivism mean? What is the role of both teachers and students in the constructivist classroom? What is the relationship between constructivist theory and the (CLE) as the learning environment of the present study? The answers to these questions will be addressed in the following sections and in more detail in chapter 3 and 4.

Constructivism is basically a theory based on observation and scientific study about ‘*how the learner learns*’. Thus, learners construct their own understanding and

knowledge of the world, through experiencing things and reflecting on those experiences. The learners in constructivist theory are working collaboratively within groups to build knowledge through the interaction with each other. To ensure that students adopt a constructivist paradigm to learning in class, they are allowed to ponder over a particular problem so that they can fully understand and use their experience and intellect to come up with solutions. The learning in this case is centred on the learners more than the teacher; according to Balanay and Roa (2013, p. 25)

“The student-centred teaching methods shift the focus of activity from the teacher to the learners. These methods include active learning, in which students solve problems, answer questions, formulate questions of their own, discuss, explain, debate, or brainstorm during class; cooperative learning, in which students work in teams on problems and projects under conditions that assure both positive interdependence and individual accountability; and inductive teaching and learning, in which students are first presented with challenges (questions or problems) and learn the course material in the context of addressing the challenges”.

The role of the teacher in constructivist theory is to organise information around big ideas that engage the students’ interest, to assist students in developing new insights (Brooks and Brooks, 1999), to connect them with their previous learning, to facilitate the transferring of the information, and finally, to administrate the learning environment (see also Section 2.6.3.2). In the present study the teacher firstly gave a brief outline of the biology topics at hand and then answered students’ various questions so that a clear understanding of the topics was established. As the students went about asking questions, they tended to develop a deeper understanding of the topics and this is reflected in the depth of their questions. The following are the main aspects of constructivist learning theory.

2.6.3.2 The role of the teacher as a facilitator

The role of the teacher is not just to facilitate the learning process in constructivist learning. The teacher's role in the constructivist classroom is to prompt and facilitate discussion, monitor the class and guide students. A constructivist approach asserts that learning should come from the student and not the teacher; the teacher’s role is to create an environment in which the learner has the freedom to create understanding (Woodson,

2007; Tetard et al., 2009, and Lambert 2002). When a teacher is using constructivist learning techniques in the class, his or her role is changed from being the instructor to a facilitator (Nath and Cohen, 2010). The job of facilitator requires the teachers to provide information regarding various problems in order to pique the interest of the students. It is considered to be a better form of learning than simply laying out all the necessary information. This process helps the students in gaining their own unique understanding of the subject at hand (Ferrari and Sternberg, 1998). They further refine their understanding by asking deeper and deeper questions. In addition, the teacher facilitates the students by helping them reflect on their previous learning. Furthermore, teachers provide opportunities for students to build on prior experiences and learning, exploring possibilities and different solutions, learning as they solve problems (Derry, 1996, and Steffe and Gale, 1995). More detail about the role of the teacher in constructivist learning theory and in the wiki class will be given in Chapter 4.

2.6.4 Collaboration and constructivist learning theory

Collaboration is important among students as it helps them come to a mutual agreement regarding many issues so that they move towards a unified goal. Constructive learning techniques also help in developing the spirit of collaboration among students. The mutual agreement among students makes them put forward their points of view and convince each other of their belief and understanding.

Constructive learning techniques have been criticised for being insufficient for a wide variety of scenarios and can be best applied in a project based environment, but none of the criticisms invalidates the basic premise that the best learning is student led (Brooks and Brooks, 1999, and Liu and Matthews, 2005). Despite this, both the supporters and critics of constructivism believe that this learning technique helps individuals in learning and collaborating with each other to achieve a particular goal. In order to understand a constructivist learning environment in comparison to traditional class, Traditional teacher-centred approaches emphasise the role of the teacher as a source of knowledge and the students as the recipients. In the traditional teacher-centred approaches, the role of the learner as a receiver conflicts with teaching (Hawi, 2012). Davis (1993) believed that teaching can occur as a result of the interaction between a student and a teacher about a subject, thus emphasising the nature of classroom interaction. Effective learning cannot happen without any interaction between the

teacher and the learners. Table 2.2 presents several differences with regard to teacher, students, curriculum, learning process etc.,

Constructivist Classroom	Traditional 'Didactic' Classroom
Social learning is interactive, building on what the student already knows.	Learning is based on repetition.
Teacher's role is interactive, rooted in negotiation.	Teacher's role is directive, rooted in authority.
Teachers have a dialogue with students, helping students construct their own knowledge.	Teachers disseminate information to students; students are recipients of knowledge.
Curriculum emphasises big concepts, beginning with the whole and expanding to include the parts.	Curriculum begins with the parts of the whole. Emphasises basic skills.
Students work primarily in groups.	Students work primarily alone.
Pursuit of student questions and interests is valued.	Strict adherence to fixed curriculum is highly valued.
Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product.	Assessment is through testing, correct answers.
Knowledge is seen as dynamic, ever changing with our experiences.	Knowledge is seen as inert.
Materials include primary sources of material and manipulative materials.	Materials are primarily textbooks and workbooks.

Table 2-2: The differences between constructivist and traditional didactic forms of learning using basic assumptions of knowledge, students, and learning

2.6.5 The difference between perceptions and attitudes

According to Carr et al., (2007), students' attitudes towards using e-learning depend upon their overall experience of using e-learning. The first and the fifth research sub-questions are used to explore students' perceptions and attitudes towards wiki. Perceptions precede attitude formation, which might ultimately lead to the development of performed behaviour (Borkowski, 2009). Person perception refers to a wide variety of behavioural manifestations like impression, judgement, opinion, cognition and understanding of others. These perceptions can be changed over time as an individual gains more experience and information. O'Shaughnessy (1995, p. 137) states that "perceptions can be changed without trying to change basic attitudes". While attitudes are more stable in the decision about something and the judgement on someone's decision, normally the person's attitudes can be a negative or positive.

An attitude has been defined as "a positive or negative evaluation towards a stimulus, such as a person, object, action, or concept" (Tesser and Shaffer, 1990, p, 481).

According to Schiff,(1970, p, 11) “perceptions are more transitory than attitudes, less stable, and more subject to change with the immediate past experience and present state of the perceiver”. More precisely, an attitude can be defined as a persistent tendency to feel and behave in a particular way toward some object, which may include an event or individual as well (van Wasbeek, 2004; Robbins and DeCenzo, 2003, and Volker, 2010). Thus, the previous comparison confirms the researcher’s point of view on selecting the term ‘perception’ to describe the stage before the use of wiki, in contrast, the term 'attitude' selected to describe the stage after the use of wiki.

2.7 Summary

In this chapter, a literature review was presented on the main concepts relating to the use of wikis in learning. The chapter began by discussing the history of Al-Baha University (ABU) and the possibility to use wikis as a learning tool through brief details about Higher Education in the Kingdom of Saudi Arabia (KSA). This led to discussion about teaching biology in KSA in general and at ABU in particular, followed by a description of wiki technology through reviewing the Web 2.0 applications as an aspect of e-learning and through presenting local and global studies conducted in this regard. The chapter then focused on three learning theories, behaviourism, cognitivism and constructivism and provides reasons behind the selection of constructivist theory for this study. The chapter then addressed the CLE as a learning pattern in the present study and the relationship between the CLE and constructivism learning theory (CLT). Finally, the difference between the perceptions and attitudes was considered, in order to differentiate between the students’ perceptions and their attitudes towards wikis.

Chapter 3: Conceptual Framework

3.1 Introduction

This chapter discusses the conceptual framework of the present study, including the key concepts and terms associated with this study. These elements, as seen in Figure 3.1, are the focal aspects in this thesis in constructing a conceptual framework. Moreover, this chapter clarifies the interrelationship among these concepts, at the end of this chapter a brief summary of its content can be given.

One of the main purposes behind this study is to explore an effective way for students to learn, in higher education, in general and for ABU students in particular. This framework incorporates the concept of each element that makes up the overall structure for the procedure of the present study, and the extent of the interrelationship between the aforementioned areas of learning theory, learning environment, learning activities, activities outcomes and learning community (Figure 3.10 Page 65). The rationale for selecting these areas of the framework is that the present study based on the use of wikis as a learning tool which is characterised by collaborative work in the construction of its content, and this can be achieved from the first and the second areas. Moreover, the aim of the study is to measure the impact of wikis on students' learning. However, this aim requires determining the types of students' learning activities undertaken and what the outcomes of those learning activities are.

The first area in this framework is 'learning theory' and the particular approach taken in this thesis is Constructivist Learning Theory (CLT). According to Tomei (2009, p. 60), CLT is seen as "a cognitive activity that produces mental models that represent perceptions of reality". Generally, CLT aims to identify how learning processes are implemented in the classroom, and how knowledge is constructed (Butler and Griffin, 2010).

'Learning environment' provides the second area in this framework, adopting an approach offered by is 'Collaborative Learning Environment' (CLE). CLEs are systems specially developed to support the participation, collaboration, and cooperation of users sharing a common goal. Collaborative learning systems design should take into account social factors to discover and describe existing relationships among learners, existing

organisational structures and incentives for collaborative action (Zaraté et al., 2008).

This area addresses the environment of learning and how learners work collaboratively to achieve particular goals under the umbrella of CLT.

The third area is the 'learning activities' of the students. According to, Pueyo (2009, p. 160):

“Wiki is social in nature and is an open editing website, it is an excellent web tool which supports learner centred collaborative activities and is widely used for learning purposes. It enables learners to share authority and empower themselves with the responsibility of building on their initial and basic knowledge”.

In this research, Pueyo's ideas are used to show the relationship between the concept of learning activities and wiki technology. At this stage 'learning activities' will be through a private wiki designed for the purposes of this study. Wiki technology is a tool for collaborative work designed for the learners to be able to share their contributions with others via three types of communication: synchronous, asynchronous and face-to-face .As a result of the learners' activities they seek to construct the content of the biology curriculum.

The fourth area is the activities' outcomes. This phase shows the final expected outcomes of students' use of wikis which this study seeks to investigate. These outcomes are: students' perceptions and knowledge about wikis, the extent of acquiring e-learning skills, achieving subject knowledge (biology), and their attitudes towards the wiki. Cartwright et al. (2009), state that student activities' outcomes directly describe what a student is expected to learn as a result of participating in academic activities. They focus on knowledge gained, skills and abilities acquired and demonstrated, and attitudes or values changed.

The last area is the learning community of the present study, which is the students and the teachers at ABU, specifically, students in the College of Science.

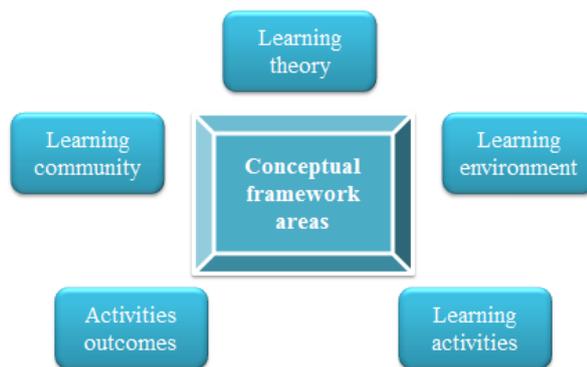


Figure 3-1: The conceptual framework areas

3.2 Learning theory

Learning theory is the first component of the framework and is essential for understanding the subsequent components in the framework; in other words all the components of the framework are based on the learning theory adopted for this study. Additionally, learning theory helps to understand how the next stages in this study take place, thereby, how learners deal with each other constructively in a wiki learning environment and how the learning process occurs (Henson, 1996). Also and in order to understand the effect of this theory on the students' knowledge construction and students' learning, the comparison with the traditional learning will be addressed. The following paragraph addresses a detailed explanation for CLT.

3.2.1 Constructivist learning theory (CLT)

The term constructivism refers to the idea that students construct knowledge and their own understanding for themselves. The most important application in constructivism is a strong concentration on student-centred learning (Kasemvilas and Olfman, 2009). According to Zarli and Scherer (2008, p. 537), “constructivism as a paradigm or worldview posits that learning is an active, constructive process”.

Further, students always create their own meaning regardless of what teachers do (Guzdial, 1997). Each learner, individually and socially, constructs meaning as he or she learns (Hein, 1991). The building of students' understanding and knowledge occur through experiencing things and reflecting on those experiences (Land and Jonassen, 2000). The literature stresses the importance of the discussions, interactions and activities among students in the constructivist classroom, thus shifting the focus of

activity from the teacher to the learners. For example, Harasim (1990) says that, in a constructivist learning environment, a student will be actively participating with other students to learn together. In contrast, in the conventional teaching style, the learning process centres on what the teacher is doing in the classroom, with the students taking passive roles in the learning process. According to Balanay and Roa (2013, p. 25) “The conventional teacher-centred approach is focused on the teacher, where the teacher talks and the students just listen while the student-centred approach the students are exposed to hands on activities thus, they will gain first-hand experience, and they will also know how to use all their senses”. The social learning theory of Bandura (1977) emphasises “the importance of observing and modelling the behaviours, attitudes, and emotional reactions of others. The theory also explains human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural, an environmental influences” (Walker, 2008, p. 84). The component processes underlying observational learning are: (1) Attention, if learners are going to learn anything, they have to be paying attention. (2) Retention, learner must be able to retain - remember - what he/she have paid attention to (3) Reproduction, learners have to translate the images or descriptions into actual behaviour. So they have to have the ability to reproduce the behaviour in the first place, and (4) Motivation, including external, vicarious and self-reinforcement (Walker, 2008; and Sommers-Flanagan and Sommers, 2012). This means that the learner is the focal point, as opposed to the lesson plan or subject matter, which the instructor will teach (Kasemvilas and Olfman (2009). Because the nature of the current study is based on collaborative learning, the following section will address the social part of constructive theory, i.e. ‘social constructivism theory’.

3.2.2 Social constructivism theory

Social constructivism theory focuses on how meaning and understanding are created through social interaction” Stavredes (2011, p. 83). Social constructivism’s origins are largely attributed to Vygotsky’s psychosocial theory that knowledge is not transferred from teacher to student but constructed in the student’s mind (Chiari and Nuzzo, 2003).

In comparing between a traditional classroom and a constructivist classroom, traditional teaching approaches (e.g. lecture methods) are very common in education, especially at university level due to the large number of the students enrolled in the universities.

Traditional classroom lacking of the dynamic learning that is occurring in other

classrooms that are structured for collaborative learning and from a constructivist philosophy. It involves coverage of the context and rote memorisation on the part of the students (Abida and Muhammad, 2012). Constructivism offers a divergence from traditional teaching and learning environments that are primarily teacher driven, where students mainly memorised what teachers taught, in contrast to traditional classrooms where the teacher's role is to pass on knowledge to learners and students just absorb information passively. The social constructivism emphasises the role of culture in developing personal and shared interpretations and an understanding of reality (Pritchard and Woollard, 2010). Moreover, social constructivist approaches emphasises the social contexts of learning and that knowledge is mutually built and constructed (Santrock, 2001).

The social constructivists believe reality is understood through human activity. Furthermore, it cannot be discovered because it does not exist prior to its social construction. To constructivists, knowledge is a human product that is socially and culturally constructed (Ernest, 1998; Gredler, 1997, and Hartas, 2010). The most effective methods for learning in a social constructivist classroom involve "activity methods and community-based project approach" (Barron, 2005, p. 58). The role of the social context and interactions with others is central in social constructivism. In addition, "in a social constructivist classroom, knowledge is always in the process of being constructed; both the teacher and the students are always constructing new ways of thinking about and solving problems. Thus, practical applications of social constructivist teaching are grounded in the notion that learning is a reciprocal and collaborative process among all members" (Cochran and New, 2007, p. 746).

The major theme of Vygotsky's theoretical framework is that social interaction with teachers and other learners plays a fundamental role in the development of which occurs in a zone of proximal development (ZPD) (Cantillon and Wood, 2011). The ZPD in the present study equates to the distance between the actual level of students' perceptions of wiki *determined by* (stage before the use of wiki) and the level of the students' attitudes of wiki *determined through* (the stage after the use of wiki) under the teacher guidance, in collaboration with the group members. Figure 3.2 represents the ZPD.

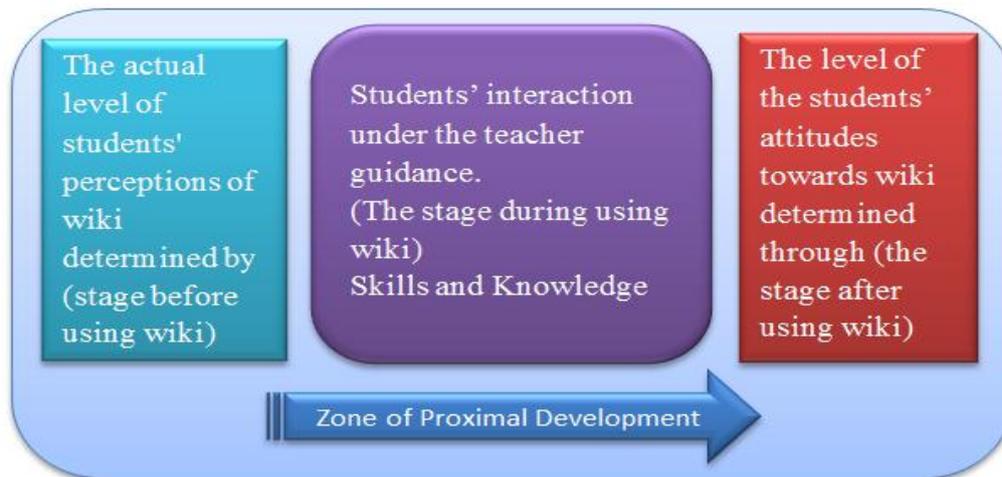


Figure 3-2: Students in their Zone of Proximal Development (ZPD)

Vygotsky and Cole (1978, p. 86) defined ZPD as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers”.

The relationship between social constructivist learning and collaborative learning is that learners are working together in order to achieve one goal, which is that of building knowledge through learning activities and discussions. Ashcraft et al. (2008), state that, in social constructivism, knowledge is developed through cognitive activity that happens through the discussion of experiences with other individuals or in groups. Therefore, the role of teacher in constructivist learning and collaborative learning is to actively facilitate the learning process. Finally, both constructivist learning and collaborative learning seek the creation of an environment which supports the active involvement of students in collaborative and empowering activities, such as the exchange of ideas and opinions, and responsibility for making decisions about learning and for generating flexible rules. The teacher concentrates on students' learning development rather than on teacher performance (Gray, 1997).

The next section addresses in detail the concept of the learning environment for collaborative learning supported by the evidence from the literature review.

3.3 Learning environment

The learning environment in the current study depends on the collaboration among the students to build the content of the biology topics. Generally, the term “environment” is, according to Sinha (2007, p. 90), “a broad concept, which includes all external conditions influencing the growth and development of children, animals, plants, etc.” In the educational sense, the environment includes all aspects affecting the learning process, such as teacher, student, equipment, curriculum, etc. A learning environment is composed of five main elements: enabling context, resources, tools, potential outcomes and scaffolds. The learning process in the present learning environment directly depends on the social context which appears through the students’ interactions and discussions within groups in or out of the classroom. Social context is a term which can be used to refer to how an object or invention is used or interpreted by people; it can also refer to the setting of people surrounding an invention (Coker, 2101). The nature of learning in the wiki class requires both the teacher and the students to work together in order to construct knowledge. Thus, the social context can influence the extent of acquiring the information and the quality of the knowledge constructed. In this regard, the teacher’s role according to Paul (2013) is not only with creating and designing a learning environment, but also with the job of acting as an expert, model, guide, and facilitator of these social interactions. The teacher takes the lead to design the tasks, develop resources, and establish the classroom culture and norms for interactions. This includes identifying roles and appropriate behaviour for students as they interact with one another, fostering discussion between and among students, and managing the complexities of multiple on-going tasks and activities. There are two types of learning environment according to Cook (2009), the ‘natural learning environment’ and the ‘prepared learning environment’. Usually, the natural environment is richer in culture and practice, and it has a greater influence on personal growth and development. In contrast, the prepared learning environment is more organised and effectively such as the online learning. Online learning is a term used to describe distance or correspondence courses that are offered over the Internet through the use of electronic media and information and communication technologies (ICT) in education.

The following section addresses CLE via wiki technology as a prepared online learning environment. Baer and Koby (2003, p. 16) say a CLE is:

“Where students work together with peers, more advanced students, and teacher-facilitators to resolve complex, authentic problems, would seem to offer an ideal setting for developing the type of cognitive flexibility and self-concept as a creative problem-solver”.

3.3.1 Collaborative learning environment (CLE)

The learning environment of the present study is defined as collaborative with the learners working together in order to gain new knowledge and acquire e-learning skills during their activities under the umbrella paradigm offered by CLT. Collaborative patterns and constructivism transforms the student from a passive recipient of information to an active participant in the learning process. The collaboration and construction processes are guided by the teacher, students construct their knowledge actively rather than just mechanically ingesting knowledge from the teacher or the textbook, and this is how learning is moving from traditional to collaborative instruction. According to Uden and Beaumont (2006, p. 93), collaborative learning “is an educational approach to teaching and learning that involves group of students working together to solve a problem or complete a project”. The task of the teacher is to translate information to be learned into a format appropriate to the student’s current state of understanding. In order to understand the information being taught and to build the knowledge about the subjects identified, students are working in a group of two or more, mutually searching for understanding and knowledge or creating a product and occasionally solving a problem. The curriculum should be organised in a spiral manner so that the student continually builds upon what they have already learned (Straughn, 2008). There is a wide range of such activities, but most centre on students (Smith and MacGregor, 1992) working together and, as such, learning through their interaction with peers.

Important characteristics of CLE have been identified by several authors (e.g. Leung and Chu, 2009; Su and Beaumont, 2010; Grant, 2009, and Pereira and Junior, 2007). Forte and Bruckman (2007) pointed out that one of these characteristics is the wide distribution of free educational material. Moreover, CLE seeks to prepare students to become skilled collaborators and producers of knowledge, not mere consumers. The literature indicates the relationship between the use of a wiki in education and CLE on one hand, and the impact of CLE on learners via wiki technology on the other. In the

present study the CLE contains five groups, each group consisting of four to six students, according to the total count of the sample.

Figure 3.3 represents the researcher design of a collaborative classroom in which wiki technology is used as a learning tool.

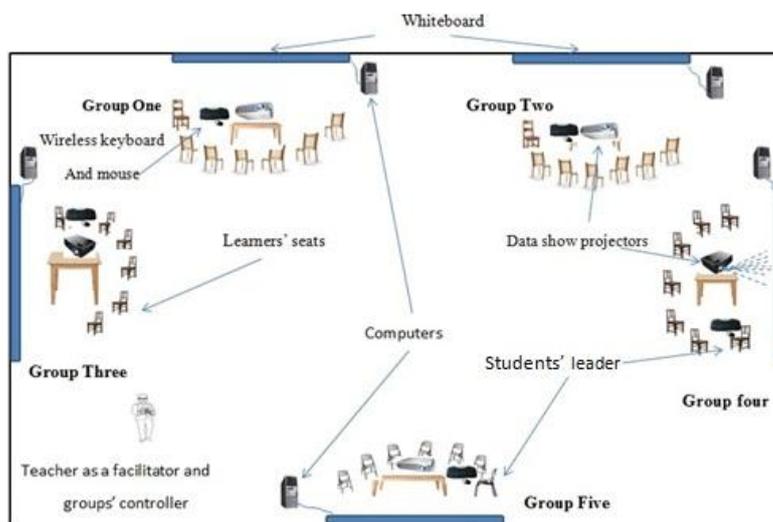


Figure 3-3: A collaborative learning environment using wiki technology in the classroom

Students are divided into groups with a leader designated for each group. Each group has its leader who is responsible for the other members of the group. Initially, five groups are designed together in one classroom to facilitate the task of the teacher in controlling the group members. In addition, the teacher plays an important role in a CLE in providing the information for how groups should work collaboratively, and in facilitating the possibility of sharing information on the subject relating to the lesson through the use of wiki. The constructivist teacher helps the students through problem-solving and inquiry-based learning activities with which students formulate and test their ideas, draw conclusions and inferences, and convey their knowledge in a collaborative learning environment.

Students work individually and collaboratively during the learning process (Leung and Chu, 2009). The success of any student in the group encourages other students to be successful through help them and motivate them to learn (Shimon, 2011).

3.4 Learning activities

According to Zhan (2008), learning activities can engage students' participation and interaction, working together toward a common academic goal, and increasing the level of satisfaction and feelings of connection and community. Participation in learning activities is valuable work for several reasons. It enhances students' collaborative skills, provides students with opportunities and helps them understand new knowledge and strategies. It helps them to examine their thinking processes and recognise the need to revise their thinking (Turner and Patrick, 2004). In contrast, students' activities in conventional learning styles and their interactions are almost non-existent or restricted because of the full role of the teacher in teaching process inside the classroom. *Students' activities in conventional teaching* are passive; they only sit, listen, see, and then write. In constructivism, students being able to work together and discuss things with other members of their team made the activities more fun. Consequently, students spent less time doing individual work, and more time discussing the activities in which they were involved (Lord et al., 2011). This social aspect is a primary strength of the constructivist learning model. Thus, the students in the constructivist class are more enthusiastic, develop a greater appreciation of science, and demonstrate better attendance and increased participation in the lab activities than the traditional group (Lord et al., 2011). The following sections deal with a detailed explanation of these activities which are based on wiki technology as a learning tool to practice these activities which are:

- Wiki Technology,
- Synchronous and Asynchronous Communication Activities,
- Visual, Audio and Written Materials, and
- Constructing the Content.

Figure 3.4 shows the sequence of these activities.

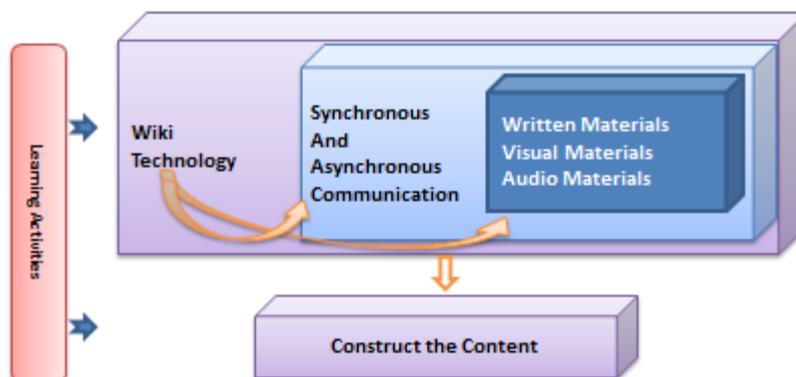


Figure 3-4: The sequence of learning activities

3.4.1 Wiki technology

A wiki site <http://wikibaha.wikispaces.com> Appendix 13 has been designed for the present study including four main pages: Home page, Discussions, History and Comments. All sample members could access the wiki after registration as members and then they were able to use their membership to allow them to add their comments and to participate on discussions through wiki pages. To this end, students were given tutorials before the use of wiki Appendix 12. “One of the main features of wiki technology is its support for collaborative editing of content” Tetard et al. (2008, p. 1). This technology therefore has the potential to complement and enhance online collaboration (Parker and Chao, 2007). Students can provide constructive feedback on their partners’ entries, by adding further contributions to the wiki; each student uses the feedback to improve his/her initial entry (Kear and Woodthorpe, 2009). Previous literatures such as (Deters et al., 2010; Davies, 2004; Elgort et al., 2008; Grant 2009, and Kaminski, 2008) assert that the use of wiki in education would help both the student and the teacher to change the pattern of learning. Heafner and Friedman (2008, p. 288) suggest that “the use of wikis facilitates a pedagogical shift from traditional teacher-centred instructional approaches to student-oriented, constructivist learning, which result in increased student self-efficacy and motivation”. The wiki enables students to have collaboration continuously not only in the educational location such as the classroom or library but also at home.

3.4.2 Synchronous and asynchronous communication activities

There are two ways for students to communicate with each other when using wiki technology: synchronous and asynchronous. Lodder and Zeleznikow (2010) describe synchronous and asynchronous activity thus: in synchronous communication, all parties are working simultaneously (synchronously) on the discussion, whereas in asynchronous communication, parties are working on different parts of the discussion at different times (asynchronously) (i.e., they do not need to react instantly). Both asynchronous and synchronous communication and activities are important in an online class.

The literature indicates that asynchronous communication activities take place outside of real time (Porter, 2004). In contrast, synchronous or real-time communication takes place when people are connected at the same time, i.e. simultaneously, but in different places (Beatty, 2003). Carliner et al. (2006, p. 89) present examples of synchronous and asynchronous forms of communication activities such as:

“Computerised audio-video communications, fibre optic transmission technology, networked information services and products, videoconferencing and chat room. Asynchronous communication such as mail systems, listservs, forums, discussion boards, bulletin board systems and learning content management system”

Within a wiki class, the need for these two communication activities is very important as a base to facilitate the exchange of ideas and information. Communication among students lead to facilitate the exchange of ideas, a large part of successful collaboration comes from the open and free exchange of ideas (Harvey, 2009).

3.4.3 Visual, Audio and Written materials

To support and clarify their ideas, students tend to upload ‘visual and audio’ learning materials such as movies, pictures and sound clips. The content curriculum materials can also include activities to facilitate the learning process through peer interaction and ‘working within group’ (Cox, 2004). The Internet may help students to choose the appropriate items that correspond with the biology topics. According to Treadaway and Smith (2010; and Sahlin and Botello (2007), YouTube is the most popular video sharing site; it contains thousands of homemade video clips. There are two main reasons behind the importance of visual and audio material. First, the current study uses wiki to teach students the biology curriculum as is it known that most biology subjects contain pictures of natural phenomena. Secondly, such online resources can help the teacher meet the needs of students in terms of the principle of individual differences (learning styles), and deliver information to them through the senses of sight and hearing.

‘Written material’ is the usual resource of a wiki. Each wiki includes pages which allow students to post their comments, questions and opinions in the written form. Students can read the comments of their classmates are colloquial-peers, other learners would be better and then they can respond to these comments (Corpuz, 2006). They can share

their notes or other items that may benefit the group. The literature in Chapter 2 section 2.5.1.4 indicated the benefits of wiki pages in terms of how users can deal with the wikis through history and discussion pages.

3.4.4 Constructing the content

Learning science in today's classroom does not have to be restricted to text-based curricular resources. Websites present learners with a wide range of science activities in various formats ranging from text-only information to providing authentic real-time data sets and interactive simulations (Bodzin, 2002). According to Barton and Cummings (2009, p. 81), “a wiki offers much more functionality for supporting collaboration, such as creating documents with multi authors or working on projects that require a group to coordinate and integrate their individual tasks”.

Having students construct the content makes the learning more memorable in two ways. First, they are learning by creating both text-based and visual content. Second, because students are involved in discovery and constructivist learning, the content becomes personalised and more relevant to them (Shelly et al., 2007). The idea of creating biology course/curriculum content is to motivate students collaboratively to collect the information for each subject. Wikis provide opportunities to use different types of interaction tools ‘visual, audio and written materials’ to create curriculum content and collaborate with peers. The role of the teacher in the current study regarding the biology curriculum content is to provide a brief introduction to each subject, and then students seek to collect information on the subject from various sources, including the Internet and the library.

3.5 Achieving activities’ outcomes

This section addresses the expected outcomes of the students’ learning activities through their use of wiki technology in their learning in order to construct the content of a biology curriculum (Figure 3.5).

Uden and Beaumont (2006, p. 330), define students’ outcomes in terms of “the knowledge, skills, and abilities that students have attained as a result of their involvement in a particular set of educational experiences...what students should know, understand and be able to do at the end of the course”. As a result of students working

in groups or individually, they seek to construct the content of the biology curriculum through using wiki pages.

This interaction between students happens synchronously and asynchronously whether it is in the classroom or out of the classroom (i.e., outside of regularly scheduled class time) in the library, a house, the Internet café or any place they may access and connect to the Internet. The expectations of students' activities are the primary areas the present study seeks to investigate: knowledge about wikis; acquiring e-learning skills, achieving biological knowledge and evaluating students' perceptions and attitudes towards wiki technology in their learning. Thus, the evaluation of participants' outcomes can be done with several qualitative and quantitative criteria (Tetard et al., 2008).

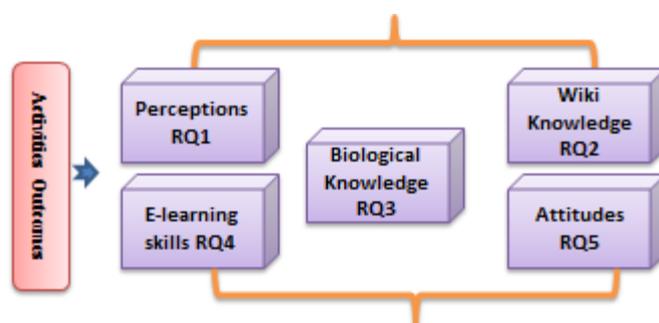


Figure 3-5: The outcomes expected of students' activities

3.5.1 Acquiring e-learning skills

Bateman and Snell (2007, p. 28), define the concept of skill as “the ability to perform a specialised task that involves a certain method or process”. The most important skills regarding the use of wiki in learning are e-learning skills. Wurdinger and Carlson (2010) emphasise the importance of acquiring e-learning skills such as communication, responsibility, and time management. In the wiki class, students are in more need of communication and e-learning skills. Learners can acquire e-learning skills through their interactions in the wiki class, through others' experiences and exchanging knowledge and opinions. The repetition of these interactions contributes to developing their skills, with the importance of focusing on the use of the Internet on all of these interactions in order to achieve acquiring e-learning skills. With respect to the present study, students are expected to acquire e-learning skills through using the Internet. Thus, four axes were identified to examine the extent of students' acquiring e-learning skills (Appendix 3). These axes are: searching the information on the Web, synchronous

and asynchronous communication, using wiki features and working collaboratively to gain experience about the use of wiki. E-learning skill takes place in three stages. Figure 3.6 shows these stages. After acquiring e-learning skills students are expected to develop their skills through the continuous development practices, and then employ these skills to gain knowledge, information and then construct the content of the wiki (i.e., the content of a biology curriculum).



Figure 3-6: The proposed stages of learning and communication skills

3.5.2 Achieving biological knowledge

Students regularly use wiki as a source of information and a way to build and share knowledge across groups of students for example to get knowledge about a subject for an assignment (Tetard et al., 2008). “The writing of a group assignment is an excellent example of knowledge building” Hawamdeh (2008, p. 28). Recently, “wikis are being increasingly used as knowledge management tools” Babar et al. (2009, p. 129). New knowledge creation can be made through the reflection on the shared information among students.

To gain biological knowledge through using wiki technology, learning process happens by experimentation, and not by being told what will happen. Hawamdeh (2008, p. 28), emphasises that “learning is not an "all or nothing" process but that students learn the new information that is presented to them by building upon knowledge that they already possess”.

Several features of wiki technology can support constructivist learning and collaborative writing when learners gain new knowledge. According to Kasemvilas and Olfman (2009, p. 46) “the users of wiki can come back to modify what they have previously written in a wiki. They can read what other users write, generate meaning through shared comprehension, refine and reshape their perceptions, and share or negotiate their understandings with other users”. Achieving knowledge of biology is one of the main

outcomes of the present study. This knowledge can be achieved through constructing the content of the biology subjects predetermined by the biology teacher at ABU.

3.5.3 Evaluating students' perceptions and attitudes

To evaluate students' perceptions and attitudes towards using wikis in learning, it is important first identify the difference between these two concepts. It is worth introducing a distinction between attitudes and perceptions (Cox, 1981). Warr and Knapper (1968) suggest that perceptions are more flexible and transitory and only occur in the presence of a stimulus, attitudes logically depend on perception. Downie and MacNaughton (2007, p. 2) argue that "attitudes necessarily have a cognitive core, in the sense that they depend on beliefs, or on the way we see a situation, a person or a relationship. We have the attitude we do because we perceive the world, including other people, in a certain way".

Students' perceptions of using wikis are described as the degree of agreement to use wiki. In other words, with respect to the present study, students may give their perception of wiki as either agree or disagree with the use of wiki technology in learning. Tan et al. (2011), determine several aspects of learners' perceptions of wikis, such as: positive perceptions, negative perceptions, useful platforms, convenient platforms and confidentiality.

The aim of identifying students' perceptions of wiki technology is to identify the willingness of students' use of this technology, which will help the researcher to deal with the students during the study period. Moreover, evaluating students' attitudes towards the use of a wiki are done through their comments on the wiki pages or via the personal e-mail at the end of the research period.

3.5.4 Knowledge about the wiki

During the research period, students use the wiki as a learning tool in order to construct the content of the wiki. The expectation of students' use of the wiki during this period was to gain knowledge about it in terms of how to use it, the main components of the wiki pages, and the main obstacles that may face them during their use of it. According to Hadjerrouit (2012), students should acquire basic knowledge about wiki functions such as adding, deleting, changing and developing content collaboratively using wiki, as

well as discussing issues related to the wiki. Having students' knowledge about wiki gives an indication of their ability to use it as a learning tool. There are several factors that may affect the gaining knowledge about wiki such as the desire to use wiki and previous experiences. In contrast, the availability of the basic requirements to use wikis such as the Internet, computers and training programmes aid in acquiring the knowledge about wikis.

3.6 Learning community

The learning community mentioned here is the last component of the conceptual framework (Figure 3.10 Page 65). Due to the large number of students at ABU, more than 13,000 students are currently studying in 11 colleges. Therefore, it is impossible to include each one of the university students in this research, and there was a limitation on time allocated for the current study. For these reasons, a sample of students in the College of Science was chosen as the learning community.

In addition, as mentioned in the chapter of the literature review, students seek to work collaboratively in order to construct the content of a biology curriculum, and because biology is currently taught in the College of Science only, this leads us to identify the place of conducting this research, which is the College of Science.

3.7 Relationships between key components of the conceptual framework

This section addresses the relationships between the key components of the conceptual framework; these elements are constructive learning theory (CLT), collaborative learning environment (CLE), learning activities and activities outcomes. The aim of providing these relationships is to clarify the extent of interdependence between these components and the impact they have on each other.

3.7.1 The relationship between CLT and CLE

CLT and CLE represent the learning theory and learning environment during the use of wiki in the present study (Figure 3.7). CLE integrates with CLT to achieve the requirements and the aims of the learning process in this study. According to Arthur and

Cremin (2010, p. 49), social constructivism is a variety of cognitive constructivism that emphasises the collaborative nature of much learning.

The relationship between CLT and CLE can be seen through several aspects, such as: the role of the teacher in the classroom, the learners' activities with each other, learning style, and the ways of acquiring information and knowledge. Both CLT and CLE advocate that the learning process focuses on learner-learner interactions more than those between teacher and learner (Sherman and Sherman, 2004, and Orvis and Lassiter, 2007). Moreover, both learning theory and learning processes are characterised by an inextricable relationship and are profoundly rooted in culture and learning between individuals (Cooper and White, 2011). Therefore, a CLE makes for a learner-centred and team-based approach based on social constructivist theory. In social activism, learning takes place in the social environment where there are collaborative activities.

The literature reveals that knowledge can be imparted from a constructivist teacher to a learner in the classroom through instruction, lecture and practice (Gulati, 2004).

“The constructivist learning theory contends that learning is a proactive and goal-oriented process in which individuals acquire knowledge and meaning by processing information through their cognitive structures and then placing it in their long-term memory for retrieval or further processing at later time” Hiltz and Goldman (2005, p. 192).

Moreover, the teacher facilitates the learning process in which students are encouraged to be responsible and self-governing (Gray, 1997).

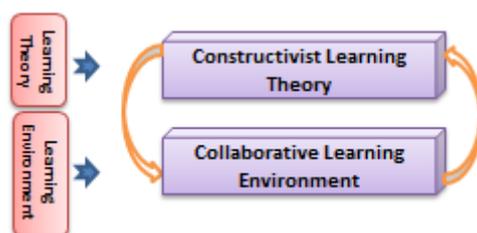


Figure 3-7: Learning theory and learning environment

During the use of wiki technology in the classroom the teacher seeks to apply the constructivist role with students in a CLE. Furthermore, “participation in a wiki is a

good example of ZPD in action. Participants are socially mediated by others in a problem-solving situation” (Erben et al., 2008, p. 134).

3.7.2 The relationships between CLT, CLE and learning activities

According to Ali and Brebbia (2006) a collaborative learning environment (CLE) encourages students to take responsibility for their own learning through structured activities. Students' activities can be affected positively or negatively, an effect which can be attributed to the degree of interaction between students. Thus, this interaction can be affected depending on the correct application of the learning theory and the way of learning. Both CLT and CLE (Figure 3.8) aim to engage students in collaborative learning work together toward a common goal through a variety of activities.

The first requirement for successful collaborative activities is for them to include an element of positive interdependence between group members (Onwuegbuzie and DaRos, 2001). Through these activities, learners communicate, interact and learn from each other and as a result they construct their own world knowledge. “These activities can include collaborative writing, group projects, joint problem solving, debates, study teams and other activities” Jian et al. (2010, p. 225).

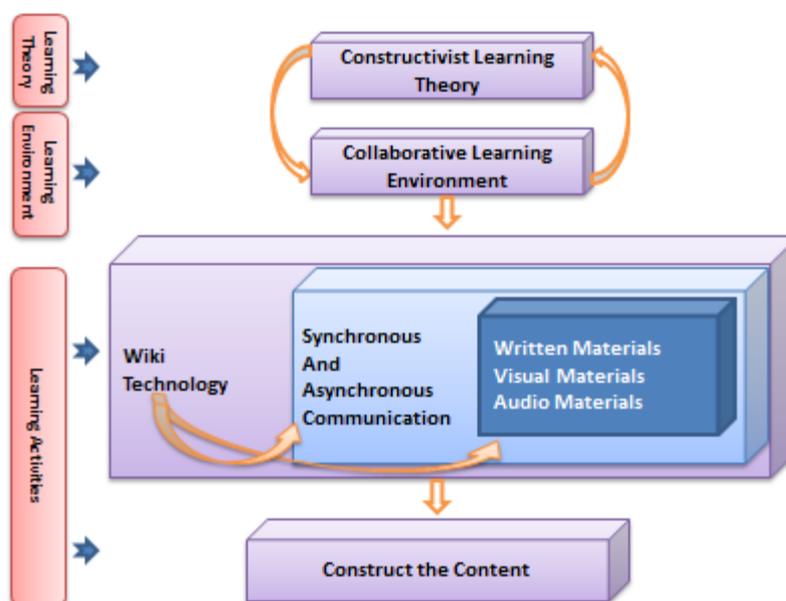


Figure 3-8: The interrelationship between CLT and CLE and learning activities

In the case of using wiki technology in the classroom with students, the learning process is done through learners' activities, and their attempt to create the content of the biology

curriculum. In other words, the learning aims can be achieved through understanding and conducting the requirements of both constructivist learning theory and a learning environment ‘collaborative learning’.

3.7.3 The relationship between learning activities and activities’ outcomes

According to Jenkins (1996), activities’ outcomes are statements of what is expected that a student will achieve as a result of a learning activity. There is a close interrelationship between learning activities and activities outcomes. These outcomes are a reflection of the extent of learning activities. More specifically, activities’ outcomes are the skills, knowledge, attitudes, and habits of mind that students take with them from a learning experience (Suskie, 2009). Regarding the present study, Figure 3.9 below illustrates that, activities’ outcomes are e-learning skills, knowledge about wikis, perceptions and attitudes towards wikis and the biological knowledge as expected outcomes of the students’ activities (i.e., students’ use of wikis).

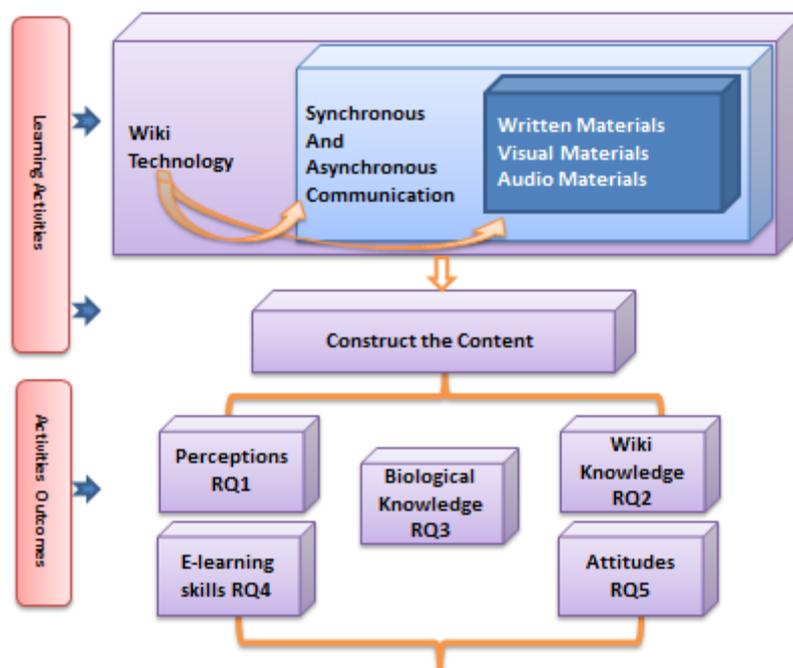


Figure 3-9: The relationship between learning activities and activities outcomes

Lambropoulos and Romero (2010) note that students' activities’ outcomes are the tangible products of their activities. Activities’ outcomes are also the evidence of their learning activities. In the evaluation of the activities’ outcomes, outcomes are the items that will actually be measured to evaluate students' activities before, during and after the

use of wiki. Measuring activities' outcomes answers the question: What did students do? In order to obtain the best activities' outcomes, learners should possess skills related to using wiki technology, such as text editing, uploading learning materials (visual and/or audio), online discussion and synchronous and asynchronous communication. Ultimately, it is the responsibility of the educator to help learners achieve the best activities' outcomes possible (Edwards, 2003).

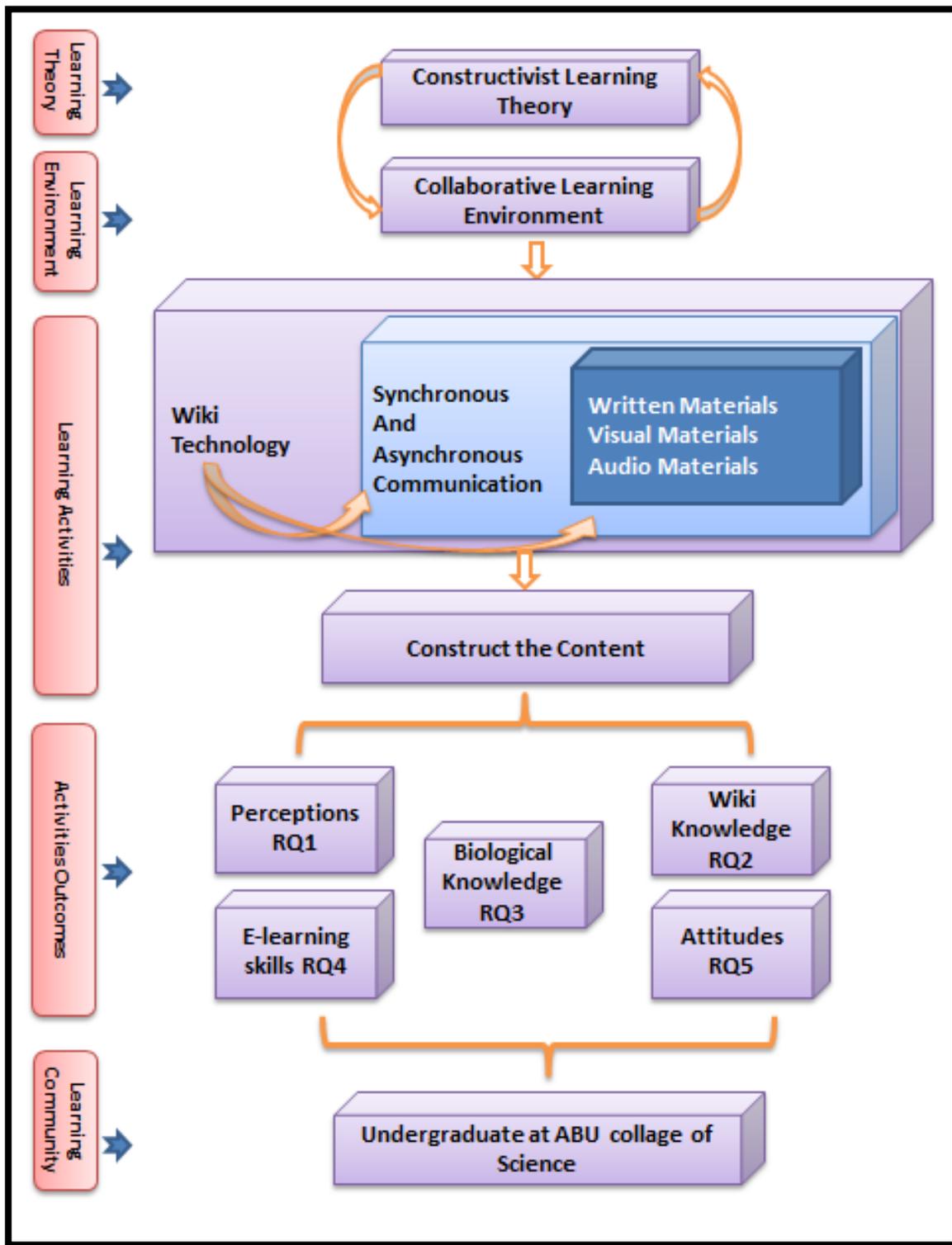


Figure 3-10: The conceptual framework areas

3.8 Summary

The purpose of this chapter is to present the conceptual framework which determines the direction of this study, including the review of literature on the subject. The conceptual framework is based on the findings presented in the literature reviewed in the previous chapter. The main goal of the present study is to identify the impact of using wiki technology in learning biology among ABU students and to find out their attitudes to and perceptions of using wikis. Further, the aim is to determine the extent of the knowledge acquired and the level of skills development. The chapter has reviewed five areas related to the topic: learning theory, learning environment, learning activities, activities outcomes and learning community.

Figure 3.10 represents the conceptual framework and the interrelationship between its components. Moreover, the framework is designed in successive and interdependent parts for two reasons: on the one hand, to find out the relationship and the correlation among framework components, and on the other hand in order to know the stages of implementation of the study. In order to describe the conceptual framework, Figure 3.10 illustrates that the study is based on constructivist learning theory as a suitable theory of learning due to its characteristics of being consistent with the role of the teacher in teaching and students in learning. As described in this chapter (Section 3.3.1), students dealing with wiki technology in groups benefit from each other. This theory states that learning is an active process of creating meaning from different experiences (Brooks and Brooks, 1999). Thus the teacher facilitates the transfer of information to the students. However, a teacher plays the role of facilitator more than that of a teacher's role as it is more generally understood. According to Sims (2002) and Fry (2009) people learn best by trying to make sense of something on their own, with the teacher as a guide to help them along the way (Gerding, 2007). The word facilitator is more appropriate than teacher in the constructivist context (Lambert, 2002) where the learner is actively constructing knowledge, rather than passively taking in information (Fox and Schirmacher, 2011, p. 79). Furthermore, learners interact with each other in a collaborative environment.

The interdependence between CLT and CLE seems clear in this study. However, the nature of learning is collaborative, which means that all group members work collaboratively in order to obtain an academic goal, which is to construct biology

curriculum content. This is not the main objective of the current study, but a means to motivate the learners to work together. The goal is not some "right answer" or even consensus, but the collaborative exploration of ideas and issues (The Human Rights Education Handbook, 2000). However, learners need some types of activity in order to interact with each other and to build the biology curriculum via wiki technology. For this reason, the framework represents several types of learning activities, such as synchronous and asynchronous communication, multimedia material 'visual and audio' written material and 'text editing'. Students sometimes respond better to the visual and audio stimuli of lectures but often get lost in the material or lose interest in the presentation (Thompson and Chimenti, 2009).

The final expected outcomes of these activities are known as activities' outcomes. During the use of wiki technology in learning, students are expected to gain new knowledge regarding the biology curriculum and new e-learning skills through the use of the Internet, because a wiki is based on the Internet. Finally, students are expected to give feedback about their attitudes and perceptions toward using the wiki in learning. This chapter has discussed the conceptual framework for the impact of using wiki technology in learning biology among ABU students, in order to find out their attitudes toward and perceptions of using wikis, and to determine their acquisition of e-learning skills and the extent to which they understand new knowledge. The framework is supported by the evidence from the literature review, and it highlights the pattern of learning that is used by students, and the teacher's role during the learning process. The chapter concludes with an explanation of the interrelationship between the components of the framework.

Chapter 4: Methodology

4.1 Introduction

This study aims to determine the impact of wikis on learning among ABU students through their interactions with each other under the umbrella of CLT and CLE. These activities lead students to construct the content of some topics in the biology curriculum. The expected outcomes of these activities are the result of their interaction and sharing of their experiences. This research seeks to investigate the most important aspects of these outcomes: students' perceptions of wikis, e-learning skills, knowledge about wiki technology, biological knowledge and their attitudes toward wiki technology in learning.

Section 4.2, the research design, presents an overall plan of how the researcher implemented the project in practice (Janet, 2004). The section gives an overview of the research process and includes a brief overview of quantitative and qualitative data analysis, how it was collected, and the instruments used to collect the data.

Section 4.3, research questions, provides the research questions to be answered after analysing the obtained results. The research questions are organised according to the study objectives.

Section 4.4 provides detailed explanation of the nature of the research and its methods, and provides a guide to the procedures that are followed in this study. The methodology contains a model that reflects selected views on reality that originate from a set of philosophical paradigms (Jayaratna, 1994). The section also considers the main rationales for choosing a mixed method research strategy; qualitative and quantitative.

Section 4.5 addresses a detailed explanation of the case study approach. This is followed by a brief review of advantages and disadvantages of case studies. The section also covers the justifications for why the current approach is chosen and why other approaches were rejected.

Section 4.6 provides an explanation of the data collection instruments including: questionnaires, interviews, weekly tests and e-comments. These methods are discussed along with a justification for their selection and the reliability and validity of these instruments.

Section 4.7 discusses the pilot study in terms of the aim of conducting the pilot study, data collection method, and the main findings that have been obtained.

Section 4.8 is about the data sources, the ‘research community’, which forms one of the major axes for this chapter, and the ‘sample and population’. The discussion of these two concepts will include the method of sampling and the method’s advantages and disadvantages. With regard to the data analysis technique, this chapter demonstrates the mechanism of data analysis manually and by computer.

Section 4.9 discusses the validity and reliability of the data collection instruments used in the study. Finally, Section 4.10 takes into account the ethical considerations in this research.

4.2 Research design

The concept of research design is defined by Burns and Bush (2004, p. 120) as “a set of advanced decisions that makes up the master plan specifying the methods and procedures for collecting and analysing the needed information”. The purpose of research design according to Macmillan and Schumacher (1993) is to provide the most valid, accurate answers possible to the research questions. Furthermore, research design helps the researcher in creating a clear structure necessary for the management of the entire research study. An appropriate research design is essential as it determines the research procedure process, the sampling methodology, the type of data, the data collection technique and the schedule.

The research questions in this study were designed to observe how the students worked collaboratively to construct the content of the biology topics and were determined in advance by the researcher and the teacher. The biology subject content constructed resulted from students' interactions with each other via a wiki system in the classroom and/or out of the university.

The appropriate instruments were designed and developed to be valid – to measure what they were supposed to measure. These instruments included:

1. Interviews to discover students’ perceptions of wikis; undertaken at the beginning of the study (i.e. before the use of wikis in learning).

2. Questionnaires comprising two types of questions: Multiple-Choice Questions and Five-point Likert Scale questions to collect data about students' knowledge and the e-learning skills.
3. E-comments by the participants, as an electronic means of discovering students' attitudes toward wiki technology. The data related to this aspect was collected at the end of the research period. The rationale behind the use of e-comments was to motivate the students to use the Internet in their learning, to encourage them to contribute their work electronically, and to make the e-learning concept more familiar among them.
4. Weekly tests: the aim of this instrument was to examine students' academic achievement level during the research period (in each week of the six weeks).

The data collected was in both quantitative and qualitative forms. To aid the analysis of the quantitative data in research questions 2, 3 and 4 (Table 4.1), the researcher used the 'SPSS' software. The rationale behind the use of SPSS refers to the popularity of this programme among researchers in the field of quantitative data analysis "the popularity of SPSS is owed to a great extent to convenience of use" Bailey (1987, p. 90). SPSS provides a variety of statistical characteristics enabling the researcher to analyse the data relating to the research questions 2.3 and 4. Moreover, the programme presents the findings in a range of formats, including graphically. The qualitative data in questions 1 and 5 (Table 4.1) was analysed through NVivo software. According to National Association of Social Workers (2008) the use of software for the purpose of qualitative analysis can provide tangible benefits; appropriate software such as NVivo can provide researchers with enhanced data management. In addition, it provides more thorough and rigorous coding and interpretation, and can shorten analysis timeframes. NVivo was chosen to analyse the data gathered from participants in the present study for students' perceptions of wiki and students' attitudes toward wiki technology in learning. Students' comments and points of view toward wikis represent the qualitative data that this study seeks to investigate. The data in both students' perceptions and attitudes was first translated from Arabic to English after gathering and before analysis in order to facilitate working with the NVivo programme.

4.3 Research questions

The main research question is: What is the impact of using wiki technology in learning biology among ABU students? This question is underpinned by five sub-questions:

- 1- What are students' perceptions of using wiki technology?
- 2- What is the extent of students' knowledge about wiki technology?
- 3- What is the impact of using wiki technology on the students' biological knowledge?
- 4- To what extent do the students' acquire e-learning skills during construction of the biology content via wiki pages?
- 5- What are students' attitudes toward using wiki technology?

4.4 Research methodology

The nature of research methodology differs according to whether it is quantitative or qualitative, but in general it includes descriptions in terms of how data is collected and analysed. Descriptions of research methodologies provide critical information about the research (Krishnaswamy et al., 2009) and the techniques employed to carry it out. Research methodology also explains the manner in which data is accumulated for a particular project.

The following subsections address the quantitative, qualitative and mixed method approach and the reasons behind the selection of these approaches. These sections also provide a brief explanation of the instruments used to collect the quantitative and the qualitative data which is explained in detail in Section 4.6.

4.4.1 Quantitative approach

Usually a quantitative approach is used when the data is measured in numbers. Burns and Grove (2001) stated that a quantitative approach is a systematic process in which numerical data are used to obtain information about the phenomenon under study. Another definition provided by Franz (2003, p. 248) is that "quantitative research is a quantitative method to explore factors of interest. Quantitative research seeks to describe, identify, explain, or predict relationships". Furthermore, Dillon et al. (1994) believed that quantitative research is a technique involving relatively large numbers of respondents who provide descriptive information that cannot easily be obtained from

the population as a whole. Thus, Spratt et al. (2004, p. 9) summarise the concept of quantitative research as follows:

“Quantitative research places the emphasis on measurement when collecting and analysing data. Quantitative research is defined, not just by its use of numerical measures but also that it generally follows a natural science model of the research process measurement to establish objective knowledge (that is, knowledge that exists independently of the views and values of the people involved)”.

According to Tull and Hawkins (1990) one of the main objectives of the quantitative approach is to determine the relationships and patterns that can be translated into numbers more than to words. The present study gathered quantitative data through two types of questionnaires, and through the weekly tests. The questionnaires were composed of multiple choice questions (Appendix 5) and five-point scale questions (Appendix 3). These methods (respectively) were selected to be the appropriate measure for measuring the acquisition of e-learning skills, and identifying the extent of students' knowledge about wiki technology. Finally, weekly tests (Appendix 4) examined students' academic achievement levels through using wikis as a learning tool during the six weeks data collection period. The study framework shows that these three instruments used to collect the quantitative data can be linked with the research questions 2, 3 and 4 as can be seen in Figure 4.1.

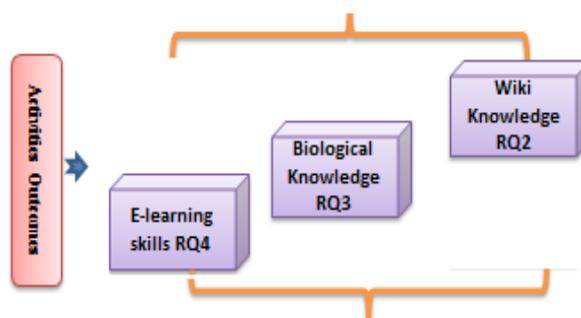


Figure 4-1 Quantitative data in the RQ2.3 and 4

4.4.2 Qualitative approach

Qualitative research is a tool used in understanding and describing the world of human experience (Myers, 2000). Qualitative research is employed in various disciplines e.g.

education, nursing, psychology and sociology and includes many strategies of inquiry. Denzin and Lincoln (1994, p. 2) offered a broad definition of qualitative research:

“Qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them”.

Creswell (1998, p. 15) provides a definition of the qualitative approach concentrating on the methodological nature, the complexity of the end product, and its realistic nature of inquiry. Creswell says that a qualitative approach is: "Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The research builds complex, holistic pictures, analyses words, reports detailed views of informants, and conducted the study in natural setting." Another useful definition given by Clipper (2008, p. 121) is that “the qualitative approach seeks to understand phenomena through understanding meanings and processes usually less amenable to statistical analysis”.

There are numerous qualitative methods of gathering data, the most common methods being: historical, direct observation, participant observation, case studies and unstructured interviewing (Giacomini, 2008). Additionally, but importantly, qualitative research aims to discover and understand individuals’ opinions, experiences, attitudes and behaviours (Offredy and Vickers 2010).

Interviews and e-comments were used to collect qualitative data for this research; interviews being one of the most common methods for qualitative data collection. According to Mack et al. (2005, p. 29) “One reason for their popularity is that they are very effective in giving a human face to research problems. In addition, conducting and participating in interviews can be a rewarding experience for participants and interviewers alike”.

The use of e-comments as a qualitative method was to collect data related to students’ attitudes toward wiki. The justification behind selecting the use of e-comments, according to the results of the pilot study, was that this was the first time for students had used wikis in learning, and they found it a good chance to express their views and to describe their perceptions and attitudes freely.

4.4.3 Mixed methods approach

Mixed methods approaches combine quantitative and qualitative approaches in social and behavioural studies (Creswell, 2003). By using questionnaires, interviews, weekly tests and e-comments, the present study adopted a mixed methods approach. There are a variety of definitions for what a mixed methods approach means (Andrew and Halcomb, 2009). Some definitions mention when or at what phase of research the mixing of quantitative and qualitative approaches takes place, while some authors include historical research in addition to the two paradigms already mentioned.

Greene et al., (1989 p. 256) defined mixed methods as “a methodological approach that includes at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words) in order to understand better our complex and diverse world”. Onwuegbuzie and Johnson (2004, p. 17) define mixed methods as where the researcher “mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study”.

Accordingly, mixed-method inquiries allow a way of investigating the social world that ideally involves more than one methodological tradition and thus more than one way of knowing, along with more than one kind of technique for gathering, analysing, and representing human phenomena, all for the purpose of better understanding (Greene, 2006). A comprehensive definition can be summarised by Tashakorri and Teddlie (2003) as a methodology that incorporates multiple approaches in all stages of research from problem identification to research questions, data collection, data analysis, and final inference; and includes a transformation of the data and their analyses through the other approach. With respect to the present study, a mixed method can be defined as the process by which the qualitative data were collected through the interview and e-comments, and the quantitative data through the questionnaires and weekly tests, and then the ‘en masse’ analyses of these data by using the framework analysis approach.

The process of ‘triangulation’ was used in this research. ‘Triangulation’ refers to a technique used in which quantitative and qualitative procedures are conducted separately from each other in order to maintain the independence of data analysis (Yang, 2005). The use of the triangulation of data then allows the researcher to “integrate findings related to a single topic of investigation” (Grossman, 2008, p. 121). In the present study triangulation was used for several considerations, namely, to avoid

weaknesses of any instruments of the data collection, to avoid the possibility of researcher bias, and to provide a more sophisticated understanding of the research problem than either type of data alone (Creswell, 2005). Moreover, triangulation was used in the stage of analysing the data, to help confirm research findings also in the final stage in the present study to interpret the results (i.e. both quantitative and qualitative findings were integrated into the final results). According to Stake (1995), triangulation can be defined as the process of employing various techniques to make sure the data is being interpreted correctly by offering multiple definitions of the subject matter. A term often used to represent case studies is triangulated research strategy. This research employed a triangulated technique to gather data through questionnaires, interview, weekly tests and e-comments. The purpose of triangulation is to ensure that valid techniques are being used to conduct the research. Yin (2009) proposes that by gathering data from a variety of sources, triangulation can be incorporated for case study based research methods.

Overall, in the present study the triangulation was applied methodologically through mixed methods. The rationale for using a mixed method approach and triangulation in the present study was that the expected qualitative data provided a rich description of students' actively participating in the wiki learning environment to support the quantitative findings.

4.4.4 Qualitising data

When analysing qualitative and quantitative data, researchers can select from the full range of analysis techniques to improve the analytic power of the study. The type of data and the process of collecting the data require researchers to select an appropriate analysis technique. With respect to the present study, a mixed method approach to the collection and analysis of the data was used. The combination of the results of two or more rigorous approaches provides a more comprehensive picture of the results than either study could do alone (Mores, 2003. P190). The process of converting quantitative data into data which can be analysed qualitatively is called, according to Tashakorri and Teddlie (1998) 'qualitising data'. According to Briggs et al. (2012 p. 133)

“Qualitising data involves creating profiles for particular result patterns or average profiles to group individuals into more meaningful categories.

Narrative profiles constructed from numerical data might help the researcher during data interpretation or might be more meaningful to invested stakeholders. Naming or labelling factors in factor analysis is another example of qualitisising. The key idea is that numbers can be converted into words, themes or narrative profiles to provide qualitative information or be analysed using qualitative methods”.

4.5 Research strategy

Designing a research strategy is one of the most important phases that lead to the success of research implementation. The term ‘research strategy’ has been defined by Singh (2007, p. 188) as “a generalised plan for a problem which includes structure, desired solution in terms objectives of research and an outline of planned devices necessary to implement the strategy”. The research strategy is a part of a larger development scheme of research approach. The strategy for the current study is based on the application of the ‘case study’ as a research approach. The following sections address a case study approach in detail from several aspects. These sections include the most common types of case studies and their pros and the cons. The final section addresses justifications behind the selection of a case study approach for the present study.

4.5.1 Case study

Case studies are suggested when the subject at hand relates to developing an in-depth understanding of a ‘case’ or bounded system. In the present study, this was a wiki system, which will be applied to the current study according to the concept of wiki defined by Newman and Thomas (2008, p. 180) “a wiki is a system of web pages that can be easily created, edited, and viewed”.

The value of a case study according, to Patton (1990), can be gauged by its ability to develop profound explanations of specific individuals, problems, and/or issues in comprehensive ways. Yin (1984, p. 23) explains research methods based on case studies as “offering a glimpse into real life events based on modern scenarios through the usage of a multitude sources of facts”. The case in the present study examined the impact of using wiki technology with ABU students in the College of Science and the way in

which the students worked collaboratively in groups or as individuals in order to construct subject content on wiki pages through adding learning materials such as the visual, written and audio material.

Researchers are split over the most accurate description of case studies. Stake (2000) suggested that case studies embody an object that needs to be understood. According to Lamnek (2005, p. 183) “the case study is a research approach, situated between concrete data taking techniques and methodological paradigms”. Creswell and Miller (2000, p. 485), however, provide a more concise definition when they referred to a case study as “in-depth exploration of a bounded system (e.g., an activity, event, process, or individuals) based on extensive data collection”.

According to Thomas (2011), case studies are investigations of a person's activities, or other strategies that are studied fully by one or more methods. Using Thomas' definition the persons in the present study were represented through a sample of ABU students and the activities were students' attempts to create biology content through their interaction with each other. The purpose of a case study is therefore to offer a deep evaluation of an individual, team, incident, or issue while emphasising the learning to be gained from the study.

4.5.2 Types of case study

According to Yin (1994) case studies can be divided into two core types, namely, single case design and multiple case design. The term ‘collective case’ is also used to refer to multiple designs of case studies. Recommendations have been given by Yin (2009); Feagin et al. (1991); and Merriam (1988) on taking a more universal approach to the formulation of a case study and also to develop case studies for particular purposes such as for exploration, explanation or description of a phenomenon. These three categories can be adopted for single case design as well as multiple case study design. The selection of single or multiple cases in the present study was based on several considerations such as the number of cases that will be studied and the type of research questions posed. According to the research questions of the present study, ‘what’ questions are formulated the set of the research questions, ‘what’ questions are generally exploratory in nature whereas ‘how’ and ‘why’ questions are more explanatory in nature. Accordingly, and because of the current study concentrates on one case that represents in the students' use of wiki technology as a learning tool, the

single case study will be applied as type of case study approach for the purposes of examining and exploring this phenomenon. The following section addresses the justifications behind the selection of case study in the present study.

4.5.3 Justifications for the use of case study

For the purpose of understanding the reasons behind the selection of a case study for the present research, this section addresses relationship between the case study approach and the present study and the main considerations behind this selection.

The decision to select a case study approach derives from the fact that the characteristics of this approach are commensurate with the present study in terms of study procedure, data collection methods, sampling, research questions, study objectives and the type of research approach (i.e. a mixed method approach using triangulation techniques). The characteristics of the case study approach made this strategy the most suitable to be applied when investigating the impact of using wikis with ABU students.

The case study approach examines a phenomenon within its real-life context, and obtains an in-depth understanding of a contemporary phenomenon (Lee, 2011).

However, this particular research deals with the contemporary situation in ABU, specifically the use of wiki technology with ABU students. Moreover, “The principal difference between case studies and other research studies is that the focus of attention is the individual case and not the whole population of cases” Nunan (1992, p. 80).

Given that the current study focuses on students at a particular level, “students in the second academic year”, and in the particular subject of “biology” and exclusively male students (though we know that the ABU provides biology classes at other levels and also for women), this identification is commensurate with the case study strategy.

The particular case in the present study is the use of wiki technology as an e-learning tool, in the present study occurring according to the university education timetable prepared in advance. This means the study is carried out during the academic semester according to the study period, which is three months. This period is not limited by a number of phases such as in action research strategy. The nature of the current study requires continuity until the end of the research period.

A case study approach aims not to examine a particular instance, but to clarify a general problem (Hansel, 2007). The current study does not solely focus on describing the case of the use of wikis with students, but more than this, the case study strategy employed here provides an in-depth understanding through data collection instruments used: questionnaires, interviews, e-comments and weekly tests.

4.5.4 Advantages and disadvantages of case study

Case studies help the people conducting the research to understand various perspectives of real life. Case studies offer a wealth of data, information, and knowledge presented in a more eye-catching manner than other forms of education projects and can be easily accessed as well. A case study helps in building up a complete view of the research topic and the case example at hand helping the readers in better understanding the issue and coming up with their own theoretical solutions based on their own analysis (Adelman et al., 1980, and Cohen et al., 2007).

The advantage of case studies, in general, is that they can incite discussions, differences, and multiple interpretations which all add to a better learning and understanding of the topic at hand. However, to get an objective and unbiased understanding of case studies in general, it is important to discuss their disadvantages too. Critics of case studies have contended that case studies do not have much in the way of methods and techniques.

According to Atkinson and Delamont (1985) case studies are usually explained according to the traits that they do not carry such as a lack of quantitative research and experimentation rather than the traits that they actually do carry. Moreover, case studies do not offer much for the purpose of scientifically generalising different perspectives and learning. While, case studies offer a very profound overview of the situation at hand, the result of case study or a variety of case studies cannot be generalised.

Moreover, the accuracy of data can be questioned when the people to be interviewed for the preparation of a case study do not cooperate; (to get accurate information, people working on a case study require full cooperation from all participants involved (Ferreira and Merchant, 1992, and Ryan et al., 1992).

When generalising the findings of a case study it is necessary to tread carefully because case study findings are restricted to the environment they are extracted from. Other disadvantages of case studies are explained by (Cohen et al., 2007, and Hitchcock and Hughes, 1995) as follows: to begin with there is a probability of research investigator

bias creeping into the findings. Establishment of personal relationships with different stakeholders can also result in subjective evaluation of data on the part of the researcher. Some respondents might feel uneasy about revealing their identities resulting in lack of cooperation. Case studies take a lot of time and hard work from the researchers. In order to avoid the disadvantages of case study there are some procedures that can be taken. For instance, in the present study, data was collected over three months and the researcher believed that this period was suitable to conduct the case study. Moreover, to avoid researcher bias the data was collected via four instruments; two types of questionnaires, interviews and e-comments, and the mixed methods approach employed triangulation to check the accuracy of the data.

4.6 Research instruments

This research dealt with five questions in order to investigate the impact of using the wiki technology in students' learning biology. The rationale for the five research questions was that the study was conducted in three stages 'before, during and after' the use of wiki, and because of the difference in the nature of each stage in terms of the aim of each stage, the type of data, and the time of applying the wiki with students as a learning tool. For these reasons, the stages before the use of the wiki and after the use of wiki took place in two weeks (one week for the stage before the use of wiki and one week for the stage after the use of wiki) thus, the researcher identified one question only for each stage to collect the data about the students' perceptions of wiki and one question for the data about the students' attitudes towards the wiki. In contrast, the stage during the use of wiki considered the main stage for the use of wiki because of the students using the wiki in this stage more than in the stage before or after. Also, as in the study framework, it is clear that the students' activities and the activities outcomes appear in this stage (Figure 4.2).

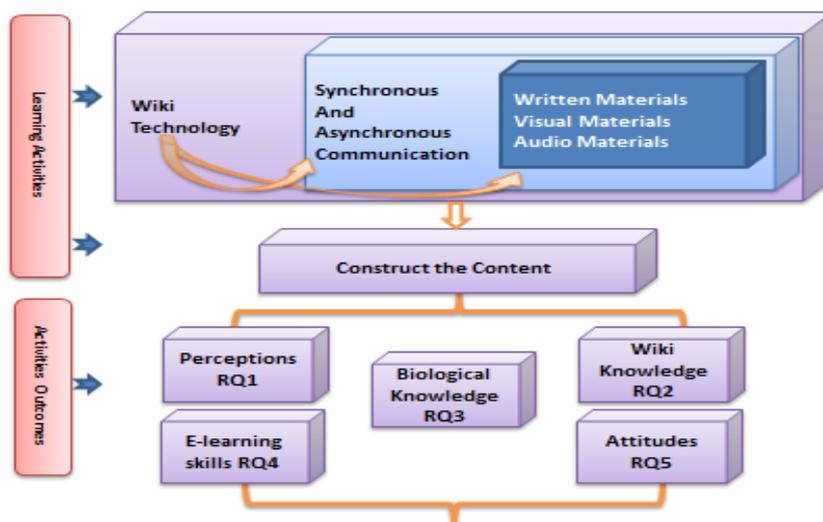


Figure 4-2The students’ activities and activities outcomes

Thus, and in order to find out the real impact of using the wiki in students’ learning the researcher identified three aspects relating the use of wiki in learning (students’ knowledge about wiki- the impact of wiki on the students’ biological knowledge and the extent of acquire e-learning skills). Each of these aspects has a specific aim and thus needs a specific question to achieve this aim.

According to Johnston et al. (2010, p. 125) “there are advantages to using two or more research methods to triangulate findings and cross-check results for consistency. The use of multiple methods can enhance confidence in overall conclusions and offset the biases or shortcomings of any single method”. Table 4.1 illustrates how the research questions and research instruments link together.

RQ No	Questions	The Instruments	Type of data collected
1	What are students’ perceptions of using wiki technology?	Interview	qualitative
2	What is the extent of students’ knowledge about wiki technology?	Questionnaire ‘Multiple Choice Design’	quantitative
3	What is the impact of using wiki technology on the students’ biological knowledge?	Weekly Tests	
4	To what extent do the students’ acquire e-learning skills during construction of the biology content via wiki pages?	Questionnaire ‘Five-Point Likert Scale’	

5	What are students' attitudes toward using wiki technology?	E-comments	qualitative
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Table 4-1: Research questionnaires, the instruments and the type of data

Several aspects were taken into account when selecting these instruments as tools for collecting the data to answer the research questions. For instance, the rationale behind the use of interviews as instruments to collect students' answers to the first research question is that they can provide access to students' perceptions of wikis and that they cannot be directly observed; in other words, interviews allow the researcher to gain particular information unavailable through other means, including "what is in and on someone else's mind" (Ohata, 2005, p. 140). Moreover, the interview method also provides a good opportunity for participants to ask the interviewer when they are uncertain about particular questions.

With respect to the second instrument 'Questionnaire Multiple Choice Design', this instrument was selected to answer the second research question. The researcher identified nine items to be the questionnaire's axes to measure students' knowledge about wiki. Thus, these items gave students more freedom to select one of multiple choices for each question. Additionally, this type of instrument was selected to find out students' knowledge about the wiki because multiple choice questions can be used to allow students to test their knowledge as they learn (Coon and Mitterer, 2010), and to self-assess their knowledge (Robinson and Schraw, 2008, and Jean, 2007). The third research question sought to examine students' academic achievement. However, conducting the tests at the end of each week allows the researcher to measure the students' progress and achievement throughout the course and to find out if the students are meet what they studied. The forth instrument is 'questionnaire five-point Likert scale'; the rationale for which was that it has a middle value that could indicate that the respondents agree to parts in both statements, it is easier and more convenient for the respondent. According to Hook (2008), five points in a semantic space between two concepts correspond to actual distinctive options. Finally, the e-comments are the instrument used to measure students' attitudes towards the wiki technology. The justification of using this instrument is to collect the students' attitudes is electronically and gave students more freedom to express their views. Moreover, because this is the last question in this research and students were asked to write about their attitudes after

they used the wiki, the selection of the e-comments allowed students to write without any limitation and after they had enough information and experience of the wiki.

The following sections address in detail each of the methods that will be used in this study, the reasons behind their selection, and finally the relationship between these methods and the key research questions

4.6.1 Questionnaire

According to Sharma (1997), the questionnaire is a systematic compilation of questions, which refers to a device for getting answers to questions by using a form which the respondent fills in by himself or herself. Generally, questionnaires are characterised by several properties which make researchers use it to collect data whether qualitative or quantitative. For instance, the components of questionnaires can be easy to analyse as “data entry and tabulation for nearly all surveys can be easily done with many computer software packages” (Fox and Bayat, 2008, p. 88). Also questionnaires can collect data from a large number of people rapidly, unlike interviews. In contrast, there are disadvantages of questionnaires which occur when statements are ambiguous without chance for explanation. The main disadvantage of using questionnaires is that there may be low rates of return when the questionnaire is given or posted to participants. Questionnaires, like many evaluation methods occur after the event, so participants may forget important issues (Williams and Kerfoot, 2005).

To achieve the study objectives relating to the research questions 2 and 4, two types of questionnaires have been designed to measure students’ acquisition of e-learning skills and students’ knowledge about wiki technology. Multiple choice questions were designed to gather the data associated with students’ knowledge about wikis. The multiple choice questions were selected as a real reflection of the extent of the students’ knowledge about wiki technologies. In addition, the questionnaire items developed are based on the most important characteristics about the knowledge of wikis, such as types of communication among students, obstacles of knowledge acquisition, improvement of knowledge, and students’ posts on wiki pages.

The second type of questionnaire was designed to measure and to collect the data related to the e-learning skills using a Likert scale. In a Likert scale “the item is presented as a declarative sentence, followed by response options that indicate varying

degrees of agreement with or endorsement of the statement” (DeVellis, 2011, p, 93). A Likert scale is probably the most commonly used scale in questionnaires (McKenna, 2000). There are several types of Likert scale: three-point, four-point, five-point and seven-point (Perera et al., 2008). Each point represents a different level of the participants’ responses. According to the wording of the questionnaire items (Appendix 3), the five point scale is enough to give adequate answers about students’ acquire of e-learning skills compared to other Likert scales. In general, the five-point scale being the most commonly used in studies on humans (Bernard, 2011). In order to evaluate participants’ opinions, respondents are asked to indicate their agreement or disagreement with survey statements using the following scale: 1. strongly disagree, 2. disagree, 3. neither agree nor disagree, 4. agree and 5. strongly agree (Appendix 3).

The reason for using the Likert scale was ascribed to its many advantages as reported in the literature such as Kumar (2008) where he mentions some advantages of the Likert scale, which can be summarised in the following three points: it is simple to construct, it can be used in many cases and it is more reliable than other scales. The questions in this type of questionnaire are formulated to measure various educational skills, such as collaborative learning skills, communication skills, writing and reading skills (Lynch, 2003), and the skill of using the Internet to search for information related to the biology topics.

4.6.2 Interview

The main aim of the interview is to obtain information relating to ideas, attitudes, perspectives, points of views and suggestions or opinions (Wall, 2011). Researchers use interviews to collect qualitative data and allow the respondents freely to answer questions. Moreover, the interview method provides the researcher with a great opportunity to ask a question which may suddenly come to his/her mind. The interview is one of the most common methods in social sciences (Grix, 2001). The interviews in the present study (Appendix 2) collected data from the students at ABU about their perceptions of wikis. Stewart (2007, p. 1) provided the following definition of interviews: “The interview is an interactional communication process between two parties, at least one of whom has a predetermined and serious purpose that involves the asking and answering of questions”. Another definition is provided by Fielding (2005), who believes that the interview is a planned conversation between two parties during

which questions are asked and answered. This conversation is prepared to exchange attitudes and information about a particular topic or purpose. Pershing (2006) believes that the interview is a type of research method for gathering data from between two persons or more, through interactive real-time communication on the telephone or in person (face-to-face).

Brewer (2003, p. 167) states that “there are three main types of interviews: structured, semi-structured and unstructured”. The differences between these three types in qualitative research are: 1- Structured interviews require the use of specific answers and a set of standardised questions that the researcher creates in advance. Each question that is outlined should be read word for word by the interviewer without any deviation from the protocol (Santiago, 2009). 2- Semi-structured interviews are a bit more flexible than structured interviews, while interviewers using this type are still expected to cover every question in the interview process (Santiago, 2009).

According to Hawthorne and Lawrence (2012, p, 210) “a semi-structured interview is one in which a relaxed but focused conversation discusses relevant issues but allows the informant to provide depth and indicate other issues of relevance”. 3- Unstructured interviews are not formatted step by step and the researcher and participants are not limited by the protocol. The questions can be changed or adapted to meet the respondent's intelligence, understanding or belief (Tarek, 2011) to a greater degree than in semi-structured interviews and without any set format but in which the interviewer may have some key questions formulated in advance (Thyer and Holosko, 2011). In the current study, a semi-structured interview was chosen as the method for collecting data related to students' perceptions of wiki technology. “The semi-structured interview is used when the researcher knows most of the questions to ask but cannot predict the answers” (Morse and Field, 1995, p. 76). Moreover, this kind of interview allows the researchers to develop in-depth accounts of experiences and perceptions from individuals (Cousin, 2008). In particular, with regard to wiki study a semi-structured interview provided the student a greater chance to think and then to answer the questions during the interview process and it was also a good opportunity for the researcher to ask a new question he may not have considered.

It can be concluded that the semi-structured interview is selected as the appropriate type of the interviews for discovering students' perceptions of wiki technology. According to

De Vos (2002), the purpose of this method is to gain a detailed picture of the participants' beliefs and perceptions about a particular subject. This method was developed and prepared by the researcher to discover the perceptions of students with respect to the use of wiki in learning. This method was applied at the start of the study because the perception of anything is usually measured before it is used or dealt with (see also the difference between perceptions and attitudes, Section 2.6.5).

For several considerations, the interviews will not be audio-recorded. The rationale for transcribing the answers without recording can be divided into three main reasons. First, recording the students' answers and then writing down their answers would have been time consuming, and the researcher believed that the data he needed to collect could be identified by transcribing the answers directly. Secondly, students at ABU do not have much familiarity with researchers recording their voices, and they sometimes have concerns about using a recorder, the negative feeling of students toward interviews can affect the quality and the credibility of their answers. Finally, during the interviews, the researcher benefited from the answers supplied by the students who were still in front of him at the time of the interview. This approach is not unusual and the literature shows that several researchers conducted their interview without recording it. For instance, Madden (2011); Loveridge (2011); Jefferson (2012); Dorris (2012); and Reichel (2012), and Al-Yateem (2013).

4.6.3 E-comments

E-comments represent the construct of gathering data based on the electronic contribution of participants in the research activities. "The easiest way to begin using electronic commenting is to use the feature of word processing applications that allows the user to insert comments and make editing changes to the text" Daniel (2007, p. 17).

The e-comments were used in the present study to provide the data related to students' attitudes toward wiki technology at ABU. A general definition of e-comment is provided by Murabayashi and Yamato (2007, p. 2): "an e-comment is a system in which citizens can make various proposals through the Internet". The researcher defines e-comments according to the current study as follows:

E-comments refers to comments that students at ABU were writing electronically through the wiki pages in order to point out their willingness and readiness to learn

through the use of a new method, 'wiki technology'. The wiki site in the present study included a particular page called the 'Comments Page'; this page allowed students to describe their attitudes during the research period. Moreover, students were allowed to send their comments via e-mail.

The use of e-comments seems common among the Internet users these days. "Many people now prefer to send and receive electronic comments, and this can be quite a good thing" Mullin (2000, p. 55). Students prefer electronic comments over handwritten comments "the use of electronic comments and feedback does provide all students with a better opportunity to engage with the learning process and benefit from electronic communication" Heinze and Heinze (2009, p, 6). The researcher believes that e-comments were a suitable way to collect data from students about their attitudes. The literature indicates that students freely use e-comments and they feel that the teacher values their work more when using electronic comments (Daniel, 2007).

The rationale here can be determined through knowing the degree of the interdependence between the following points: 1. the main axis in the current study was the use of wiki in learning; 2. the wiki system requires the Internet, and 3. attitudes are evaluative statements or judgments concerning objects, people or events. In accordance with the above three components, students may find it a good opportunity to write about their attitudes freely with unlimited use of wiki spaces (i.e., wiki pages).

4.6.4 Weekly tests

Weekly achievement tests measured the students' biological knowledge. The aim of these tests was to find out the impact of wikis on students' weekly academic achievement by asking them several questions about the threads that have been studied during that week. These questions were changed every week according to the topic; the test normally lasted from 30 to 45 minutes. Appendix 4 represents example of these tests. The tests took place before the use of wikis and during the using of wikis in the research period, which was 6 weeks. Students conducted the tests every Wednesday according to the university schedule. The role of the biology teacher was to collect the students' answers and to mark it, and then provide the researcher with the final grades obtained by students. In order to find out the impact of wikis on students' achievement the researcher compared the results of students' by using SPSS programme to see whether the scores of the students in each of the topics after the use of wiki was the

same as before the use of wiki or not, since the scores came from the same people in both cases. The differences for pre-test and post-test scores for each topic were determined and a paired t-test performed to evaluate the differences between the two tests (pre and post-test).

4.6.5 Online collaboration

The 'Recent Changes' page is one of the wiki pages that helped evaluate the students' online collaboration. This page shows a list of recent modifications in the wiki pages (Lahti and Peterson, 2005). The online collaboration refers to the students' contributions to the wiki pages. These contributions can be determined through the number of times students logged in to the wiki and the content that they added in the wiki pages (Figure 4.1). This page also showed the date and time that students accessed the wiki. In addition, it showed the length of postings that the students added. Each student had a username and password (Appendix 14), the username helped on provide a full details about each student, it was determined which of the student contributed to wiki pages and the time of the login. This also provided an indicator of whether the student used the wiki during and after the academic day (i.e. online outside the class), and what new contributions he made. Figure 4.1 is an example of students' logins to the online wiki after the academic day.

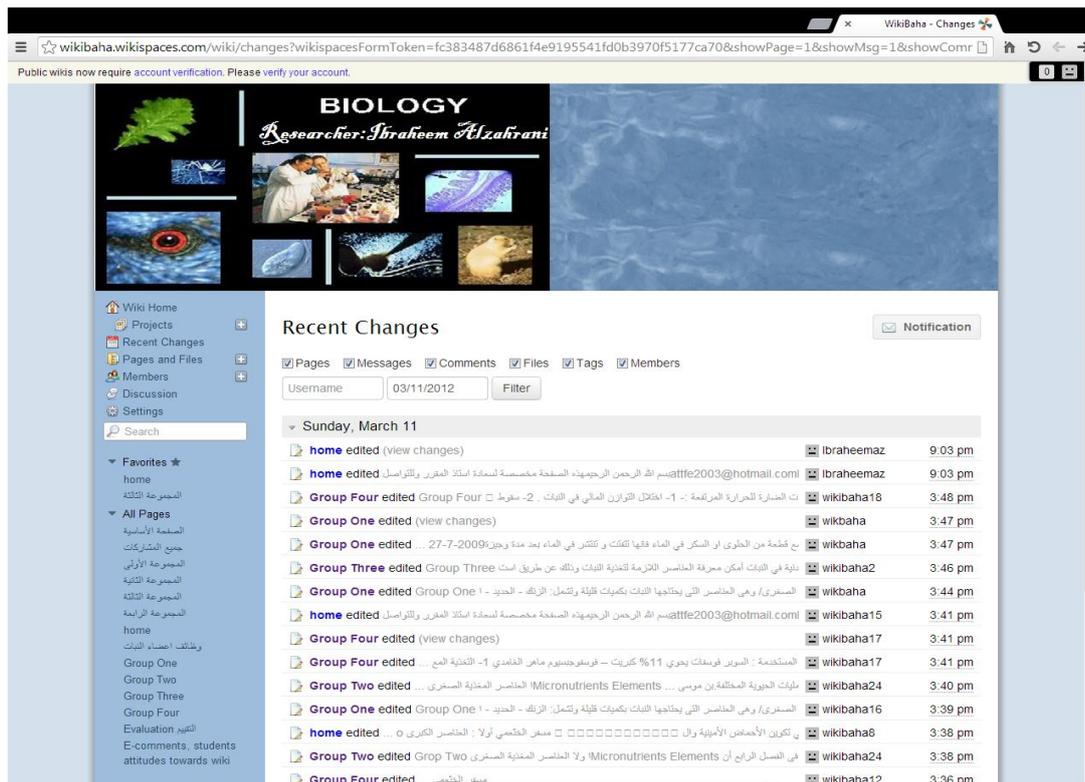


Figure 4-3: Screenshot taken for the date and time of students’ login to wiki

4.6.5.1 Verification of students’ online collaboration (Salmon five steps model)

To verify the extent of online collaboration, Salmon’s five step model used as measuring tool to ensure that students engage in online collaboration via the wiki pages.

The model suggests five stages in analysing online interaction, which are:

Stage 1: access and motivation,

Stage 2: online socialisation,

Stage 3: information exchange,

Stage 4: knowledge construction, and

Stage 5: development.

These stages will be addressed in detail in chapter 5 as part of the data analysis (Section 5.4.4).

4.7 Pilot study

The term 'pilot study' refers to mini versions of a full-scale study also called 'feasibility' studies, as well as the specific pre-testing of a particular research tool such as a questionnaire or interview schedule. Teijlingen and Hundley (2001) stated that

conducting a pilot study does not guarantee success, but it does increase its likelihood. During a pilot study, data collection instruments and procedures are tested and revised (Silber and Foshay, 2009). According to Cooper and Schindler (1998) pilot studies are conducted to detect weaknesses in design and instrumentation and provide proxy data for a selection of a probability sample. Furthermore, during a pilot study there are new aspects with regard to the research that the researcher may not be expecting to appear.

In the present study a pilot study was conducted in ABU with a convenience sample of the study population over a period of two weeks.

4.7.1 Pilot study sampling

A set of male students studying in the academic year of 2012 in ABU were chosen as sample members to carry out the pilot study. The sample was a convenience sample. According to Stevens (2012), a convenience sample is a sample where the participants are selected, in part or in whole, based on the convenience of the researcher (i.e., availability or accessibility). Cohen et al. (2007) indicate that researchers mainly select the sample from people who are easy to reach.

4.7.2 Method of pilot study

An interviewer-administered questionnaire was designed for the pilot study purposes (Appendix 1), included 16 questions. This questionnaire attempted to determine the extent of the knowledge of ABU students with regard to wiki technology, and the extent of their acceptance of learning by using an alternative to traditional teaching (i.e., the lecture).

The questions focused on: Students' access to computers and their skills on the Internet; the extent of students' awareness of wiki technology and its main characteristics; the desire of students to learn via the wiki technology compared with the current teaching style; and the role of ABU with regard to e-learning.

4.7.3 Procedure and participants

25 students were asked to participate in this pilot study in two colleges of ABU, College of Science, and College of Education. The implementation period was two weeks. The protocols used are shown in Table 4.2. Data was collected from sample members using

an ‘interviewer-administered questionnaire’, to collect data with regard to the key aspects of the main study. This type of questionnaire according to Kaden (2006, p 128) “will have skip patterns that jump a respondent from one section of the questionnaire to another based on participants responses”. Moreover, an interviewer-administered questionnaire allows participants to ask about any question that is not clear or needs more explanation. Before starting the piloting, the sample was given a brief introduction related to the aims of using wiki in education, and how the pilot study would be conducted. After the meeting, the consenting participants were asked to read and sign a consent form (Appendix 1). Following the pilot study the data were analysed by SPSS programme.

The table below illustrates the main phases of implementation the pilot study which were followed for consistency and to avoid mistakes.

Phase	Procedure
Before Implementation with regard to the sample	Identify type of sample
	Identify the sample group and number
	Identify place and time for implementation
	Identify data collection method
Before Implementation with regard to the ethics governance	Design questionnaire
	Design the consent forms
	Complete the ethics process
	Obtaining the consent of the University
	Obtaining the consent of the sample members
During implementation	Meet the sample members as a single group
	Conduct interviewer-administered questionnaires
	Collect data
After implementation	Data analysis and writing the findings

Table 4-2 : Pilot study protocol

4.7.4 Implementation

The researcher designed a schedule which included the names of students and the date of meeting. Each student chose the suitable time to conduct the interview, the researcher asked the officials in both the College of Science and the College of Education to

provide an appropriate place to meet the sample member. On the meeting day, each student was given the consent form to sign his agreement and then to conduct the interview.

4.7.5 Findings of the pilot study

The data were analysed for each question of the study axes using Statistical Package for Social Sciences (SPSS) and percentage analyses. The findings were presented by use of descriptive statistics.

First axis: Students' access to computers and their skills on the Internet.

The purpose of this axis is to find out the extent of students' skills of using the computer and the Internet to obtain an indicator prior to them using wiki technology in learning.

Students' responses to the questions of the first axis indicated that all of the students were able to access a computer/laptop regardless of whether they 'own a computer/laptop or not'. (84%) of the students had a computer; (16%) had 'access to computers elsewhere'. The final analysis of this axis indicated that all of the samples had access to a computer/laptop whether they own a computer or whether they can go to a place where there are computers. This result is a positive indicator of the ability of the students to access the wiki.

The second aim of this axis is to determine the students' possibility of using the Internet through two essential aspects: the 'students' Internet connection' and their 'practical experience' of the Internet. The responses indicated that (60%) of the students were able to access the Internet via an 'Internet café', while (24%) of the respondents were able to access the Internet through the 'university's Internet facilities' and the minority of respondents (16%) accessed the Internet in 'other ways'.

To determine their level of use of the Internet, the respondents reported their perceived level of the Internet knowledge: 'Excellent' or 'Average'. 19 out of 25 (76%) of the students had an 'excellent level' of Internet experience, while the remaining 6 students had an 'average level'. With respect to the main study, this is a clear sign that most of the students will be able to use the Internet easily.

Second axis: The extent of students' awareness of wiki technology and its main characteristics. To find out students' knowledge of wiki, this axis consisted of four

questions concerning the main characteristics of wiki including ‘understanding the concept of wiki’ ‘text editing’ ‘communication’ ‘teaching style’ and ‘content creation’.

With regard to ‘understanding the concept of wiki’, students seem to consider ‘Wikipedia’ as synonymous with wiki because Wikipedia is the most famous wiki and many students using Wikipedia as an information resource. Just 4 students understood the term of wiki (16%). 11 students (44%) understood the meaning of wiki moderately, and 10 students did not understand the concept (40%). With respect to the main study, this is an indicator that the wiki-concept is not particularly familiar to the students.

With regard to the main characteristics of wiki the vast majority of students up to (92%) indicated that they have a very good ‘level of skill in editing’. Only one student reported having a good level in editing and one student a satisfactory level. With regard to their preferred type of learning, students selected one of two learning types: ‘collaborative learning’ or ‘individual learning’. There was not a dominant preference; (52%) preferred to learn collaboratively and (48%) preferred the individual learning.

Another characteristic of wiki is the ‘communication between users’; students were asked if they knew the meaning of synchronous and asynchronous communication. The majority of students apparently did not know the meaning of these two concepts. Only 7 students did (28%). The final characteristic of wiki in this axis is ‘content creation’. 5 respondents (20%) believed that web sites that allow the user to construct the content were very useful. Importantly, (40%) of students believed that these sites were somewhat useful and the same percentage (40%) believed that it was not useful at all.

Overall, it can be said that for this axis the respondents indicated that students did not understand the term wiki but it was likely that they had the skills in editing. With regard to the meaning of communication ways between wiki users, not many students indicated that they knew the meaning of synchronous and asynchronous communication. The majority of them believed that the web sites which allow the user to contribute to building its content are somewhat useful.

Third axis: The desire of students to learn via the wiki technology compared with the current teaching style

This axis consisted of several questions that focused on students' perceptions of 'e-learning as an alternative teaching style'. In order to determine the acceptance of students to learn via an alternative method of the current teaching style (lectures).

The percentage of students indicating the popularity of learning via traditional teaching style was (64%), while (20%) of the students learned via e-learning and (16%) of the students learned via the blended learning. When asked, do you believe that the current teaching style is suitable or not? (52%) answered yes.

To determine the students' desire to learn via other teaching style, (48%) of students expressed their desire to change the current teaching style to another, while (52%) preferred to learn via the current style (traditional style).

Fourth axis: The role of ABU with regard to e-learning

The fourth axis gave an indication of the students' perceptions of 'the role of ABU with regard to e-learning'. Usually, the University should provide a sufficient number of computers in different parts of the campus, and make it easier for students to access the Internet in order to help students in their learning. With regard to the availability of the computers in the University's facilities, seven students (28%) said they could access the University computer easily. Eleven students (44%) agreed that the University computers were moderately available and seven students (28%) thought that the computers in the University were not sufficiently available.

With regard to the accessibility of the Internet in the University's facilities, six students (24%) said it was available with easy connection, four students (16%) agreed that the Internet in the University was somewhat available but most, fifteen students (60%), believed that it was not possible to connect to the Internet in the University. The situation is reflected in the students' satisfaction with the university's role relating to e-learning, five students (20%) said they were very satisfied, while fourteen students (56%) were somewhat satisfied and six students (24%) were not satisfied. Through students' responses it was clear that the students did not feel that the University took an active role with regard to e-learning in terms of the following elements: computer availability and Internet accessibility. With respect to the main study, these results confirmed the current status of the university that has been mentioned in Chapter 1 'Significance of the study'.

4.7.6 The connection between the pilot study to the main study

This pilot study was an attempt to determine the possibility of students' learning through the use of wiki technology as an e-learning tool at ABU from their perceptions of wiki. It should be noted that this was the first study applied to determine the possibility of using wiki in learning at ABU. Barriers to learning at ABU clearly include the traditional teaching style (lecture method), the rise in the number of students enrolling at University, and the geographical environment of the city of Al-Baha and its impact on the discipline of students' attendance at the university. This study aimed to find some e-learning solutions to these problems. Although conducting a pilot study does not assure success in the main study, it leads to the increase of likelihood of success (Silber and Foshay, 2009). For this reason the findings of the pilot study gave an indication of the familiarity of students with the wiki class, and their acceptance to use wiki technology in learning. Moreover, this pilot study indicated the students' views on the extent that ABU provides Internet service and computers. Finally, this pilot study gave good indicators about designing the main study instrument through evaluating the questionnaire items and the students' answers to each item, and it also discovered the positive and negative aspects such as the clarity of the questionnaire items and the importance of adding or removing of some of these items and the extent of suitability of these items in each axis. It also highlighted the importance of using more than one instrument to triangulate data, and to obtain enough data to achieve the study objectives.

4.8 Main study

The main study carried out during the autumn of 2012 according to the time-plan (Appendix 29) and to the Saudi education calendar. The study conducted with the students in the College of Science at ABU. The 31 sample members were male students in a second level course in biology at ABU, according to the number of students enrolled in the division of biology and the capacity of the classroom. The study requires access to a number of computers with the Internet and a data projector and a number of smart boards. The study lasted six weeks, during this period; students learned the biology through a wiki system in the class and out of the class.

Data were collected in accordance with the following plan. The data about students' perceptions collected on the first week before students start to use the wiki in order to

find out their perception of this technology before use it. The data of students' attitudes toward the use of wiki collected at the end of the teaching course. Data related to students' knowledge about wiki, e-learning skills and achieving biological knowledge were collected during of the teaching course through two types of questionnaires, and to verify the effectiveness of wiki on students' biological knowledge the researcher used the weekly tests.

After the completion of data collection the researcher analysed the data using several methods according to the types of data (qualitative and quantitative) these methods such as SPSS programme (Appendix 17) and NVivo software (Appendix 15 and 16).

4.8.1 Research community

This section presents a detailed explanation of the population and the sample for the main study. It provides an overview of the sample selection process, which will be based on several criteria. According to Nair (2008, p. 67), "defining the population and sample are two important aspects of statistical analysis. (a) Population: a set of all the elements of interest in an experiment or study. (b) Sample: a subset of the population is called a sample".

4.8.2 Population

A research population is a large group of individuals or items or units from which we draw our sample (Gravetter and Forzano, 2011). The population in this study was the students at ABU. In the city of Al-Baha there is one university and it is one of the emerging universities in KSA. ABU was established through a Royal Decree in 2006. Data from the MoHE suggest that there are in total 17,000 students at ABU. According to Castillo (2008), because of the large populations sizes researchers cannot investigate every as a well-defined collection of individuals or objects known to have similar characteristics. All individuals or objects within a certain population usually have a common characteristic, with respect to the presents study the common trait such as age, sex, culture, educational level.

The research population in the present study was formed of students at ABU who were studying regularly throughout the academic year 2012. According to Okaz Magazine (2011), the director of ABU, Dr Saad bin Mohammed Al Hariqi pointed out that the

number of students at ABU reached approximately 17,000 students in the academic year 2012. This number includes male and female students in 12 schools: Engineering, Education, Medicine, Science, Medical Sciences, Community, Art and Science in Al-Mandak, Science and Literature in Al-Mandak, Science and Literature in Beljurashi and Finance and Administration, College of Arts and Humanities (ABU portal, 2012).

4.8.3 Sample

The main goal in choosing the study sample is to obtain information about the study population. So, the sample must be representative of the study population. Usually, researchers cannot observe every individual in the population, so instead researchers gather data from a subset of individuals; thus these observations are used to make inferences about the entire population. According to Awe (2012, p. 17) "Sampling is the process of selecting units (e.g., people, organisations) from a population of interest so that by studying the sample we may fairly generalise our results back to the population from which they were chosen". In general, there are two types of sampling methods: probability sampling and non-probability sampling. "The difference between non-probability and probability sampling is that the former does not involve random selection whilst probability sampling does" Offredy and Vickers (2010, p. 134). In terms of the purpose of this study and for several reasons that will be mentioned in the course of this section, the researcher believes that non-probability sampling is the appropriate method for selecting the sample members. The literature indicates that non-probability sampling is divided into three main types: convenience sampling, quota sampling and purposive or deliberate sampling (Catanzaro and Woods, 1988; Cohen et al. 2010; Terry, 2011, and Rao, 2011).

In this study purposive sampling was chosen as the sampling approach. The researcher has deliberately, purposely, selected a particular section of the wider population to include in the sample (Cohen et al. 2010). The current study was conducted with 31 students representing the study sample members. The purposive sampling is defined by Oliver and Jupp (2006, p. 244) as:

"Purposive sampling is a form of non-probability sampling in which decisions concerning the individuals to be included in the sample are taken by the researcher, based upon a variety of criteria which may include specialist knowledge of the research issue, or capacity and willingness to

participate in the research. Some types of research design necessitate researchers taking a decision about the individual participants who would be most likely to contribute appropriate data, both in terms of relevance and depth”.

The justification for this choice is as follows. First, this study deals with students in the College of Science and the participants were chosen deliberately. Second, the researcher selected biology students for this study. Third, only students who were studying at the second level will participate in this study. The second level students were selected in order that the same group might benefit from the results of the study for the remainder of their academic studies, as hopefully will other students in the future.

4.9 Validity and Reliability

Data collection technique is one of the most important stages during conducting the research (Andrea, 2001). The success of this stage is dependent on the suitability of designing the instruments to achieve the objectives of the study. The weakness or the strength of the instrument leads to the weakness or the strength of the study findings. Thus, to avoid the weakness of the instruments it is important to select the appropriate instruments' items, then to assess these items through determining the validity and reliability of these methods (Carmines and Zeller, 1997).

4.9.1 Validity

Consequently, the quality of a research is related to the testing and increasing the validity or trustworthiness of the research. In order to ensure the validity of the research instruments, the researcher consulted the opinions of six experts in qualitative and quantitative research in the School of Education at ABU. As a result of this consultation, amendments were made to the research schedule, including the revision of the appropriate tenses and the modification and clarification of questions. Appendix 7 shows the first draft of the expert opinions for the interview questions.

After further consultations, the researcher conducted a pilot study with eight students to find out the extent of impact the new adjustments had on the students' answers. The researcher found that the first question needed to be more general to give students more opportunity to express their views about wiki (Table 4.3).

Question before	Question after
What is your experience of wiki technology in the educational field?	What is your experience of wiki technology in general?

Table 4-3: An example of the adjustment to the interview questions (question1)

Also the fourteen questions in their entirety had to be reduced in number due to the students’ responses during the interviews. The researcher found that it took a long time to answer and it sometimes made students feel bored. As a result, they just want to complete the interview regardless of the quality of information. The final total number of questions was nine, and the other five questions were either integrated within the nine questions or excluded. The researcher also found that, in questions three, four and five some students’ answers to these questions were ‘yes’ or ‘no’, which did not give meaning to the students’ perceptions of wiki. So the researcher found it very important to ask the students about the reasons behind their answers through adding ‘why?’ or ‘why not?’ at the end of these questions (Table 4.4).

Question before	Question after
3-Do you think the multiplicity of wiki pages may motivate and encourage you to learn and understand biology?	3-Do you think the multiplicity of wiki pages may motivate and encourage you to learn and understand biology? Why, or why not?
4-In your opinion, does the work within group enrich the content of biology?	4-In your opinion, does the work within group enrich the content of biology? Why, or why not?
5-Do you think participating in discussions helps your biology learning?	5-Do you think participating in discussions helps your biology learning? Why, or why not?

Table 4-4: An example of the adjustment on the interview questions (questions 3. 4 and 5)

According to Neuman (2007, p. 118) “validity is part of a dynamic process that grows by accumulating evidence over time. Without it, all measurement becomes meaningless”. The first draft for both types of questionnaires presented to the experts at ABU is as mentioned above in this section. Those experts had some comments which were adopted and then the new questionnaire form was tested in a pilot manner and the results checked in accordance with the research objectives. Their comments led to some amendments in the questionnaire including changes in the existing questions and also addition of some new ones. With respect to multiple choice questions, the experts’ suggestions focused on modifying the heading of the questionnaire, the total number of questions, the number of choices in some questions, and rephrase some questions as

shown in Appendix 8. With regard to the validity of the questionnaire's five-point Likert scale, the key observation pointed out by the experts was that the number of questions in the third and fourth axis was considerably more compared to the questions in the first and second axis, which were fifteen questions in each axis. Thus, following these suggestions, the final picture of the questionnaire consisted of eight questions in the first axis, nine questions in the second axis, seven questions in the third axis and seven questions in axis four (Appendix 3).

4.9.2 Reliability

According to Gideon (2012, p. 304) "reliability in research refers to dependability or consistency, suggesting that the same results will be reached each time a measure is used under the same conditions". For the reliability of the interviews, after obtaining the final form of the interview and to ensure whether the instrument was reliable and ready to apply in fieldwork, the researcher implemented the instrument twice before the first week of the research period with a group of six students. After that the comparison between the students' responses in the first and the second interviews, the researcher found:

- 1- There was a high degree of similarity between the students' responses to all questions (except question number eight) during the interview in terms of understanding the questions and then giving the actual answers from their point of view.
- 2- There were differences between the students' answers observed in question number 8: "Do you have further information?" In this case, this difference in the answers usually occurred when the interviewees were asked to add further information.
- 3- With regards to how long the students took to answer the questions, the researcher found that each of the six students took fifteen minutes to answer all of the eight questions. To some extent, the same period of time was taken to answer the questions on the second form of the interview (the average was thirteen minutes).

In order to examine the reliability of the questionnaire five-point Likert Scale, the Cronbach's reliability coefficient was used. Table 4.5 contains the reliability coefficient for each of the four axes. As we can see they are all above 0.7, thus we can say that all axes are reliable. In fact the reliability coefficients for the first, the second and the

fourth axis are above 0.8. The reliability of the third axis is the lowest and is the only one below 0.8.

	Minimum	Maximum	Median	Average	Standard deviation	Reliability coefficient
First axis	1.63	5.00	3.875	3.685	0.867	0.84
Second axis	1.56	5.00	4.444	4.161	0.854	0.909
Third axis	1.29	4.57	3	2.974	0.848	0.757
Fourth axis	1.67	5.00	3.833	3.833	0.876	0.816

Table 4-5: Descriptive statistics of the four axes

4.10 Ethical considerations

The research was approved by the University of Southampton Ethics Committee (Appendix 9), and the University of Al-Baha (Appendix 10). According to Johnson and Christensen (2010, p. 99) research ethics are “the principles and guidelines that help us to uphold the things we value”. They also comment upon the developing ideas around freedom of information, data protection and the rights of privacy of individuals. This section addresses several aspects of the ethical considerations related to the present study, such as informed consent, electronic consent, participant withdrawal, confidentiality and privacy.

4.10.1 Informed consent

The concept of informed consent is defined in many ways. MacKay (2007, p. 129) defines informed consent as “an agreement to do something or to allow something to happen, made with complete knowledge of all relevant facts, such as the risks involved or any available alternatives”. As one of the ethical research principles, researchers should take into account the consent of participants. Another definition is provided by McNamee and McNamee (2002, p. 25) “informed consent is a standard principle in a variety of professional practices as well as social research: it is the formulation of a widely recognised moral obligation to respect others and take into account their interests”. In this study electronic consent can be gained in two ways: rewriting the name of the participant or by copying the original signature and will be discussed below.

4.10.2 Electronic consent

Electronic consent or a so-called electronic digital signature is defined by Greiner and Muller (1993, p. 3) as follows:

“The digital signature scheme offers a cryptographic analogue of handwritten signatures that, in fact, provides much stronger security guarantees. Digital signatures serve as powerful tool and are now accepted as legally binding in many countries”.

The researcher needs to obtain the approval of the participants and, when there is a large number of participants or the researcher wants to activate the concept of e-learning, the participants (the sample) are required to approve their participation in the study by electronically signing a special form. This electronic consent is obtained either through copying the original signature and pasting it by using an electronic programme or by the participant rewriting their own name.

For the application of the principle of ethical issues in research, researchers must not include those participants who did not accept the invitation to participate in the study. In addition, all the participants must sign the consent forms themselves. Forging of signatures is an offence so serious that it would breach the ethical guidelines and result in the researcher being disciplined by the University’s ethical office and most likely facing severe sanctions for gross misconduct.

4.10.3 Withdrawal of participants

Participants had the right to withdraw from this study at any time, including during the follow-up, unless there is a condition that they must continue in the study. According to Gravetter and Forzano (2011, p. 126) “ethical research requires informing participants that they have the right to withdraw from the study at any time without penalty”. In other words, consent to the research must be voluntary. In order to avoid the problem of participants withdrawing or at least to reduce the likelihood of this occurring, the researcher has to take into account some reasons why participants in the study may withdraw and carry out some procedures such as: clarifying the idea behind and objective of the study, encouraging and motivating participants, choosing the largest number of participants to address the potential shortfall during the study and to cope

with any withdrawals (Carbonara, 2005), and meeting all the requirements of the study such as computers and the use of the Internet in classrooms.

4.10.4 Confidentiality and privacy

Philpott (2011, p. 1638) defines confidentiality as “the treatment of information that an individual has disclosed in a relationship of trust and with the expectation that it will not be divulged to others without permission in ways that are inconsistent with the understanding of the original disclosure”. In this study and during the communication with participants, the researcher required some personal information about the participants. This may include personal photos or personal data. This information must be secure and the participants should be assured that it will be so. Kenneth et al. (1992, p. 73) mention that “the reason for promising confidentiality to people is they have important information that they do not want to make public”. Furthermore, the researcher should point out the reason behind the research. Kenneth et al. (1992) stated that, to obtain this information for research purposes, researchers secure research participants’ cooperation by promising that they will use the information for research purposes. Moreover, the researcher must respect the confidentiality of the participants in the research and the preservation of their personal information. Thus the confidentiality of the participants here means all the aspects that are related to their personal or social lives.

4.11 Chapter summary

This chapter included a detailed description of the research methodologies used in this study. The approach of the present study is provided as mixed methods including both quantitative and qualitative approaches. Additionally, the study style is identified as a case study. Five instruments were chosen to collect data: two types of questionnaire, interviews, weekly tests and e-comments. The pilot study is included in this chapter to help design the research instruments for the main study. The main study population consisted of male students at ABU, and the sample was students of biology at the College of Science. This chapter presented a definition for the study population and how the researcher selected the sample. Finally, because of the present study dealing with the Internet and most students’ activities, this chapter presented descriptive details of ethical

considerations, including informed consent, withdrawal of participants, confidentiality and privacy and electronic consent.

Chapter 5: Findings and Analysis

5.1 Introduction

The present study examines five aspects of the impact of using wiki technology on students who are learning the biology curriculum. These aspects relate to the students in terms of their perceptions of wiki, knowledge about wiki, attaining biological knowledge, acquiring e-learning skills and, finally, their attitudes towards the use of wiki in learning biology. These five aspects were then measured using five types of instruments as can be seen in Figure 5.1 respectively: the interview, questionnaire ‘multiple choice design’, and questionnaire five-point Likert Scale, weekly tests and finally students’ e-comments. Figure 5.1 shows the final result of the students’ activities and how these activities were measured by the five instruments as described in chapter 3 (Conceptual Framework).

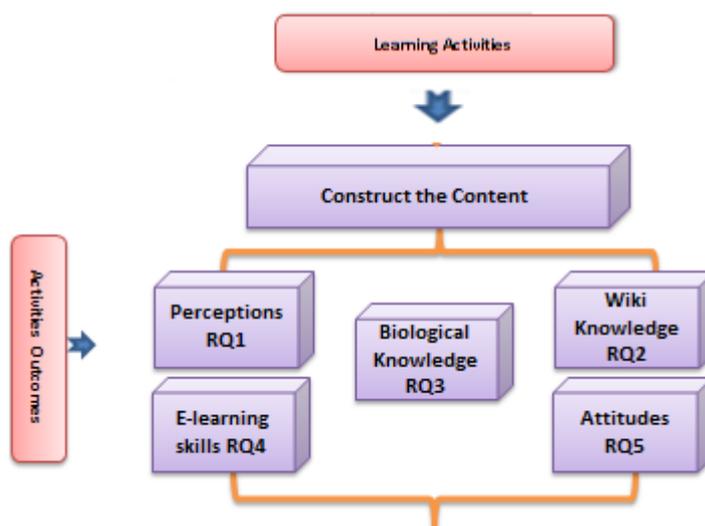


Figure 5-1 The result of students' activities and their activities outcomes

This chapter addresses findings of the study and its analysis through three stages: data collection process, preparing the data and procedures of data analysis. All of these stages have been addressed in detail in the course of this chapter. The qualitative and quantitative data were analysed ‘en masse’ using a framework analysis approach (Sections 4.4.4 and 5.4). However, in order to integrate the two different types of data into one analytical approach, the researcher ‘qualitised’ the quantitative data. Quantitative data in research questions 2, 3 and 4 were firstly analysed as numerical

data using the SPSS programme, and this was then qualited following the technique of Tashakorri and Teddlie (1998) (Section 4.4.4). Hesse-Biber and Leavy (2010), state that the term ‘qualitising’ refers to the process of converting quantitative data that can be analysed qualitatively. An example of this technique is to convert a frequency table into a narrative statement about what is occurring in the quantitative table. Moreover, qualiting the data enhances the researcher’s understanding of quantitative data by placing it in a qualitative context (Hesse-Biber and Leavy, 2010).

A framework approach has been selected to analyse the data in its entirety (quantitative data from research questions 2, 3 and 4 after it was converted to qualitative data and the qualitative data from research questions 1 and 5). This approach is based on identifying the themes deductively and inductively (i.e., predetermined themes generated from the research questions and the emerging themes which are generated from the dataset). The researcher followed the five stages of data analysis in the framework approach according to Pope and Mays (2008) which involved the following stages: familiarity, identifying the thematic framework, tabulation (drawing tables), graphical representation and interpretation. The next sections address the data analysis in detail including: data collection process, data analysis, findings and interpretations.

5.2 Data collection process

The procedure of data collection has been described in detail in Chapter 4 (Methodology). Also it can be seen in the study framework contained in Chapter 3 in the stage ‘Activities outcomes’, all the data was ready to collect after the students had created the content of the biology topics in the wiki (Figure 3, 5). Thirty-one second-level students at ABU participated in the present study. The data were collected during the period 28/01/2012 to 26/04/2012. The researcher designed wiki pages called Wikibaha, hosted by wikispaces.com under the link <http://wikibaha.wikispaces.com>. This wiki was designed for the purpose of the learning and teaching biology, and represents the stage of learning activities in the study framework (Figure 5.1).

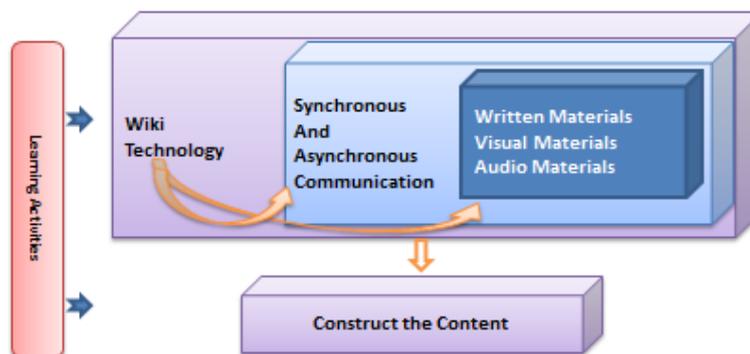


Figure 5-2 Learning activities stage using the wiki site

Five instruments were used to collect the two types of data (see Section 4.6) qualitative and quantitative. These instruments have been designed and developed by the researcher and conducted after ensuring the validity and reliability of each.

5.3 Preparing the data

Preparing the data for the analysis stage was very important and required a great deal of care and attention as this stage represented the basis for the later analysis. In the present study, preparing the data meant configuring the data in terms of translating the participants' responses into the English and labelling participants' responses using standard codes to ensure their privacy (e.g. IN01).

5.3.1 Translating the data into English

All of the students' responses were written in Arabic by the students themselves whether through the wiki pages or the data collection instruments (i.e., interviews and e-comments). A qualified translator assisted in revision translating the data into English.

The main challenge faced by the researcher when translating the data from Arabic to English was to ensure that the data maintained its accuracy and integrity and nothing was lost in translation. In the case of the present study, the data collected in Arabic represented students' responses to the research questions 1 and 5 and some of the students' online contributions. The data collected from the participants were textual in nature (qualitative), which needed to be translated into English to make it easier to deal with NVivo as a tool for the organisation and management of data, and also because the present study was to be written in English.

To ensure the validity of the translation, the researcher reviewed it with two experts in translation in the school of languages and translation, Al-Imam Mohammad Ibn Saud of the Islamic University (KSA), and with experts from the Institute of Sound and Vibration, Southampton University. The researcher found that some of the words and phrases in Arabic needed to be described in English due to the difficulty of direct translation; that is, no literal translation of these words exists. The reason for the difficulty of translating these words and phrases is that students were sometimes using vernacular in their written answers. These words and phrases can be seen in Table 5.1.

The English description	Arabic words and phrases received from students' responses
Has a positive effect	يبث في نفوس الطلاب
Course, curriculum	المقرر الدراسي
Frankly, openly	بكل صراحة
Upload the photos and typing the texts	نشر الصور والنصوص
Encouraging students	خلق التشاركية للطلاب
Needs to manage students' activities	يتم بشكل عشوائي
Control	توحد
Distance learning	الاستفادة عن طريق بعد
Familiarity	الاعتiad عليه سهل
Username for each student	يوزر نيم لكل طالب
Printing out a hard copy	بتصوير مذكرات
Weakness in English	الضعيفين باللغة
Applying the concept of e-learning	تفعيل التعلم الالكتروني
Wiki may include incorrect information	معلومات مغلوطة التي في الويكي
In-depth understanding of the lessons	للتعمق في تفهم الدروس
Peers	أقرانه في الصف
Traditional learning	التعلم الورقي
History Page 'one of wiki pages'	الصفحات المحفوظة
Content vandalism	تخريب الصفحات
Institutions Database	تكوين قاعدة معرفية للمؤسسات
Amount of information	منسوب المعلومات
Organise discussions	تنظمت النقاشات
Experience of wiki	خلفية الويكي
Students preparing	تهيئة الطلاب

Table 5-1: English description for the main Arabic vernacular sentences and words obtained from students' responses

5.3.2 Labelling participants' responses using standard codes

In order to ensure confidentiality and anonymity, each student participated in the study was given a code. Each instrument also had a code. For example, participant number 1 who answered the multiple choice questionnaire design was given acronym

QM01; (01) means student number 1(a pseudonym). Table 5.2 describes the naming of all instruments.

Instrument	Instrument code	An example of one student
Interview	IN	IN01
Questionnaire multiple choices design	QM	QM01
Questionnaire 5 –point Likert Scale	QL	QL01
E-comments	EC	EC01
Weekly tests	WT	WT01

Table 5-2: Labelling participants' responses

5.4 Procedures of data analysis

Data analysis is an ongoing activity, which not only answers the research questions but also provides the guidelines for future data collection (Collins, 2010). In the present study the data were analysed in four stages. These stages are supported by Figure 5.1 data analysis framework, and Table 5.24 the themes and sub-themes that emerged from the data in order to clarify the meaning and content of the data. The following is a summary of these stages:

- 1- Analysing the data for the stage 'Before the use of the wiki' (Students' perceptions of using the wiki) using interviews.
- 2- Analysing the data for the stage 'During the use of the wiki', includes three pre-determined themes:
 - I. Knowledge about wiki technology, using the multiple choice questionnaire design.
 - II. Biological Knowledge and Information, using the weekly tests.
 - III. Acquiring e-learning skills, using questionnaire (five-point Likert Scale).
- 3- Analysing the data for the stage 'After the use of the wiki' (The attitudes towards wikis).
- 4- Measuring the Extent of Online Collaboration and Learning.

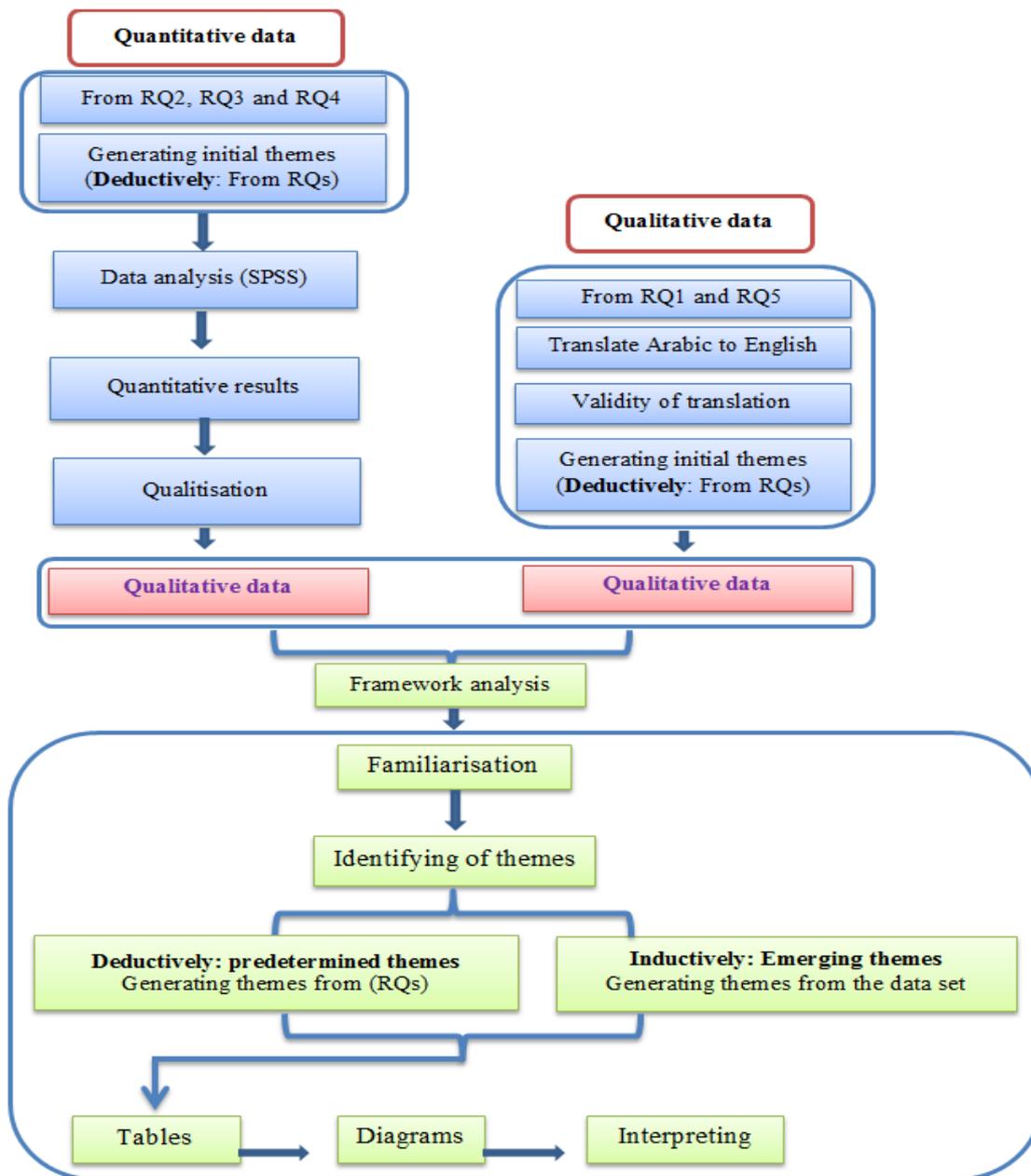


Figure 5-3: Data analysis framework

5.4.1 Analysing the data for the stage ‘before the use of wiki’

Before using wiki, fourteen students representing a sample of second-level students at the College of Science were interviewed individually to learn about their perceptions of wiki technology. Thus, semi-structured interviews, comprising nine questions, were conducted with the students one week before implementing the study of biology using wiki. On average, the individual interviews took twenty minutes at a rate

of seven students a day. The answers were then translated into English and the translation checked by two qualified bilingual academics to ensure credibility.

Generating themes from research question 1 and data set

The main theme generated from research question 1: *What are students' perceptions of using wiki technology?* was 'The perception of wikis'. This theme represented the aim that the question sought to answer.

After collecting qualitative data about the students' perceptions of wikis, the data were translated into English and then imported into NVivo (Appendix 16) to organise and extract the following emerging themes:

Emerging theme 1: Previous experiences

Emerging theme 2: Knowledge and information

Emerging theme 3: Multiplicity of wiki pages

Emerging theme 4: Working within a group

Emerging theme 5: Advantages and disadvantages

Table 5.3 presents the emerging themes and sub-themes that were extracted from the answers of the students given in the personal interviews conducted about their perceptions of wiki before its use.

Stage	Pre-determined theme	Emerging theme	Sub-themes		
			1	2	3
Before using wiki	The perceptions of wiki	Previous experiences	Good	Limited	Lack
		Knowledge and information	Searching	Resources	Exchanging
		Multiplicity of wiki pages	Motivating	Encouraging	
		Working within a group	Interaction	correction	
		Advantages and Disadvantages	Multiple benefits	Trusting	Obstacles

Table 5-3: Themes and sub-themes emerged from the dataset for RQ1

5.4.1.1 Emerging theme 1: Previous experience

The first question in the interview was about the students' experience using wiki technology. This was to gauge their awareness of the tool and their perceptions of it; what wiki meant for them in terms of concept, use, content and so on. All of these came

under the first interview question: *What is your experience of wiki technology in general ?*

Figure 5.2 shows three sub-themes which emerged from the raw data of the interviews relating the students' experience of wiki, these sub themes were: good, limited and lack.



Figure 5-4: Emerging theme1 and sub-themes emerged from RQ1

Sub-theme 1: Good

Table 5.4 shows that 42.9 % (6 out of 14) had a good experience of wiki technology, which enabled them to use it. These students knew of the technology, they could note the distinguishing characteristics of wiki and were skilled in editing, adding and modifying its content. For example, student IN04 mentioned several essential elements for using wiki in teaching in particular such as: editing pages, adding, deleting content, team editing, the online presence of the teacher and how he interacts to facilitate learning. This knowledge indicated that the latter student was well acquainted with wiki technology as he stated:

“The wiki is an educational website enabling learners to edit the pages through adding or removing the content. Also the user can benefit from the others in wiki groups and the teacher also can see the students’ contributions through their interactions in constructing the content”.

An answer that showed a deeper understanding of wiki technology was that of Student IN05, who, in addition to being familiar with the main features of wiki technology, gave several examples of its use. His answer was detailed, and this shows the extent of his experience:

“A wiki can be used for multiple purposes, such as personal, educational and entertainment use. Several features can be mentioned as follows:

- *Wiki can simplify content by the flexibility to add or remove it.*
- *Wiki uses simple icons and are not complex.*
- *There is no need to be familiar with the programming language HTML.*
- *Wiki can store and save all changes in the content, which enables the user to go back to the content at any time”.*

However, students IN11 and IN12 did not include details and only said that they had enough experience of wiki technology. Their responses were as follows:

“I have good experience of wiki in terms how to use it... I have a good experience of using wiki in learning”.

On the other hand, Student IN08 said that he had enough experience to deal with the wiki at two levels, which are essential aspects for any wiki user. These are the ability to access the information and to treat and handle the information that is available on the wiki pages, including all the editing activities. He states:

“I have enough experience of wiki. I can easily access wiki and I have the ability to add new information and I can also remove or edit the content”.

Furthermore, students IN014 mentioned some examples of wiki based Internet websites including various applications of the Web 2.0 technology such as social networks and forums. This shows that the student was aware of wiki technology. He further discussed, albeit with limited knowledge, Wikipedia and Wikimedia as applications of the wiki that he was aware of: Student responses were as follows:

“Wikipedia and Wikimedia are the most famous wiki in my opinion... just about Wikipedia... Wikipedia is the most famous wiki”.

Sub-theme 2: Limited

Six students (42.9%) of the sample had limited experience of wiki technology. For example, Student IN02 only knew about the ability to edit wiki pages. As he put it:

“I think this application allows the user to change and amend the content of the others’ contribution”.

The response of Student IN02 was echoed by Student IN06, who believed that a wiki is the result of group effort:

"The wiki is an electronic service characterised by participating in content constructing".

However, one of the professors at ABU has used a wiki previously, so the students who attended his class had a theoretical knowledge, including Student IN01, who searched on the Internet to learn about wiki technology:

"... However my study with Dr (HA1) increased my experience gradually and I will practically apply this experience to understand this technology and to take advantage of it".

It was also interesting that Student IN07 was aware of the roots of the word 'wiki' as being derived from the Hawaiian language meaning 'fast or quick.' The student was also aware of the editing feature of the wiki, which demonstrates his interest in this technology:

"The wiki is a website that allows the users to add and modify the content page...I think wiki mean 'Quick' and sometimes the content cannot be trusted".

Student IN03 focused on the theoretical aspect of the wiki, without mentioning any practical experience with the technology. He described the open editing feature of the wiki and emphasised its role in gathering the knowledge and experiences of many people. The student stated:

"The wiki is a participatory technology and I think it is a good learning method to understand what information and experience others have".

Student IN13 along with students IN01, IN03 and IN07 were candid about their limited knowledge and experience and only mentioned Wikipedia as an example of a wiki. Student IN13 said:

"I have limited experience in using wiki. I know it is a scientific encyclopaedia and there are several types of wiki across the Internet".

Sub-theme 3: Lack

Two students (14.3 %) had no experience of wiki technology. Student IN10 was very candid in his answer, which was very short and direct:

“I do not have enough experience in using wikis”.

Student IN09 argued that his poor knowledge was the due to the passive role of the university in promoting and adopting the wiki (and other electronic tools) in the teaching/learning process.

“Unfortunately, I do not have enough experience of using wiki in learning because of the lack of applying wiki in learning among the universities”.

Students' experience of wiki	Frequency	Percentage
Good experience	6	42,9
Limit experience	6	42,9
Lack or no experience	2	14,3
Total	14	100,0

Table 5-4: Frequencies and percentage of students' responses on the first sub-theme the previous experiences of wiki

5.4.1.2 Emerging theme 2: Knowledge and information

The terms ‘knowledge’ and ‘information’ were repeatedly mentioned when the students tried to describe their experience with the wiki during the interviews. Indeed, these terms were mentioned more than 40 times, which indicated their importance and identified them as part of an emerging theme. Consequently, three sub-themes were extracted from the ‘knowledge and Information’ theme, as shown in Figure 5.3.

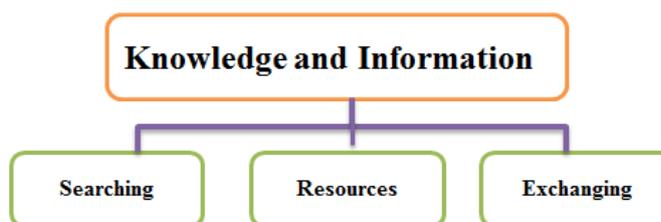


Figure 5-5: Emerging theme 2 and sub-themes emerged from RQ1

Sub-theme 1: Searching

The students used this term when describing how they used the wiki to look for information on the Internet. The students believed that the wiki would help them learn new information and to gain more knowledge about the curricula they were studying. In addition to viewing the wiki as a tool that could help them find information on the

Internet, the students thought that they could use it to look up information about curricular and extracurricular topics. Student IN13 stated:

“The wiki will allow us to search the information about biology in the classroom and outside the university”

Furthermore, Student IN13 stressed that the wiki may help him remember the information as he seeks to find it himself:

“The wiki may encouraging me to search for the information and this task will help me to remember the biology information over a long time”

Regarding the use of the Internet to gather information, Student IN14 believed that learning through the wiki would encourage him to search the Internet for longer periods, which translated into more knowledge gained:

“The wiki will make me spend a lot of time using the Internet to search for the information”.

On the other hand, Student IN07 argued that the wiki would strengthen his use of the Internet and enhance his search skills, so he expected to be able to find information from various sources in a shorter time:

“The wiki will allow us to search, understand, remember and discuss the information with my group members in classroom...promoting searching and discovering the information”.

Student IN12 combined the skills of searching for information online and editing the content through the use of the wiki. The student stressed that using the wiki was crucial for improving his academic skills since this required additional knowledge and information to edit and modify the wiki properly. Student IN12 stated:

“Yes, using the wiki will develop my ability to search for the information and to learn about the ways of changing the colour and the size of the font”.

Sub-theme 2: Resources

The responses of the students showed that they were generally in agreement that the wiki could be a reference for finding information at any time, through the various wiki pages. Student IN05 remarked:

“The wiki can store and save all changes in the content, which enables the user to go back to the content at any time”.

The same perception was shared by Student IN07, who clearly stated the importance of the wiki as a source of information:

“...the wiki can be used as a resource for the information”.

As for the additional information and the building and editing of the content of the wiki, according to Student IN02, he used the Internet as the main source of information to learn about the topics he was studying:

“...Yes, because the wiki links with the Internet directly and the Internet is considered as the main source for the information”.

Finally, Student IN07 noted the user-friendliness and flexibility of the wiki, which would make it his primary source of information about the topic he is studying:

“In my opinion I think wikis have one of the greatest characteristics which may help the user to find information constantly and smoothly that is (A speedy resource for the information)”.

Sub-theme 3: Exchanging

A group of students (n=5) argued that the wiki can be a very suitable and efficient tool to exchange information, ideas, experiences, knowledge, etc. This showed that the students had a well-formed vision of the wiki since they mentioned several of its advantages. In this context, Student IN02 linked ‘encouraging him to learn in an efficient manner’ and ‘the exchange of learning materials’ through the wiki:

"I think that wiki pages may motivate me to learn biology in an active way because of the ability to exchange the information, the pictures and other learning materials via this technology".

Student IN06 commented that exchanging information and knowledge with the other students was a good opportunity to reinforce his knowledge:

“...and it will be a good opportunity to exchange the experiences and information”.

Yet, Student IN05 believed that there was a relationship between the capability of exchanging information and the continuous presence of the class members in the wiki

space. Student IN05 argued that the wiki would directly influence the exchange between the students during the teaching session:

“The wiki will help all of the group members to exchange the information and also to identify the useful information from the others during the discussion sessions”.

It is interesting at this point to mention how Student IN10 would use the wiki to break the routine (and perhaps the boredom) of the traditional teaching session. Student IN10 would use the wiki, on the one hand, to exchange information with the other students to enhance the learning experience, and on the other hand, to make the classroom more engaging:

“It is a good idea to better facilitate the exchange of ideas among students and to break the monotony”.

Student IN01 further added that using the wiki in itself would encourage the students to use e-learning and interact with it as a tool for learning. Consequently, Student IN01 saw the exchange of information with the other students as a means of making e-learning more efficient:

“The wiki will encourage the students to communicate and collaborate on the topics/research on going in the classroom and I think it is a good way to exchanging the information and activating the e-learning concept”.

5.4.1.3 Emerging theme 3: Multiplicity of wiki pages

One of the most frequent concepts that came up in the responses of the students was the multiplicity of wiki pages and their positive and encouraging effects on learning. The students believed that the wiki is an attractive teaching technology that can be used to create the content of biology subjects. The views of the students about the multiplicity of wiki pages were varied. However, they all mentioned the concept of multiplicity itself, which indicates that they had a correct perception of the wiki as a teaching technique that uses stimulators to encourage and facilitate the learning process. To begin with, this perception was a good indicator of the students' elementary knowledge of building the content of the wiki, or at least handling/influencing its content.

According to the data collected from the student sample, and due to the frequency of “multiplicity”, this then can be identified as a main theme with two sub-themes shown in Figure 5.4.

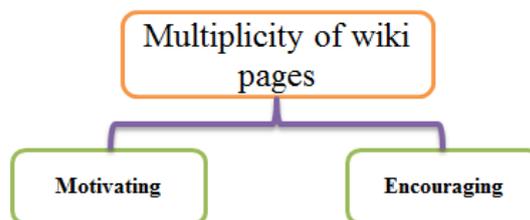


Figure 5-6: Emerging theme 3 and sub-themes emerged from RQ1

Sub-theme 1: Motivating

Student IN14 believed that it is possible for the wiki to be a learning tool that motivates the students to learn:

“I think the wiki will increase my motivation to learn biology because it’s a new learning style”.

The reason for this is that the wiki was a relatively new teaching method, and thus the students were enthusiastic to use it. This point was echoed in the responses of several other students who said that their lack of knowledge of the wiki was due to ABU not using Web 2.0 applications among its teaching methods.

The multiplicity of the wiki pages led Student IN02 to think that the wiki will motivate him to learn, especially in biology, since this is one of the attractive features of the technology that allows the students to view the content of the wiki page in a different way, while each page has a different objective. Student IN02 stated:

“...I think that the wiki pages may motivate me to learn biology in an active way”.

At the same time, Student IN03 believed that using the wiki would motivate him to learn in the presence of a group of students in the classroom. It should be noted that the student’s perception combines the two features of motivating the learning process and group learning, which is another positive feature of using the wiki. Although group learning was not directly mentioned here, the student did state that he would be motivated and the others:

“...It may motivate me and the others to learn better”.

However, Student IN04 had good experience of the wiki technology (as evident in his answer to the first question of the personal interview), and so he believed that this would encourage and motivate him to learn more efficiently especially if the wiki pages include well-organised, attractive content with easy navigation (similar to the more famous wiki websites):

“I think the wiki may motivate me if it has all the features and characteristics”.

In agreement with the opinion of Student IN04, Student IN07 remarked that the wiki pages should be dynamic, with well-organised and attractive content that can enhance the learning of biology. The information could be uploaded to a wiki platform to facilitate accessing the information and any relevant learning material. Student IN07 added:

“It could motivate me if the pages include visual materials such as photos and video clips to clarify the information”.

The views of Students IN04 and IN07 were echoed by Student IN11, who stressed the importance of including attractive wiki pages that would attract the students to use this learning tool. Student IN11 perceived the wiki as a technique that motivated better learning:

“Yes, because the wiki pages usually include several types of learning materials such as graphics, texts and video clips which will motivate students to learn by the wiki technology”.

In contrast to the views of students IN04 and IN07, student IN10 did not seem positive desire in terms of the multiplicity of wiki pages. Student IN10 did not see himself using any of the features of the wiki to enhance his learning experience. This student had limited experience of the wiki technology as he stated in his answer to the first question of the personal interview. He stated:

“I do not know about the ability of the wiki pages to motivate students to learning”.

As for the effect of multiple wiki pages on encouraging students to learn, according to Student IN12, this feature had a directly positive influence on encouraging the interaction among students, and the gaining of information. The more the students

participated in the learning environment, the easier it became for the individuals to gain knowledge and understand the concepts being taught. As he put it:

“Multiplicity of wiki pages encouraging me to interact with others and leads to ease in obtaining the information”.

Sub-theme 2: Encouraging

This is the second sub-theme extracted from the collected data relating to the multiplicity of pages in the wiki. This was confirmed by Student IN09 who argued that the multiplicity feature distinguished the wiki from other Web 2.0 applications. Student IN09 stated:

“I think multiplicity of the wiki pages is an interesting future in wiki technology which characterises the wiki with the other web2.0 applications, this characteristic will encourage me to use wiki among other web components”.

Student IN13 also stressed the role of the wiki as a search tool that encourages searches for information related to the biology curriculum:

“...home page, discussion page and the history page on wiki encouraging me to search for the information and to participate in projects together with other students and share their combined knowledge”.

5.4.1.4 Emerging theme 4: Working within a group

Working within a group is one of the most important features of the wiki. Data is yielded from the presence of a perception among students regarding the interaction between group members and its impact on the discussions, as well as the impact of working within a group to amend or correct the information provided by the students. To this end, in examining the collected data about the ‘working within a group’ theme, the sub-themes of ‘interaction’ and ‘correction’ were identified (Figure 5.5). In the following sections, these themes and sub-themes will be discussed.



Figure 5-7: Emerging theme 4 and sub-themes emerged from RQ1

As regards, in particular, the first sub-theme (interaction), the views of the students were very varied. Below is a summary of the discussions and interactions with the students.

Sub-theme 1: Interaction

Students pointed to the effectiveness of discussion in the learning process, and this is one of the features of using wiki in the classroom environment. The responses of the students concentrated on several topics including: the effect of discussions on the learning process as a whole, the necessary conditions to moderate effectively the in-class discussions and the positive results of the discussion on the mentality of the users of the wiki. Finally, there was comparison between using discussions as a learning tool and the traditional teaching methodology that is often based on lecturing.

Student IN04 explained that the discussion between the group members is an important catalyst for obtaining the information. The in-class discussions motivate the students to express their views, and this will enrich the knowledge of all the group members. Student IN04 stated:

“In general, for anyone who wants to enrich his or her information I believe that discussion is the best way to do that; in the case of learning biology, discussion, in my opinion, is one of the most important ways to understand the topics”.

Students IN01 and Student IN05 confirmed the views of Student IN04. They too argued that in-class discussion enriches the knowledge of all the students with new information about the topic being studied:

“Discussion will help me to understand the topics in depth and with clarity...Actually, discussion within a group will help me to obtain new information”.

In general, Student IN02 believed that in-class discussion could have a positive effect on the learning experience of the students:

“Actually discussion with others has a positive role in learning”.

According to Student IN06, the role of in-class discussions was more than positive for the learning environment; it was, as Student IN02 stated, essential to establish a successful and effective learning environment:

“In my opinion, interactions and discussions are the basis of the learning process”.

One of the most frequent answers was that mentioned by Student IN04 and Student IN07 about the importance of the organisation and management features of the wiki. These two students believed both features to be key elements for a successful discussion:

“Participating in discussions helps me to understand biology if the discussion is controlled by the teacher or the leader of the group...Yes, if there is interaction among students and the discussion is organised”.

In a criticism of the traditional didactic teaching techniques, Student IN09 tried to clarify the role of the student in the traditional classroom in comparison with a discussion-based learning environment. In the former environment, the student is passive whereas in the latter, the student plays an active (positive) role by sending and receiving information and knowledge, thus making the learning environment more interactive:

“Yes, because discussion makes the position of the students more effective than just being recipients of information and knowledge”.

Student IN13 emphasised the cognitive and mental skills that are stimulated during the discussions, which are necessary for building and editing the content of the wiki. This student believed that information (obtained from several sources) will be

repeated, and probably explained in multiple ways, during the discussions between the students. This in itself will aid the student to develop a deeper understanding of the topic and stimulate his cognitive skills of memorising, understanding and analysing. Student IN13 argued that this resulted in longer retention of the knowledge discussed:

“Yes, because it will help students to remember the information that they have prepared by themselves and they may spend time collecting the information from several sources”.

Student IN10 stressed the deeper understanding that could be achieved through discussions, which echoed the perception of Student IN13. According to Student IN10, one of the results of these discussions is that concepts will become more established:

“...Also discussion leads to rooting in the mind what the debate around it is”.

Sub-theme 2: Correction

The second sub-theme treated the students' perception of the role of discussions in modifying and correcting the information that they possess. The collected data showed that nearly all students agreed on the importance of editing the content of the wiki in an effort to correct the information they have. In order to avoid repetition in this section, the following are just examples of the students' responses.

Student IN14 argued that participating in the discussions was advantageous: it made the students aware of new information and it increased their knowledge which enhanced the learning experience:

“Yes, I think the discussion will add new knowledge and correct my information”.

In contrast, Student IN06 was wary of participation in the discussion as erroneous information could be mentioned. Furthermore, the corrections to any information might be incorrect, and thus for Student IN06 believed that such discussions are fruitless:

“One of the major benefits of wiki sites is the accuracy of articles because anybody can write, or change, its articles...In the same time, the amendment of the information by other users may be incorrect”.

The response of Student IN05 is a rebuttal of Student IN06's argument. Student IN05 argued that as long as the discussion is on-going between the students, the information will be eventually corrected since it is very difficult for all the students to reach a wrong consensus especially in the presence of the teacher:

“The benefit here is that if any one of the group members has incorrect information actually the others may correct him”.

5.4.1.5 Emerging theme 5: Advantages and disadvantages

All the students (fourteen) in the surveyed sample responded positively to the questions regarding the advantages and disadvantages of using the wiki. Analysing the data showed that the students' perceptions of using the wiki as a learning tool varied according to their experience and knowledge of this technology.

In general, the answers of the students to the question “*What are the advantages of using wiki from your point of view?*” showed the extent of their knowledge. The students perceived many positive aspects including using the wiki as a learning tool, the role of the teacher in a wiki-led learning environment and the untraditional way in which it presents a change in the routine (and boredom) that they sometimes feel in class. The students also mentioned what they perceived as negative aspects of using the wiki as a learning tool. However, the advantages outweighed the disadvantages, which could be indicative of the students' willingness to use wiki in their learning activities. Consequently, three sub-themes about the advantages and disadvantages of using the wiki were identified (Figure 5.6).

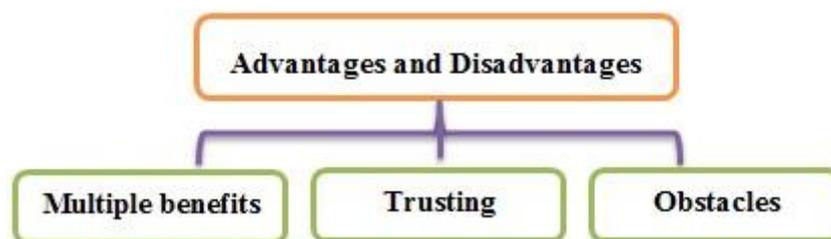


Figure 5-8: Emerging theme 5 and sub-themes emerged from RQ1

Reading the answers of the students revealed that their responses were mostly positive when asked about the benefits of wiki. However, their responses were mostly positive when discussing the quality of the content and how much they trusted it. As for

the obstacles that the students could foresee, these were mainly logistical relating to the accessibility of the Internet and availability of suitable classrooms and training.

Sub-theme 1: Multiple benefits

Information handling refers to facilitating the accessing, sharing, searching and editing of the wiki content. One of the most comprehensive answers was that of Student IN07 whose perceptions of the wiki included most of its advantageous features. Student IN07 mentioned the following features:

- *“Multiplicity of the sources enriches the wiki pages.*
- *Promoting searching and discovering the information.*
- *Communicating with others gives self-confidence”.*

Student IN03 added that one of the useful aspects of using the wiki was that it encouraged the user to evaluate critically the content, and this is the highest level of learning:

I can find the information rapidly (i.e. quickly when I need it). Acquiring new information... Helps in critical thinking. It may motivate me and the others to learn better.

The ability to exchange information and knowledge and to look for additional information was another advantage of the wiki mentioned repeatedly. Students IN02, IN08, IN12 and IN13 stressed that the wiki will facilitate their search for information from other sources or the wiki itself. Additionally, the students believed that the structure of the wiki encouraged them to exchange information. One answer was:

“It is easy to search for the information through the wiki pages and sharing the experiences and the ideas. Exchanging the information...Finding out the others’ opinions and it will be a good opportunity to exchange the experiences and information...Facilitates searching for the new learning materials...Encouraging me to search for the information and this task will help me to remember the biology information over a long time”.

The wiki could also encourage the students to rely on themselves to find the information and perhaps to teach themselves. Students IN04, IN07 and IN14 suggested

that students' independence and their ability to communicate would increase their confidence and enhance their learning experience:

"The wiki acquires leaner self-learning...Communicating with others gives self-confidence...Finding information by the student".

Other positive perceptions of the wiki were described by IN06 and IN11 mainly focusing on the ability to access information directly. The two students also commented on the efficiency of the wiki as a learning tool. Information could be accessed quickly, thus saving time and effort. Furthermore, information could be exchanged easily through the pages of the wiki, thus breaking the routine of the traditional classroom and making the learning experience more enjoyable:

"Saving time and effort for both students and teachers. The wiki would give all students the freedom to participate in discussions and to express their opinions. The ability to change and amend the information that is stored in wiki pages. Helps to create an educated generation".

Sub-theme 2: Trusting

Trusting the content of the wiki is a priority for the users and anyone else who will be benefiting from the information available on its pages. The responses of the students during the interview revealed that they were cautious about the content of the wiki, especially regarding the addition of incorrect information, the modification of correct information and the possible exposure to hacking.

Student IN12 openly used the term "trust" to express his wariness of erroneous contributions that could be posted on the wiki:

"The wiki pages can be included of a huge amount of the information added by the students, but in my opinion not all of the students' contributions can be trusted".

Student IN07 used another expression to express his wariness of erroneous information, which indicated the importance of having a correct, valid and accurate content on the wiki, this being one of its disadvantages. As he put it:

"Despite the importance of the information that I find in the pages of the wiki, but I feel concerned about lacking of confidence in the content sometimes".

When Student IN02 was asked about the advantages and disadvantages of the wiki, he also expressed his wariness of the inclusion of erroneous information:

“One more thing that bothering me when using a wiki is that wiki may include incorrect information”.

In the same context, Student IN01 expressed his lack of trust in a milder tone by arguing that trust in the content of the wiki could be restored and maintained by establishing revision mechanisms for the editing process. Thus, Student IN02 stated:

“The wiki content being a continual work in progress was difficult for many students to accept. Thus, the reality of the information is sometimes a weak and untrustworthy”.

Student IN05 believed that the ease of accessing wiki pages could lead to adding or removing the content; at the same time, it was impossible to identify the student who edited the content and track his modifications. However, in the opinion of Student IN05, the wiki could still be hacked, which is a major disadvantage. He remarked:

“Anyone can amend the content if wiki does not require a username and password. Moreover, wiki may be exposed to vandalism”.

Sub-theme 3: Obstacles

Many obstacles can impede using the wiki, and this is regarded as its major disadvantage. According to the data collected from the students, it seems that the need for planning, training and pre-configuring the educational environment as a whole were classified as the most important obstacles.

Student IN11 considered that one of the major obstacles that would currently limit the use of the wiki was the lack of needed equipment and the pre-configuration of the classrooms. Student IN11 elaborated his opinion:

“I think the main obstacles is that the needs of a pre-configuration of the classroom in terms of providing computers and Internet”.

Moreover, a group of students argued that training for users should be provided as a necessary condition to overcome the obstacles they may face when using this relatively new technology. For the wiki to be used as a teaching tool, all the students should be at a similar level of skill in using it. Students IN03 and IN11 stated:

“It could be difficult to use it at the beginning...The need to train before using it in learning is necessity, through workshops for example”.

Student IN12 believed that the presence of the teacher helped some students overcome any obstacles they might face while using the wiki. The teacher can also alert the students to other complex features of the wiki. Student IN12 said:

“I may feel the need for the teacher to help me to facilitate overcoming ambiguity in inserting the visual materials”.

Finally, some wikis do not support the Arabic language, so certain students might find it difficult understanding what the icons on wiki pages might mean, how to edit text and how to add audio-visual files. These skills might require a basic level of familiarity with English as a virtual language of the wiki pages. Student IN04 explained his view stating:

“I think the difficulty of dealing with the wiki can be seen in terms of the language, because some wikis are not supported by Arabic. Also the users of wiki need to have at least the basic skills in using computers”.

5.4.2 Analysing the data for the stage ‘during the use of wiki’

The ‘during the use of wiki’ represents the second phase of the current research. This phase sought to collect the data from students through different instruments during the research duration of six weeks (i.e., during the use of the wiki in learning). These instruments (Appendices 3, 4 and 5) were used to collect data from a sample of students studying biology at ABU, the instruments as shown in section 4.6 are:

- 1- Multiple choice questionnaire design;
- 2- Weekly tests; and
- 3- Five-point Likert Scale questionnaire.

The nature of the data is numerical, and to analyse this together “en masse” with the qualitative data collected before and after using wiki through the interviews and electronic comments, the quantitative data were converted to qualitative data through the technique of ‘qualitising the data’ (Section 4.4.4). To this end, a set of themes emerged in order to analyse the quantitative data. These themes were extracted from the data of the research questions 2, 3 and 4 as detailed in Table 5.5.

Stages	Pre-determined themes (from the RQs)	Emerging themes (from the dataset)	Sub-themes			
			1	2	3	4
During the use of wiki	Knowledge about wiki technology	Learning materials	Written	Audio-Visual materials	Photos and graphics	
		Difficulties	Internet service	Computers and equipment	Searching for sources	
		Contributions	Discussion page	Content page	History page	
		Interaction	No effect	Relatively good effect	Good effect	
		Communication	Synchronous	Asynchronous	Face to face	
		General characteristics	Ease of use	Plurality of pages	Edit and remove	
		Gaining knowledge	No effect	Good effect	Some effect	
	Biological Knowledge and Information					
	Acquiring e-learning skills	Essential skills	Wiki skills	Collaborative learning skills	Communication skills	Searching skills

Table 5-5: Generating the pre-determined themes from research questions 2, 3 and 4, and extracting the emerging themes and sub-themes from the dataset

5.4.2.1 Pre-determined theme 1: Knowledge about wiki technology

The twenty students were given a questionnaire with nine multiple choice questions (Appendix 5). Some of the answers had three choices and some other questions had four choices. This feature has no effect on the statistical analysis or the results later described. For every question, the respondent was asked to choose one option. Students’ answers to these questions indirectly indicated their knowledge of wikis. In other words, the questions sought to measure knowledge through evaluating students’ use of wikis and identifying the difficulties (obstacles) that they may have faced and other aspects. These aspects will be addressed in the following sections.

Generating themes from research question 2 and data set

Knowledge about wiki technology was the pre-determined theme generated from the research question 2: *What is the extent of students’ knowledge about wiki technology?* This theme represented the aim that the question sought to answer. After analysing the data statistically by using the SPSS programme, the results were converted to qualitative

data through re-categorising all items, which were received from the students' answers to the research question through using the NVivo programme. Qualitising the data uncovered seven emerging themes and 28 sub-themes, as shown in Table 5.6.

Stage	Pre-determined theme from the RQ2	Emerging themes	Sub-themes		
			1	2	3
During the use of the wiki	Knowledge about the wiki technology	Learning materials	Written	Audio-Visual materials	Photos and graphics
		Difficulties	Internet service	Computers and equipment	Searching for sources
		Contributions	Discussion page	Content page	History page
		Interaction	No effect	Relatively good effect	Good effect
		Communications	Synchronous	Asynchronous	Face to face
		General characteristic	Ease of use	Plurality of pages	Edit and remove
		Gaining knowledge	No effect	Good effect	Some effect

Table 5-6: Themes and Sub-themes emerged from the dataset for RQ2

Emerging theme 1: Learning materials

In order to examine students' knowledge of wikis, they were asked to answer several questions relating to learning materials that exist on the wiki pages. Learning materials were composed of the biology information in the form of texts, audio-visual materials (e.g., movies), photos and diagrams. The percentage 65% (n=13) of the students identified '*written material*' as the most materials used during the use of wiki site. The remaining seven students (35%) believed that the '*Audio-Visual materials*' such video and audio clips had an impact on their knowledge. The third choice, '*photos and graphics materials*', were selected by none of the students. See Table 5.7.

Item	Frequency	Percentage
Written Material	13	65%
Audio-Visual materials (e.g., movies)	7	35%
Photos and graphics materials	0	0%
Total	20	100%

Table 5-7: Frequencies of the answers to the question (1) of multiple choices questionnaire:

Which of the following materials helped you to improve your knowledge?

Emerging theme 2: Difficulties

The relationship is between the students' knowledge of wikis and the obstacles that they face using it. The extent of their knowledge can be identified through their awareness of the requirements of using wikis, and whether it is possible to use wikis with or without any of these requirements.

The data collected from the students revealed that equipping the classroom in terms of computers and other technology requirements was, for 11 students, the main obstacle. The second obstacle that prevented the use of wiki was the Internet service; the data indicated that 45% of the students viewed Internet disconnection or unavailability as preventing them from using wikis. It should be noted here that Internet service unavailability or the lack of Internet service in the university or students' homes was stated in another part of the data collected from students. The data also revealed that searching for the information on wiki pages was not considered an obstacle for students' use of wiki. This may give an indication of students' familiarity with wiki technology as shown in Table 5.8.

Item	Frequency	Percentage
Obstacles related to the Internet service	9	45%
Obstacles related to the computers	11	55%
Searching of the information within wiki pages	0	0%
Total	20	100%

Table 5-8: Frequencies of the answers to question (2) of multiple choices questionnaire: During your use of wiki to obtain knowledge what are the obstacles that faced you?

Emerging theme 3: Contributions

Students' contributions on wiki pages represented further means of discovering their knowledge of wikis. Tables 5.9 and 5.10 illustrate the number of students who posted on the two main pages of the wiki 'discussion and content page'. Due to the difference in the numbers of contributions between students who posted on the 'discussion page' and on the 'content page', the tables have been separated.

The data in the two tables below show the similarity in students' assessment in terms of their contributions. At the same time, the tables show that 0% of students posted on these page whether 'daily contribution' or 'never contribute'. The similarity

in the responses of students with a numerical value can be noted in the two items ‘sometimes (more than two times per week)’ and ‘seldom (two times or less per week)’.

Item	Frequency	Percentage
Consistently contribute (daily)	0	0%
Sometimes (more than two times per week)	10	50%
Seldom (two times or less per week)	10	50%
Never (did not contribute)	0	0%
Total	20	100%

Table 5-9: Frequencies of the answers to question (3) of multiple choices questionnaire: How would you assess your posts in the discussion page in order to build your knowledge of biology?

Item	Frequency	Percentage
Consistently contribute (daily)	0	0%
Sometimes (more than two times per week)	8	40%
Seldom (two times or less per week)	12	60%
Never (did not contribute)	0	0%
Total	20	100%

Table 5-10: Frequencies of the answers to question (4) of multiple choices questionnaire: How would you assess your posts in the content page in order to build your knowledge of biology?

One of the ways to discover students’ knowledge was to determine which of the wiki pages had an impact on building their knowledge. The three main pages in the wiki are ‘Discussion page,’ ‘Content page’ and ‘History page’. As shown in Table 5.11, the content page, which is the main page in the wiki, was the most used by students. It also had the most impact on students’ knowledge, they believed. Nine students selected the content page, while (seven) selected the discussion page. The history page normally contains the old versions of students’ contributions and the recent amendments they have made. For this reason, only four students believed that this had had an impact on their knowledge as shown in Table 5.11. Students used the history page to track the new changes a phenomenon also noted by (Ding and McGuinness, 2009).

Item	Frequency	Percentage
Discussion page	7	35%
Content page	9	45%
History page	4	20%
Total	20	100%

Table 5-11: Frequencies of the answers to question (5) of multiple choices questionnaire:

During the use of wiki pages, which page or pages had an impact on building your knowledge?

Emerging theme 4: Interaction

The interaction with team members was one of the features that characterised the wiki. The effect of the interaction on students' knowledge was on three levels as shown in Table 5.12: 'The interaction had no effect', 'it had relatively good effect', and 'it had good effect'. These levels identified the effect of working within a group as one of the wiki characteristics of students' knowledge. Only one student had a negative response. He thought that the interaction with the group members did not affect his knowledge. In contrast, the majority of students (16) found that the interaction with others had relatively good effect on their knowledge. Finally, in terms of 'good effect', only three students thought there was some effect of the interaction with others on building their knowledge.

Item	Frequency	Percentage
The interaction had no effect	1	5%
The interaction had relatively good effect	16	80%
The interaction had good effect	3	15%
Total	20	100%

Table 5-12: Frequencies of the answers to question (6) of multiple choices questionnaire: What was the effect of the interaction with other team members on your knowledge?

Emerging theme 5: Communications

Another feature characterising the wiki was the type of communication among the wiki users. Students were asked to identify which type of communication between the group members they believed helped them to acquire knowledge during the use of wiki.

It seems that the traditional way to communicate with others '*face to face*' was more familiar among students. Table 5.13 shows that 13 students, 65% (i.e., more than half the number), agreed that the face to face communication helped them to acquire the

knowledge. In contrast, seven students either believed that Synchronous communications (four students) or Asynchronous communications (three students) helped them to communicate with others to acquire knowledge.

Item	Frequency	Percentage
Synchronous communications	4	20%
Asynchronous communications	3	15%
Face-to-face communications	13	65%
Total	20	100%

Table 5-13: Frequencies of the answers to question (7) of multiple choices questionnaire: Which type of communication with the group members do you believe helped you to acquire knowledge?

Emerging theme 6: General characteristics

In order to understand the extent of students' use of wiki, they asked to identify the main characteristics of the wiki. Students were asked to choose one of the three main characteristics. These choices as shown in Table 5.14 were: ease of use, multiple pages of wiki and the ability to deal with content in terms of editing or removing others' contribution. The items 'ease of wiki use' and 'multiple pages' were chosen by eight students for each of these items, whereas only 4 students believed that their ability to edit others' contribution helped to gain biological knowledge.

Item	Frequency	Percentage
The ease of using Wiki	8	40%
Plurality pages of Wiki (main page, content page, discussion and history page)	8	40%
The ability to edit or entirely remove my own comments	4	20%
Total	20	100%

Table 5-14: Frequencies of the answers to question (8) of multiple choices questionnaire: What are the characteristics of wiki that you think helped you to gain knowledge?

Emerging theme 7: Gaining knowledge

Table 5.15 represents a summary of the wiki efficacy in terms of students' understanding of wiki. The frequencies of students' responses give an indication of how effective or ineffective was using wiki in helping them to understanding wiki in several aspects. It seems that using wiki had no effect on gaining knowledge about wiki in the case of only two students, which means that there was actually an effect with the rest of the students (18 out of 20) but at different levels. The level a 'good effect' was selected by four students, while fourteen students selected the level 'some effect.'

Item	Frequency	Percentage
The use of wiki had no effect	2	10%
The use of wiki had a good effect	4	20%
The use of wiki had some effect	14	70%
Total	20	100%

Table 5-15: Frequencies of the answers to question (9) of multiple choices questionnaire:

Overall, how effective or ineffective was using wiki in helping you to gain the knowledge about wiki?

5.4.2.2 Pre-determined theme 2: Biological knowledge and information

In order to answer the research question 'what is the impact of using wiki technology on the students' biological knowledge', the paired t-tests were used to identify this impact. Table 5.16 contains descriptive statistics of the topics before and after the use of wiki. The mean scores in all topics were higher after the use of wiki for all topics.

Generating themes from research question 3 and data set

The main theme that has been generated from the research question 3: *What is the impact of using wiki technology on the students' biological knowledge?* was 'Biological knowledge and information'.

Topics		Mean	Std. Deviation
Topic 1 before wiki	Plant Cell	5.742	1.124
Topic 1 after wiki		6.701	1.553
Topic 2 before wiki	Solutions	6.032	1.402
Topic 2 after wiki		6.484	1.503
Topic 3 before wiki	Osmotic	6.065	1.436
Topic 3 after wiki		6.645	1.582
Topic 4 before wiki	Absorption	5.742	1.154
Topic 4 after wiki		7.645	1.427
Topic 5 before wiki	Plant Water	6.774	1.407
Topic 5 after wiki		8.226	1.230
Topic 6 before wiki	Enzymes	6.452	1.207
Topic 6 after wiki		8.968	0.752

Table 5-16: Means and standard deviations of the topics before and after wiki

The purpose of this data collection was to compare the mean scores before and after the wiki and specifically to see whether the scores of the students in each of the topics after the use of the wiki were the same as before the use of the wiki. Since the scores came from the same students in both cases a paired t-test was performed in order to answer this question.

Table 5.17 summarises the results from the paired t-tests applied to each of the topics. The difference in the mean scores was significant for the topics 1, 4, 5 and 6, but not for the other two (2 and 3). This means that there is evidence to say that the use of the wiki helped the students for these four topics significantly, but not the topics 2 and 3. It can be noted that in both of these two topics there was an increase as seen from Table 5.16 as well, but it was not high enough to be significant.

Topics	Mean difference	t-test	Significance
Topic 1	0.968	2.881	0.007
Topic 2	0.452	1.133	0.266
Topic 3	0.581	1.438	0.161
Topic 4	1.903	5.842	<0.001
Topic 5	1.452	4.081	<0.001
Topic 6	2.516	11.602	<0.001

Table 5-17: Paired t-test for each topic

5.4.2.3 Pre-determined theme 3: Acquiring e-learning skills

A five-point Likert-scale questionnaire was distributed to twenty-seven students to investigate the extent of acquiring e-learning skills; the questionnaire was comprised of four axes. The first axis was the ‘wiki skills’ which contained eight questions. The second axis was the ‘Collaborative Learning Skills’ which contained nine questions. The third axis was the ‘Communication Skills’ which consisted of seven questions and the fourth axis was the ‘Searching Skills’ which consisted of seven questions.

There were five possible answers: 1 as Strongly disagree, 2 as Disagree 3 as Neither disagree nor agree 4 as Agree 5 as Strongly Agree. Numbers were allocated to each of these answers, ranging from 1 to 5 for every answer, in order to implement a statistical analysis.

Descriptive statistics about the axes

There were 27 male respondents answering all the questions in the questionnaire. Each respondent’s score was calculated for each of the four axes. That is, for every respondent, the average of his answers was calculated for each axis. This was possible because each answer was allocated a number.

Table 5.18 presents descriptive statistics of the scores of the four axes. The second axis ‘collaborative learning skills’ had the highest average, whereas the third axis ‘communication skills’ had the lowest average. Almost half of the students had scores above (Mean=3.685, SD= 0.867) on the first axis, and almost half of the students had scores above (Mean=4.161, SD = 0.854) on the second axis. The scores of almost half of the students were (Mean= 2.974, SD =0.848) or more on the third axis, whereas on the fourth axis almost half of the students had scores above (Mean=3.833, SD=0.876) respectively.

Axes	Minimum	Maximum	Median	Mean	Standard deviation	Reliability coefficient
First axis	1.63	5.00	3.875	3.685	0.867	0.84
Second axis	1.56	5.00	4.444	4.161	0.854	0.909
Third axis	1.29	4.57	3	2.974	0.848	0.757
Fourth axis	1.67	5.00	3.833	3.833	0.876	0.816

Table 5-18: Descriptive statistics of the four axes

Reliability of the axes

In order to examine the reliability of the questionnaire, Cronbach's reliability coefficient was used. Table 5.18 contains the reliability coefficient for each of the four axes. As can be seen, they are all above 0.7 and thus it can be said that all axes are reliable.

Inferential statistics about the axes

Inferential statistics were used to draw conclusions about the population based on the sample of the twenty-seven respondents. Hypothesis tests were performed and the value of the significance level set to $\alpha=0.05$. This means that if the p-value of the test is lower than 0.05, then the result is said to be statistically significant.

Correlation coefficients amongst the four axes

Table 5.19 contains the correlations between all the pairs of axes. The maximum value of the correlation can be 1. The closer the value of the correlation is to 1, the higher the correlation between two axes. This indicated that two axes were highly positively correlated. If the scores in one axis were increasing then the same is expected to happen to the other axis.

The value of the correlation coefficient between the first and the second axis was equal to 0.703. This was a high value and means that these two axes were strongly correlated. A similar image was obtained for the other pairs of axes. The practical interpretation is that when someone scores high on the one axis, he is expected to score high on the other three axes as well.

However, when looking closer at the correlation values, the correlations of the third axis with all the other axes are below 0.6. Table 5.19 shows that the third axis has the lowest average score. By combining these two findings, it can be said that the third axis seemed to have the lowest score and did not to match the higher scores of the other axes.

Pairs	Correlation	P-value	Result
First axis and Second axis	0.703	<0.001	Significant correlation
First axis and Third axis	0.584	0.001	Significant correlation
First axis and Fourth axis	0.695	<0.001	Significant correlation

Second axis and Third axis	0.576	0.002	Significant correlation
Second axis and Fourth axis	0.693	<0.001	Significant correlation
Third axis and Fourth axis	0.569	0.002	Significant correlation

Table 5-19: Pairwise correlations between the scores of the four axes

As for the significance of the correlation values, the table above shows that all of them are significant. This means that there is evidence to say that these axes were indeed correlated with one another.

T-tests for the averages of the four axes

The next step was to compare the averages of the four axes between them. The four means are presented graphically in Figure 5.7. In order to compare the four averages, two dependent sample t-tests were performed, since the same students responded to all questions. Thus, the four scores came from the same respondents.

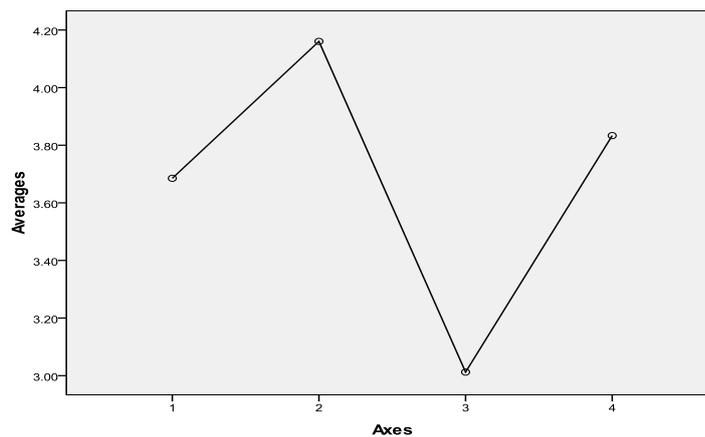


Figure 5-9: Averages of the four axes

Table 5.20 contains the result of the six t-tests (there are six pairs formed by the four axes). As can be seen, most of the results were significant. This meant that the average scores between the four axes cannot be assumed to be the same. The exception is between the first and the fourth axis. The averages of the scores of the two axes seemed not differ significantly and thus could be assumed equal.

Pairs	Average difference	t-value	Degrees of freedom	p-value	Result
First axis - Second axis	-0.475	-3.725	26	.001	Significant difference
First axis - Third axis	0.673	4.365	26	.000	Significant difference

First axis - Fourth axis	-0.148	-1.132	26	.268	Not significant difference
Second axis - Third axis	1.148	7.432	26	.000	Significant difference
Second axis - Fourth axis	0.327	2.506	26	.019	Significant difference
Third axis - Fourth axis	-0.821	-5.209	26	.000	Significant difference

Table 5-20: T-tests for the averages of the axes

As seen from Figure 5.7 and table 5.18 the highest average was met on the second axis 'Collaborative Learning Skills'. The fourth axis 'Searching Skills' had the second highest average. The difference in the averages between the second and the fourth axis was statistically significant ($p\text{-value}=0.019 < 0.05$). The third highest average was met on the first axis 'wiki skills'. The difference between the averages of the first and the fourth axis was not significant ($p\text{-value}=0.268 > 0.05$). Finally, the lowest average was met on the third axis 'Communication Skills'.

The results of the t-test showed the order of knowledge the students acquired on each of the four axes. In addition, it can be seen that the average of the third axis was almost 3, meaning that on average the participants neither agree nor disagree with the questions for the third axis. In addition, the averages of the other three axes were above 3.5 and close to 4 (Agree). This provides grounds to say that the students agree on average with the skills they were expected to acquire.

Generating themes from research question 4 and data set

The main theme that has been generated from the research questions 4: *To what extent do the students' acquire e-learning skills during construction of the biology content via wiki pages?* is 'Acquiring e-learning skills'. This theme represents the aim that the question sought to be answered.

After analysing the previous quantitative results statistically, the results were interpreted descriptively (qualitising data, see section 4.4.4) by expressing the numerical data as concepts and terms. The objective of interpreting the data descriptively was to transform it to a form that could be integrated with the qualitative data collected through the interviews and electronic comments. In light of the combined data, the emerging themes were extracted. Table 5.21 displays the emerging themes that were extracted after the qualitisation of the quantitative data.

Stage	Emerging theme	Sub-themes			
		1	2	3	4
During the use of wiki	Essential skills	Wiki skills	Collaborative learning skills	Communication skills	Searching skills

Table 5-21: Themes and sub-themes emerged from the dataset for RQ4

5.4.3 Analysing the data for the stage ‘after the use of wiki’ (the attitudes towards wiki)

The second part of the qualitative data was collected after the students used the wiki. This stage depended on three foundations:

- 1- The time of collecting the data and the motivation for choosing this time.
- 2- The data collection method and the reason for using this method.
- 3- The purpose of data collection in this stage.

The students’ views of the requirements and obstacles to using the wiki, the role of the teacher in the wiki class, and the in-class activities were collected. The e-comments provided the most relevant way to learn about the views of the students (Appendix 6 and 15) since they had the complete freedom to answer to the fifth research question: *What are the students’ attitudes towards using wiki technology in learning at ABU?* In comparison, the personal interviews that were conducted before the students started using the wiki included nine questions to learn about the perceptions of the students.

The difference in the number of questions was motivated by the knowledge of the students about the wiki. Before using it, the students needed many detailed questions to learn about their perceptions. In particular, the pilot study conducted by the researcher (Chapter 3) showed that the students had little knowledge about the wiki as this technique had not been used at ABU before. However, after using the wiki, the students could answer the single general question posed above.

The e-comments were the most suitable tool to collect the responses of the students. Here, the e-comments are the opinions of the students, which represent their attitudes towards using the wiki for learning, and these were submitted through the pages of the wiki or standard e-mails. Several reasons motivated the researcher to ask the students to submit their attitudes electronically; perhaps the main motivation was to

instil in them the concept of e-learning. In addition, it gave them the chance to demonstrate their skills in using the wiki through editing the content of the wiki page of any of the units that were covered during the study.

Fourteen students participated in the survey to gauge their attitudes towards using the wiki as a learning tool. As mentioned in the beginning of this chapter, and according to Table 5.2, each of these fourteen students was given a symbol to record his responses in order to conceal identity. The objective of this stage of the study was to learn about the attitudes of the students through their e-comments. Thus, the symbol “EC(n)” was used to indicate the students; “EC” was the abbreviation of “e-comment”; and “n” was the number of students (varying between 01 and 14).

The students used their personal e-mails and the wiki pages to express (in writing) their attitudes and views on using the wiki in learning while using it. Those who used their personal e-mail accounts attributed this choice to their desire to maintain their confidentiality and privacy.

The students’ responses, which were originally in Arabic (Appendix 11), were translated to English and the authenticity of the translation was confirmed by two linguistics and translation experts (as detailed in Section 5.3.1 ‘Translating the data into English’). After translating the responses of the students, the data became ready for importing into NVivo (Appendix 15) to organise and to extract the themes and sub-themes that could be linked to the responses of the students (Table 5.24).

Generating themes from research question 5 and data set

The attitudes are the predetermined theme about students’ attitudes towards wiki that extracted from the fifth research question: *What are students’ attitudes toward using wiki technology?* This theme represents the aim that the question sought to answer.

After interrogating the data, two themes were extracted: ‘positive’ and ‘negative’. These were identified as the main themes since the students’ responses were revolving around them. Accordingly, five sub-themes were extracted from the dataset.

Table 5.22 shows the themes and sub-themes that were extracted through examining the responses of the students about their attitudes towards using the wiki for learning biology.

Phase	Pre-determined them	Emerging themes	Sub-themes		
			1	2	3
After using wiki	The attitudes	Positive	Educational characteristics	Impact on learners	
		Negative	The Internet	Experience and training	The language

Table 5-22: Themes and sub-themes emerged from the dataset for RQ5

5.4.3.1 Emerging theme 1: Positive

The data showed that there was a positive attitude towards using the wiki in learning, which reflects the students’ satisfaction with and benefit from using the wiki. In other words, the positive attitude of the students in this study indicates that using the wiki to learn biology was beneficial to them. The data were collected while the students were actually using the wiki during a six-week period.

Examining the data showed that the positive attitudes of the students can be attributed to several reasons, which can be categorised into sub-themes, thereby facilitating the linking of the students’ responses. These sub-themes were identified as shown in Figure 5.8.

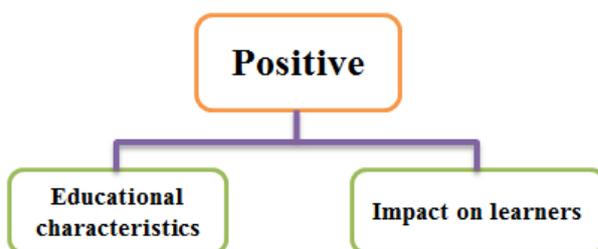


Figure 5-10: Emerging theme 1 and sub-themes emerged from RQ5

Sub-theme 1: Educational characteristics

Nearly 90% of the surveyed students expressed a positive attitude towards the wiki, particularly because of their satisfaction with its educational characteristics, which included the ability to: edit the content, add learning materials (figures, pictures, schematics, etc.) and delete or edit the contributions of the other students. Moreover, the wiki allowed the students a medium by which they could freely exchange information

and knowledge. In the following, samples from the responses of the students are presented in support of this sub-theme.

For example, Student EC01 mentioned three characteristics of the wiki which contributed to his positive attitude towards its use in learning. These three characteristics were, he noted:

"Wikis can be used in learning due to their ease of editing, and wikis can also be used as sources and to communicate with other students".

The response of Student EC03 touched upon more general features of the wiki which meant that he had a positive attitude towards its use in learning. The student explained the effect of the wiki on his (and his colleagues') learning experience by stating:

"In my use of wiki while learning biology I can enumerate the benefits as follows: I found them easy to use and to deal with. They are a good method to share educational materials related to the biology topics with other students, such as pictures, videos clips and texts".

Despite his lack of experience with the wiki and his poor perception of the wiki before using it, Student EC04 was able to benefit from its use, after two weeks, by improving his learning and exchanging knowledge with his peers:

"...However, after the second week I found wiki technology very interesting and very helpful, especially when exchanging information with others".

Student EC05 strongly advocated using the wiki as a learning tool, which was clearly a positive attitude. The student justified his response by the freedom and ability of editing and modifying the content. He stated:

"Another point I would mention is that wiki gives me the freedom to edit and to change other people's contributions if I felt they were wrong, needed modifying or did not relate to the biology topic. From my point of view, I strongly support the idea of using wiki in learning".

Here, it is worth mentioning the response of Student EC08, who had a positive attitude towards the wiki. In particular, he described the wiki as an information bank that he could use, whenever he needed, to revise and solidify his knowledge. According

to EC08, some of the special characteristics of the wiki were the presence of multiple pages, which helped the student increase his knowledge:

“Wiki is a new technology consisting of four or sometimes five pages and students use these pages to exchange information through the Internet...I would describe a wiki as an information bank based on students’ contributions and the information students collected during the semester”.

It is also worth noting what Student EC06 stated in his response. He believed that one of the most important pages in the wiki is the History page, which kept a comprehensive record of all the modifications of the pages. The student also mentioned his desire to use the wiki to retrieve the previous versions of the wiki to reinforce his knowledge and to aid his learning. The History page could also be used to categorise the changes, who did them and when. Student EC06 stated:

“I like using wiki in learning because I can go back to the wiki pages when I want to read or compare with previous information through using the “History” page. Moreover, I found this page to be very important for students and wiki users because it is a useful information store”.

The response of Student EC11 can be regarded as a summary of the responses of Students EC06 and EC08. Student EC08 stated that his experience with the wiki as a learning tool was beneficial. Student EC11 described his attitude towards wiki as following:

“I strongly support the use of wikis in higher education in general and in Al-Baha University in particular. Wikis have been a successful learning method for me because of the huge amount of information I have read on different pages such as the front page, discussion page and the history page”.

Student EC12 mentioned two main features of the wiki which had a positive impact on his learning of biology. The feature was the ability to add various learning materials (which were previously obtained from different sources) to the wiki pages. The second feature was the rather interesting sequential process which started with finding the information on the Internet, then adding the information to the wiki pages, and ended with discussing the information with the students:

“One characteristic that has had a particularly positive impact on my studies is the ability to insert multiple materials on wiki pages, such as written material, multimedia, photos and PowerPoint slides...Using the Internet to search for information and then adding it to wiki pages and discussing it with other students was very interesting and helpful”.

Finally, Student EC13 mentioned three elements that contributed to his positive attitude towards using the wiki for learning: (a) the flexibility in reaching the various wiki pages, (b) encouraging team work in the learning process and (c) motivating the students to engage actively in the learning process. The response of this student clearly shows his team spirit, which is one of the characteristics of the wiki. Student EC13 stated:

“For me, using wiki was a very good way to learn. It made for an interesting learning style due to the flexibility of access to multiple wiki pages. Another benefit is the collaboration it fosters among students, which motivates group members to work actively. In my opinion, using wiki was very easy”.

Sub-theme 2: Impact on learners

As regards the effect of the wiki on knowledge building, Student EC01 clarified the relationship between knowledge building and the discussions with his peers using the discussion page, which he viewed as the most important page of the wiki:

“Wiki encourage me to discuss issues with my peers in the class and to search for enriching information. For example, the discussion page had a positive effect in building my knowledge and I found it easy to edit and modify the other contributions”.

Students EC02, EC03 and EC04 agreed on the importance of wiki technology in motivating group learning and its impact on content building, especially when recalling that the pages are enriched through the continuous addition of content by the users. Some of what these students said included:

“In terms of collaborative learning, I found that wiki pages helped me to construct the content of biology through other people’s contributions...One

of the defining characteristics of wiki in my opinion is that they create a “spirit of collaboration” among students...Finally, using wiki encouraged me to work collaboratively”.

The academic achievement and the ability to memorise the information were the main aspects that constituted the positive attitudes of Students EC05 and EC06 towards using the wiki as a learning tool. Both students respectively expressed their positive attitude towards using the wiki in learning biology, although they cited different aspects that positively impacted their learning:

“I think wiki help students to search for information from different and multiple sources such as the Internet. In my opinion, searching for information is an effective way to store this information in students’ minds...Wikis have had a positive effect on my biology learning in terms of my understanding of topics and increasing my academic achievement. This progress can be attributed to several causes, such as wikis’ characteristics and the interaction between the teacher and students on one hand and among students in wiki classes on the other”.

The e-learning skills are paramount to use the wiki effectively. In this regard, Student EC07 stressed that the wiki helped the students to acquire important e-learning skills while they were looking for biology information on the Internet. Student EC07 stated:

“I believe that wiki technology can be considered an educational tool to provide students with a better learning environment, and it can help us in acquiring e-learning skills while searching for biological information”.

5.4.3.2 Emerging theme 2: Negative

The students' responses attribute the negative attitudes towards wiki to external factors, except the responses of students EC12 and EC13, who attributed their negative attitudes to the language used in the wiki. In particular, the students believed the Internet, their previous experiences and training as the main factors that caused them to have a negative attitude towards using the wiki in learning (Figure 5.9).



Figure 5-11: Emerging theme 2 and sub-themes emerged from RQ5

Sub-theme 1: The Internet

Students EC02, EC03, EC04 and EC06 described the negative aspects related to the Internet as the main disadvantage in using the wiki. As for the complete lack of Internet access, Student EC03 mentioned that he lives in a remote area where there is no Internet connection to begin with. The student had to visit some friends or Internet cafes to overcome this obstacle and to access the wiki. He stated:

“Unfortunately, I had negative attitudes towards using wiki in learning due to the lack of Internet in my house. Although I tried to access the wiki from an Internet café and sometimes from my friend’s house the difficulties I had using wiki in the university made them not so useful to me”.

The continuous disruption of the Internet connection motivated the negative attitude of Students EC02, EC04 and EC06 towards using the wiki. These students had problems uploading audio/visual learning materials to the wiki pages, and with the continuous Internet disruption, they wasted much time doing this.

“I found some obstacles faced me during the use of wiki pages, due to being disconnected from the Internet or if the Internet speed was not adequate...In order to benefit from wiki, however, you have to be constantly connected to the Internet and this is the worst problem I faced...The only obstacle I have faced when using wiki in the university is Internet disconnection”.

Sub-theme 2: Experience and training

Student EC09 expressed openly the importance of experience and skills to use the wiki effectively. In this case, Student EC09 confirmed that his lack of experience was the main reason behind his negative attitude towards the wiki:

“Wiki technology is a suitable method in learning and teaching if people are given enough time to understand how to use it. In my case, I do not have enough experience to deal with this technology”.

Student EC08 noted that the time allocated for the wiki teaching session was short. Thus, this student did not have the chance to master the skills needed to use the wiki properly. He was not able to add information to the pages of the wiki; he preferred more time to search for information on the Internet and to select the best to add to the wiki. This response shows this student’s lack of experience with regard to the wiki in comparison with the other students. Student EC08 stated:

“The major disadvantage I have found in using wiki in learning is that the time on wiki was limited (i.e., during the lecture period, which was 50 minutes daily). For this reason, I sometimes found it difficult to add the information to wiki pages”.

Student EC04 argued that training the students on using the wiki would assist them in overcoming any problems they might face. This might explain the response of Student EC09, who complained of his lack of experience of the wiki. This could have been resolved by providing proper training, which would enable the student to be more time-efficient: Student EC04 stated that:

“To be honest, and because it was the first time I had used wiki in my learning, I found them to be of little benefit at the beginning. The reason behind that in my opinion is that training students is an urgent need if wiki are to be a successful educational method”.

Student EC01 believed that educating students about using the wiki was essential to guarantee the benefits of using this technology. He also pointed to the effectiveness of the wiki in eliminating the boredom that students might feel during the traditional teaching sessions:

“To benefit from wiki technology students must be educated on this technology”.

Sub-theme 3: The language

The language support of the wiki remains one of the main negatives that the students faced, especially those who do not know English (which is considered the standard in most wiki pages). Students EC12 and EC13 revealed their negative attitude towards using the wiki because it does not support Arabic. However, Student EC13 preferred using the wiki in learning, even though it does not support Arabic, whereas Student EC12 is adamant on the Arabic support in the wiki. The students stated:

“The disadvantage that I have noted is that wiki pages need better Arabic language support and are completely reliant on Internet access...Although they do not support the Arabic language. Overall, I would like to use wiki in my learning”.

5.4.4 Measuring the extent of online collaboration and learning

To verify the extent of online collaboration, Salmon’s five step model (2000) was applied to measure the students' engagement in online collaboration via the wiki pages. As shown in Figure 5.10 the model suggests five stages in analysing online interaction, which are: 1: access and motivation; 2: online socialisation; 3: information exchange; 4: knowledge construction; and 5: knowledge development.

Applying Salmon’s model shows that:

1- Students at the first stage were able to access and use the online discussion wikis and have posted their first messages. Some of students needed some technical support at this stage to facilitate access to wiki pages. In the meantime, the online researcher's role was to solve any access problems and to encourage and motivate participants to spend time and effort on the discussion group. Access is therefore not viewed merely as an initial problem but as an ongoing issue (Moule, 2007), thus, some students found it difficult to access the Internet at the beginning as students IN13 and EC07 described respectively:

“I have limited experience in using wiki. I know it is a scientific encyclopaedia and there are several types of wiki across the Internet”.

“I tried to access the wikis from an Internet café and sometimes from my friend’s house”.

Appendix 19 verifies this stage and shows the first access of students to the wiki pages. Just 35.5% accessed the wiki in the first week. The main factor that might have contributed to this result is that, as the findings in Section 5.4.1.1, 'previous experiences of wikis' indicated, the arithmetic mean of the students' level of the previous experiences was limited = 42.9 (Table 5.4). The limitations of the students' prior experience of wikis made it difficult for them to access the wiki.

2- Students at the second stage became more socially involved having introduced themselves to each other. Students also were able to send and receive messages to each other. Reviewing the students' responses gave several indications on verifying this stage, such as the initial interaction, sending and receiving the messages. For instance, Table 5.13 and Section 6.3.1.5 showed that 35% preferred to communicate with others synchronously and asynchronously, because the wiki allowed them to deliver and receive their messages. This second stage moves into the third stage when participants 'share a little of themselves' online (Nisbet, 2004). At this stage the online researcher attempted to create an atmosphere of mutual respect where 'productive and constructive exchanges of views' could take place. Appendix 20 verifies this stage.

3- After the students became more familiar with each other and with the wiki technology, they moved to an advanced stage of the online interaction. Students at this stage were able to exchange the information and the knowledge. Students also were able to use the wiki with more confidence and focused on the content of the biology topics. This is evidence of students' achievement of this stage can be seen from the students' responses. Student EC04 stated:

"After the second week I found wiki technology very interesting and very helpful, especially when exchanging information with others".

Another justification to claim that students were working at this stage is that students felt comfortable to edit others' contributions and make changes and comments on others' work. For example, student EC05 asserted that:

"...Another point I would mention is that wikis give me the freedom to edit and to change others' contribution if I felt it was wrong, needed modifying or does not relate to the biology topic".

The role of the researcher in this stage was to organise the online discussion, such as opening and closing discussion themes and arranging for discussions to be synthesised in a summary. Appendix 21 verifies this stage.

4- The fourth stage was about knowledge construction. At this stage, the students started to take more responsibility for their own learning, some of them were able to upload the learning materials and the others add new information, and some of them supported his work by adding website links relating to the biology topics. The online researcher's role was to build and sustain the group (An et al., 2008). Students' contributions included written materials more related to the biology topics. This fact can be seen in Table 5.7 showing that 65% of students believed that adding written material helped them to improve their knowledge about biology, while 35% selected the Audio and Visual material. This result indicated that all the students achieved an advanced level on the online learning via the wiki. Also they were able to post comments more easily and better than in the previous stage in terms of the quality and the authenticity of these comments. It can be concluded that, through this stage students were able to construct their knowledge through multiple sources of information, and through more activities and interactions with others. Appendix 22 verifies this stage.

5- The final stage in Salmon's model is the knowledge development. According to Su and Beaumont (2010, p.13) "students at this stage are developing towards being mature and experienced users and are expected to become critical and confident learners who take responsibility for their own learning". The students felt confident in their learning and they were more interactive especially in the last two weeks. By looking to the results of students' weekly tests (Table 5.23), the total scores for the students' group increased gradually from the fourth week to the sixth week, the best score was recorded in the sixth week, which indicated that students sought to develop their knowledge and that has been reflected on their academic achievement.

	1 st week	2 nd week	3 rd week	4 th week	5 th week	6 th week
Topics	الخلية النباتية Plant Cell	المحاليل Solutions	الأسموزية Osmotic	التشرب Absorption	العلاقات المائية Water Plant Relations	الانزيمات Enzymes
scores	208	201	206	237	255	278

Table 5-23: The total scores for the students' group during six weeks

The students' participation in online discussions made them become responsible for their own learning, with experienced participants guiding the less experienced and participants establishing their own agenda for exploring and learning. In this final stage, both the researcher and the students were using a constructivist approach to exploring their own thinking and knowledge-building process. Appendix 23 verifies this stage.

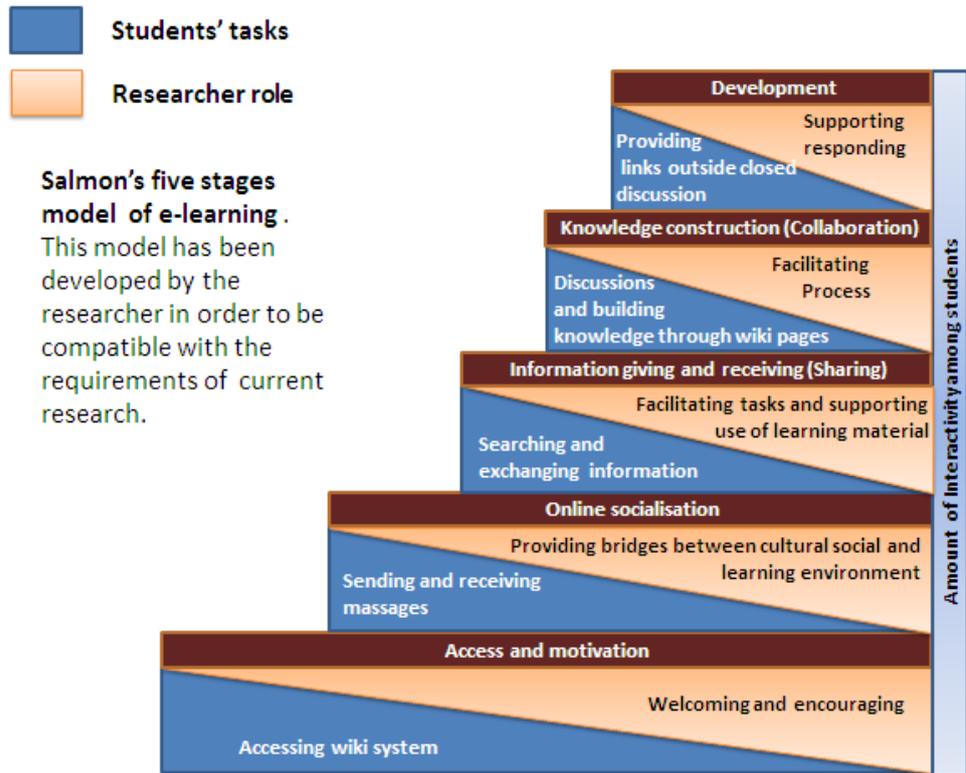


Figure 5-12: Salmon's Five-Stage Model of E-learning

Stages	Pre-determined themes (from the RQs)	Emerging themes (from the dataset)	Sub-themes			
			1	2	3	4
Before using wiki	The perceptions of wiki	Previous experiences	Good	Limited	Lack	
		Knowledge and information	Searching	Resources	Exchanging	
		Multiplicity of wiki pages	Motivating	Encouraging		
		Working within a group	Interaction	correction		
		Advantages and Disadvantages	Multiple benefits	Trusting	Obstacles	
During the use of wiki	1- Knowledge about wiki technology	Learning materials	Written	Audio-Visual materials	Photos and graphics	
		Difficulties	Internet service	Computers and equipment	Searching for sources	
		Contributions	Discussion page	Content page	History page	
		Interaction	No effect	Relatively good effect	Good effect	
		Communications	Synchronous	Asynchronous	Face to face	
		General characteristics	Ease of use	Plurality of pages	Edit and remove	
		Gaining knowledge	No effect	Good effect	Some effect	
	Biological Knowledge and Information					
Acquiring e-learning skills	Essential skills	Wiki skills	Collaborative learning skills	Communication skills	Searching skills	
After using wiki	The attitudes	Positive	Educational characteristics	Impact on learners		
		Negative	The Internet	Experience and training	The language	

Key colours	
Stage	
Pre-determined themes	
Qualitative themes	
Quantitative themes	

Table 5-24: Summary of themes and sub-themes emerged from the dataset for RQs

Chapter 6: **Discussions and Conclusion**

6.1 Introduction

The aim of this study is to investigate the impact of using wiki technology on students' learning at ABU in the Kingdom of Saudi Arabia. The study considered five elements to examine the impact of wiki on their learning: perceptions of wiki, knowledge about wiki, biological knowledge, acquiring e-learning skills and attitudes towards wiki. To this end, this study sought to answer the following research questions:

- 1- What are students' perceptions of using wiki technology?
- 2- What is the extent of students' knowledge about wiki technology?
- 3- What is the impact of using wiki technology on the students' biological knowledge?
- 4- To what extent do the students acquire e-learning skills during construction of the biology content via wiki pages?
- 5- What are students' attitudes toward using wiki technology?

To achieve the objectives and to answer the research questions, the study adopted a mixed-method design using qualitative and quantitative data (Li et al., 2010). Data for the study was collected from five instruments, as described in Section 4.6, using semi-structured interviews, a five-point Likert Scale questionnaire, a multiple choice questionnaire, weekly tests and e-comments.

According to the study framework, the major themes extracted from the research questions and which emerged from both the quantitative and qualitative data will be discussed in this chapter in the light of the study results. The framework represents several types of learning activities, such as synchronous and asynchronous communications, multimedia materials (visual and audio) and written materials (text editing) (Figure 6.1).

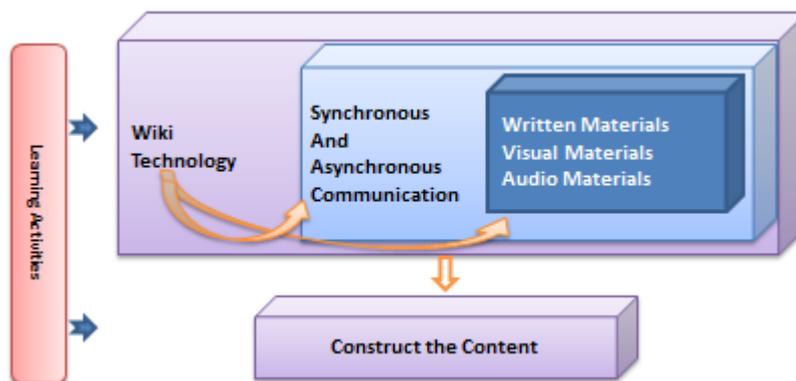


Figure 6-1 Students' activities based on wiki technology as a learning tool

The purpose of this chapter, therefore, is to discuss the results of the study resulting from the students' use of wiki technology and consider their conclusions in a broader context.

The discussion will address each theme in turn, with regard to its results and interpretation of all the data resources 'questionnaires, interviews, e-comments and weekly tests'. Data triangulation will be used to prove the reality of students' responses in different instruments. Vermeulen et al. (2012, p 24) stated that "triangulation is a powerful technique that facilitates validation of data through cross verification from more than two sources".

6.2 The stage before the use of wiki (students' perceptions of using wiki technology)

According to Abd El-Gawad (2011, p 66), "the success of any new educational system requires great attention to the expectations of the learners before using this system and their own perceptions to benefit from this system".

In order to answer the first research question '*What are students' perceptions of using wiki technology?*' interviews were designed to elicit the reflections of students regarding their perceptions of wiki. The total number of students who participated in the interviews was fourteen. When asked about their perceptions of wiki prior to the course, the responses of the students varied. Despite this, there appeared to be certain common general perceptions which will be divided into five main themes: *previous experiences* as discussed in the studies by (Karhu, 2011, and LaFrance and Calhoun, 2012), *knowledge and information* (Ismail et al., 2010), *multiplicity of wiki pages* examined by

(Li et al., 2010), *working within groups* (Elgort et al., 2008; Leung and Chu, 2009, and Kessler, 2009), and *the advantages and disadvantages of using wikis* as discussed by Deters et al. (2010); Woo et al. (2011); Li et al. (2010), and Forte and Bruckman (2007).

6.2.1 Emerging theme 1: Previous experiences

As described in Chapter 5 (Section 5.4.1.1), there were three levels of students' previous experiences of wiki which were classified as 1- good experience, 2- limited experience, and 3- lack or no experience. This classification (i.e., Sub-themes) built on the basis of the attributes that characterised the students' answers. Based on the findings gathered under these sub-themes, students' responses revealed that, overall, students' previous experiences of wikis tended to be limited (Table 5.4).

For the first sub-theme 'good experience', less than half of the students (Table 5.4) believed that they had a good experience with using the wiki. Students assessed their level of experience as good on the basis of having the important information that enables them to use wiki. Thus, using the wiki and dealing with its components required an understanding of how to log on to the wiki, how to move through wiki pages correctly, and understanding the functions of each icon and page. Furthermore, editing, adding and deleting the comments are the main skills and an essential requirement for the wiki user. This was reflected in the number of responses from students who believed that they had good experience of using the wiki. There were several responses of which the following are representative: For example:

“The wiki is an educational website enabling learners to edit the pages through adding or removing the content. Also, the user can benefit from others in wiki groups and the teacher also can see the students' contributions through their interactions in constructing the content” (IN04).

“Wiki can be used for multiple purposes, such as personal, educational and entertainment use. Several features can be mentioned as follows:

- *Wiki can simplify content by the flexibility to add or remove it.*
- *Wiki uses simple icons and are not complex.*
- *There is no need to be familiar with the programming language HTML.*

- *Wiki can store and save all changes in the content, which enables the user to go back to the content at any time” (IN05).*

The information mentioned by students for the sub-theme ‘good experience’ agrees with the main requirements of using a wiki in its proper use. These requirements are described as the main components of wikis (Section 2.5.1.4). Many studies emphasise the importance of wiki users having the information and skills such as that mentioned in the students’ responses. The fact that students may be able to use wikis in their proper form in the light of understanding their fundamental requirements of using wiki is evidenced in the literature. This is consistent with the studies of Bosque and Costello (2010); Cubric et al. (2008), and Plantikow et al. (2007) that touch on the main characteristics of wikis and their important features. The functions of wiki components are detailed by Belknap and Wiseman (2012) and Zorko (2009). Issues such as accessing constructing wiki contents are examined by Tolksdorf and Simperl (2006). Constructing the content leads to the build-up of knowledge among students as a result of the collaborative activities in wiki classes such as the studies of Cole (2009), and Brindley et al. (2009).

In relation to the functionality of the knowledge gained from wikis, gaining knowledge is the main aim of using wiki in the educational field (Kelly, 2006; and Lyndsay, 2006). This aim requires a thorough knowledge of how to add texts and other types of learning materials to wiki content and then to benefit from them. This was supported by the students’ perceptions of wiki collected in this study. For example:

“I have good experience of wiki in terms of the use and how to add texts and visual materials” IN12.

These perceptions were stated by many authors and it can be characterised as the main axis in studies such as Puente, (2007); Tetard et al., (2009); Parker and Chao, (2007), and Albion (2012).

Based on the triangulation of the findings, students with the level of ‘good experience’ were verifiable in two ways: 1- by reviewing and discussing their responses to other questions in this study. 2- by evaluating the quantity and quality of their activities and contributions when using wiki pages. To illustrate 1, for example, student IN08 (who participated in the interviews) was given a new code QM08 (as a participant in the questionnaire multiple choices design). When asked about his knowledge about

wiki technology, his answer was positive and he selected at least one choice for each question. Moreover, his answers to questions 3, 4, 6, 8, from the questionnaire indicated that the student was quite familiar with wiki, and the answers did not include any negative responses. 2 can be seen by the participation of students using wiki pages. Appendix 26 shows a screenshot taken during the first participation of student IN08 from 'Group 1' using the wiki (added 78 words) which includes the appropriate text in terms of the font sizes and colours, adding numbers, using brackets and supporting his information by adding English concepts. All of these skills in dealing with the content gave an indication of student IN08 having a good perception of the wiki.

Regarding the second sub-theme 'limited experience', the limitation of students' experience means that students' knowledge of wikis does not meet the main requirements to use wikis competently (Deters et al., 2010; and Chen, 2008). Table 5.4 shows that the percentage of students found with 'good experience' and 'limited experience' was equal. The limitation of the experience of students is attributed to their level of knowledge of wikis in terms of the understanding of the feasibility of using the wiki to aid their learning. These attributes were collected from students' responses to the interview questions which can be summarised in two ways; the meaning of wiki and understanding some of its characteristics.

The data collected from the students reflected what some of them explicitly voiced the limitations of their experiences. For example: *I have limited experience in using wiki. I know it is a scientific encyclopaedia and there are several types of wiki across the Internet* (IN13). Others just stated the preliminary and basic information about wikis, an example of this is what IN06 stated: *Wiki is an electronic service characterised by participating in constructing the content*. Students' responses here were not sufficient to give such a judgement on their level of knowledge about wiki. Also, they do not provide a clear evidence of their ability to deal and use wiki pages. However, by reviewing the students' contributions to the wiki pages, the limitation of their experience of wikis was confirmed, especially when they used the wiki in the first week. The screenshot Appendix 27 shows the level of quality of the students' (IN13 and IN06) contributions to wiki pages. Their contributions were very simple in terms of, for example, typing, adding learning materials, saving the work in wiki pages. However, from the perspective of the researcher, this answer does not give an indication of students' ability to use wikis well in learning.

With respect to the third sub-theme ‘Lack (or No) Experience’, a minority of students (Table 5.4) described their experience of wikis as a lack of or no experience at all. Students’ responses reflected this. For example, student IN09 stated: *Unfortunately, I do not have enough experience of using wiki in learning because of the lack of applying wiki in learning among the universities.* Furthermore, the same perception was mentioned by student IN10: *I do not have enough experience in using wiki.* This result indicates that students at this level will not be able to use the wiki in their learning unless they are offered the necessary expertise of how to use wikis. Therefore, students should be provided with opportunities to practice and also appropriate training. Several studies strongly claim that training will be the optimal way for students to get this necessary experience and skills. That is consistent with the studies of Engstrom and Jewett (2005); Robertson (2008); Li (2012); Leung and Chu (2009) and Raman et al., (2005). The effectiveness of wikis in learning and teaching depends on careful planning and training of both students and teachers in order to familiarise them with this technology (Woo et al., 2011).

To make sure of the fact that these students lack any wiki experience, a ‘History page’ (Appendix 24) was developed to track the users’ contributions. This technique follows Andersen (2004, p 4) who stated that “the history page, which tracks the changes to the page and the authors that have contributed to it. Version tracking is a key feature of wikis, and one of the main ways to control the quality and evolution of wiki content”. Thus, reviewing the ‘history page’ revealed that, for example, student IN09 logged onto the wiki four times and student IN10 three times during the first week which means that the lack of experience hinders them to access the wiki compared to their peers. In addition, and most importantly, is that their ‘log on’ to the wiki records any contributions in the discussion page compared to other students in the wiki class. The information presented in Appendix 24 was extracted from the wiki history of group three recorded on Saturday, 13 March 2012.

Based on previous findings, it can be concluded that examining students’ previous experiences of wikis indicated that the arithmetic mean of the two levels (good and limited = 42.9%) revealed limited experience of wikis in terms of, how to use wiki pages, the main components of wikis and the functions of these components. A minority of students (n=2) suffered from a lack of experience of using wikis or had no experience at all. The implications of these findings are that the overall level of wiki experience of

the students is not sufficient enough for them to take advantage of all of its features and functions in their learning unless raises their level of experience and knowledge as educationally desirable. However, this does not mean that they are not capable of using wiki at all. Indeed, several studies such as Raman et al., (2005); Engstrom and Jewett (2005); Robertson (2008); Leung and Chu (2009); Al-Ghamdi (2010); Woo et al., (2011); Alzahrani and Woollard (2012), and Li (2012), have proposed ways to enable students to acquire knowledge and skills which enable them to use wikis. Thus training students in using wikis and involving them in continuous practice leads students to acquire the experience needed. This point is verified by the Coaching Association of Canada (CAoC) (2003 p, 43) which stressed that “when constant practice is used to learn a skill or task, the performance during the session is often be better compared to random practice”.

6.2.2 Emerging theme 2: Knowledge and information

Knowledge and information is the second theme that emerged from the data set collected from the students when they were asked about their previous experiences of wiki. The construction of knowledge is an active process, but the activity can be described in terms of individual cognition or in terms of social processes and can either be physical, mental or both (Phillips, 1995). This theme contained three sub-categories: searching, resources and exchanging.

Regarding the first subcategory, students used the term ‘*Searching*’ to express their ability to find the information from different sources. The data showed that students’ perceptions were positive in terms of using wikis as tools to search for information. The students’ responses revealed three factors behind their positive perceptions of wikis. These factors are as follows: 1- Wiki encourages them to use the Internet and other sources to obtain the information that they want. 2-Using the Internet will develop their e-learning skills. 3- Searching for the information by themselves requires a mental effort to obtain the information which allows them to remember this information for a long period of time. These results are consistent with different studies, namely Bartlett and Miller (2011); Sheina (2009); Davies (2004); Cain (2007), and Moeller, (1996). It is clear that the process of searching for the information and knowledge requires using multiple sources (Sridevi and Reddy, 2013). One of these sources is the Internet; thus, students believed that using wikis could encourage them to

use the Internet and other sources to obtain information, build their knowledge base and increase their understanding of a subject. The data also revealed that there was strong interdependence and agreement between students' views about the use of wikis as search tools and sources of information.

Regarding the second sub-theme, '*Resources*', students mostly agreed that the wiki can be considered as a reference to find information through its multiple wiki pages (Home page, Discussion page and History page). An example of this is what student IN07 and student EC08 respectively stated:

"In my opinion I think wiki has one of the greatest characteristics which may help the user to find information constantly and smoothly, that is, a speedy resource for the information" IN07.

"Wiki is a new technology consisting of four or sometimes five pages and students use these pages to exchange information through the Internet...I would describe a wiki as an information bank based on students' contributions and the information students collected during the semester" EC08.

Students' perceptions were in near total agreement regarding wiki content being an information resource. The literature revealed that wikis can be a good source of information according to the quality of the content (Richardson et al., 2011). Thus, the content of any wiki is usually built through the users' contributions and due to the multiplicity and diversity of the level of users' information, the content becomes a potentially useful resource. The study of Hughes and Narayan (2009) confirmed that wiki content is considered a good learning resource for students. This is also consistent with the studies of Cubric (2007) which agreed with that wiki is a good source of information especially with difficult topics.

The results of the two sub-themes '*searching*' and '*resources*' showed that students agreed in their perceptions of wikis as positive learning tools. thus, discuss these results with the results of students perceptions of the third sub-theme '*exchanging*' will give the overall perceptions of the main theme of '*Knowledge and Information*'.

With respect to the third sub-theme '*Exchanging*', exchanging information, ideas, experiences, knowledge and learning materials (i.e., content of wiki) was expressed by students as an effective method of learning. Students considered that the process of

exchanging information was a way to put them in an active learning environment. The most interesting point noted in the students' responses is that they believed the exchange process breaks their sense of routine, monotony and boredom. This view was supported by the response of student IN 10.

“Learning by wiki is a good idea to better facilitate the exchange of ideas among students and to break the monotony”.

Several studies in the literature have stated the effect of exchanging content on students learning. For example, Zorko (2009) stated that wikis help students to exchange information and ideas more easily. Leung and Chu (2009) used a wiki as a communication platform to exchange ideas and report progress between group members. Woo et al. (2011) found that both the students and their teacher perceived the exchange of comments through a wiki platform as beneficial to their collaboration and construction of their group writing. In contrast, these findings conflicts with the studies of Elgort et al. (2008) who found that students were good at posting information, but not so good at sharing information or exchanging ideas.

Overall, the majority of participants indicated a very high agreement concerning the feasibility of the wiki as a source of information, a way to encourage students to learn and as a platform to exchange multiple learning materials.

6.2.3 Emerging theme 3: Multiplicity of the wiki pages

The most frequent term that appeared in the students' responses was the multiplicity of the wiki pages. The views of the students about this theme were varied. The students believed that the wiki was a teaching technology that can use content, which they also regarded as attractive. However, they all mentioned the concept of multiplicity of pages positively (a positive perception). The possible explanation for this might be that they perceived the wiki pages to motivate and encourage them to learn more efficiently especially if the wiki pages were well organised with attractive content. This can be considered as an indication of having an accurate perception of the wiki as a teaching technique that is used to encourage and facilitate the learning process. This perception is a good indicator of the students' elementary knowledge of building the content of the wiki, or at least handling/influencing its content. In order to confirm these facts, the following sections will address the two sub-themes that emerged from the data.

It can be noted that all student responses were centred on their perceptions of ‘Motivating’ and ‘Encouraging’. These categories were very close in meaning as they appeared in student responses. The data revealed that the majority responses showed the desire by students to learn using wiki. On the other hand, a few of the responses did not seem to present a positive desire in terms of the multiplicity of wiki pages. An example of these responses:

“I do not know about the ability of wiki pages to motivate students to learning” (IN10).

This negative perception is because of their lack of previous experiences of wikis discussed in ‘Theme 1’. It seems that there were some elements that were directly influenced the degree of students’ perception of wiki pages. These elements centred on the inclusion of the main features of wiki, including wiki language (Section 5.4.3.2, Sub-theme 3: The language), and how to use wiki icons and the uploading learning materials. These perceptions are consistent with the study results of Benckendorff (2007), and Lund and Smordal (2006). Students’ responses revealed that the attractive design of the wiki pages is considered as the major motivation among students to use the wiki; furthermore, most of the students’ responses focused on the importance of this aspect as a catalyst to encourage them to interact with each other. This is similar to the results of the studies by (Rico et al., 2009; Cubric et al., 2008, and Su and Beaumont, 2010). In contrast, Hadjerrouit (2012) found that the lack of graphic elements, illustrations, and background colours made the wiki more attractive.

6.2.4 Emerging theme 4: Working within groups

One of the main features of wikis is that students work collaboratively in groups to create the page contents (Scarlett, 2009, and Wingersky, 1999). Thus, it is essential to have a group of users to build the wiki, who would seek information and enrich the wiki by continuously editing its content. Consequently, the final version of the wiki cannot be reached without the fruitful discussion between these users, be it in face-to-face meetings or through the available spaces on wiki pages (Tzanavari and Tsapatsoulis, 2010). The qualitative data collected about the ‘Working within groups’ theme revealed two sub-themes, ‘Interaction and discussion’ and ‘Information correction’. These two sub-themes were selected from students’ responses to identify their perceptions of the importance of working within groups in the wiki environment. The data revealed that

there were strong relationships and interdependence between students' activities, the interaction in wiki-class and the information correction. At the same time, the data showed that there were several factors affecting the success of the discussion among students. Students' responses attributed the success of discussions to several factors: an example of these factors stated by students IN04 and IN07 respectively:

“Participating in discussions helps me to understand biology if the discussion is controlled by the teacher or the leader of the group... Yes, if there is interaction among students and the discussion is organised”.

The data also emphasised the mental skills that are stimulated during the discussions, which are necessary for building and editing the content of wiki pages. Usually, in the wiki-class during the discussions between the students, that information will be repeated and probably explained in multiple ways by students themselves. Thus, this in itself will provide students with deep understanding and ability to memorise the topic. Chao and Lo (2011) emphasised that the discussions provide an opportunity to listen to peers' points of view. In line with the research literature (Hadjerrouit, 2012, and Li, 2012), confirm that the wiki helps promote discussion with other team members in order to understand the information relating to topics identified. Also there is evidence from the point view of students (IN13) about the impact of the discussion on students' understanding and memorising of the information:

“Yes, because it will help students to remember the information that they have prepared by themselves and they may spend time collecting the information from several sources”.

The most interesting point noted from students' opinions (e.g. IN09, EC14) is that their perceptions were not devoid of criticism of the traditional teaching techniques, (i.e., the data tried to clarify the role of the student in the traditional learning in comparison with a discussion-based learning environment). To illustrate this, in the former environment, the student is a relatively inactive recipient of information, whereas in the latter the student plays a dynamic role by sending, receiving, exchanging, and constructing the knowledge and information, thus making the learning environment more interactive. This view was supported by the responses by both student IN09 and student EC14 respectively:

“Discussion makes the position of the students more effective than just being recipients of information and knowledge”.

“Wiki helped me in learning and also motivate students to compete and break the routine represented in the traditional learning (Lecture)”.

In contrast, the data revealed that the effective discussions among students yield positive results on students' information. This fact can be confirmed through discussion of the second sub-theme, 'Information correction'. As described earlier in this section, the students agreed in their perceptions of the presence of a positive relationship between both the interaction between students and the information modification and correction. The data collected relating to this sub-theme revealed that students agreed that the interactions controlled and organised by the teacher helped students to obtain the correct information or to modify the incorrect information. This finding is consistent with the studies by Deters et al. (2010). The wiki fosters a collaborative scaffolding through which students help each other to re-organise the content and correct errors (Lee, 2010).

In order to clarify the previous results from the data collected, student IN11 stated, in his perception of the wiki, three main concepts closely linked to each other: working within a group, interaction among them and correction of information. He believed that the interaction among students ultimately leads to correcting any erroneous information. As he put it:

“In my perception, working with others in a group increases the interaction among the group members, which will lead to obtaining the correct information”.

Another worthwhile note observed in the students' responses was that not all of the discussions led to correct information. In other words, everyone has the right to edit the wiki content, thus, someone might add incorrect information to the content. This result is consistent with the study of Cowan et al. (2009) that adding incorrect information to the wiki content is considered the main issue causing anxiety and fear among the users. An example of this concern was taken from student IN06:

“One of the major benefits of wiki sites is the accuracy of articles because anybody can write, or change, its articles...In the same time, the amendment of the information by other users may be incorrect.”

This matter is of concern to several researchers, especially those who conduct their research with students. These concerns have been observed directly through the students' use of the wiki in similar study of the present research. Siddique (2013) found that students only add the simplest things or even incorrect information to wikis just to gain marks and do not bother to link their contribution to other useful matters that some other students have accomplished.

The implications of these findings have a direct impact on the quality and trustworthiness of wiki content. The findings suggest the importance of a student's contributions to constructing wiki pages needing to be monitored and reviewed by the teacher to avoid adding any incorrect information. The success of the interactions and discussions among students in a wiki class can be directly linked to the existence of the teacher, and his or her effective role in the class. Adding incorrect educational materials is sourced from the weakness of the students' learning and, therefore, this information may affect the learning of the rest of the group members in the classroom, these facts are consistent with the studies of Little (2010). In contrast, the studies by Hiltz (1998) and Arnold and Ducate (2006) found that students were not very satisfied with the process of group interaction and the quality of group discussion.

6.2.5 Emerging theme 5: Advantages and disadvantages

If anything offers advantages, then it has disadvantages too (Goswami, 2013). All the students in the surveyed sample responded positively to the questions regarding the advantages and disadvantages of using the wiki. The data showed that the students' perceptions of using the wiki varied according to their experience and knowledge of this technology.

In general, students' answers to the interview question "*What are the advantages of using wiki from your point of view?*" reflected the extent of their knowledge. The students' answers included many aspects relating to wikis such as the use of wiki as a learning tool, the role of the teacher in a wiki-led learning environment, the benefit from a non-traditional method of learning in which it presents a change in the routine and prevents boredom. These perceptions were examined and confirmed by Chao and Lo (2011), who emphasised that the online collaboration such as that in the wiki environment reduced students' anxiety, and the use of wikis provided students with a better collaborative writing experience than the experience they had in traditional

classroom. The students also mentioned what they perceived as negative aspects of using the wiki as a learning tool. The negative perceptions centred on the extent of the information credibility. Consequently, three sub-themes involving the advantages and disadvantages of wiki were identified as follows: *'Multiple benefits'*, *'Trusting the content'*, and *'Obstacles of use'*.

Overall, the students' responses about their perceptions of the wiki revealed that the advantages outweighed the disadvantages, which could be indicative of the students' willingness to use wikis in their learning. With respect to the multiplicity of benefits of wiki pages, the students considered the wiki to be the facilitator of the information and a catalyst to learning. Also, there is the ability to exchange information and knowledge; an example of the students' responses can be seen from four students' perceptions, as they stated:

"It is easy to search for the information through wiki pages and sharing the experiences and the ideas... Facilitates searching for the new learning materials... Encouraging me to search for the information and this task will help me to remember the biology information over a long time...Saving time and effort for both students and teachers. Wiki would give all students the freedom to participate in discussions and to express their opinions".

Regarding the second sub-theme 'Trusting the content' many studies considered that the creditability of the information was the basis of the success of wiki. This is consistent with the studies by Davies (2004); Adler et al., (2008); Landefeld and Sack (2009), and Lucassen and Schraagen (2010). In this regard, students expressed their fears of the wiki because of the ability to amend the content of wikis compared to other Web 2.0 applications; thus, the content can be described as non-credible (i.e., untrustworthy).

The interesting point found in students' responses is that there is a confirmation and support among those students' responses. This compatibility between students' responses can be seen by examining the data collected on the sub-theme *'lack or no experience'* and the data collected on the sub-theme *'Obstacles of use'*. In other words, the responses of students regarding 'obstacles of use' concentrated on two aspects as the main barriers impeding the use of wiki, which were the Internet and the equipment including computers. The same obstacles were noted when the students were asked to identify their level of previous experiences of wiki (Theme 1: Previous Experiences).

Students justified their lack of wiki experience due to Internet disconnection and the lack of computers at the university campus. The importance of the technical aspects including computers and the Internet was stated by Barajas and Frossard (2012). Hughes and Narayan (2009, p. 74) stated that “the study’s findings indicate that technical aspects of wiki technology may have a strong influence on the students’ perceptions of the wiki for learning and collaboration”.

In order for the students to benefit from the wiki, decision-makers and the officials must provide the fundamental requirements to use wiki, such as a reliable Internet service and a sufficient number of computers (Alzahrani and Woollard, 2012).

6.3 The stage during the use of the wiki (Knowledge about wiki technology)

The stage ‘during the use of the wiki’ is the second stage of the research implementation. This stage sought to collect quantitative data in order to add to the qualitative data that was collected previously. There were three different types of instruments used to collect the data in this part of this study ‘during the use of wiki’ (Section 5.4.2). The aim of this stage is to examine the ability to use the wiki in learning and its impact on students’ academic achievement through their responses to the following three aspects, which were selected later as pre-determined themes:

Pre-determined theme 1: Knowledge about wiki technology

Pre-determined theme 2: Biological knowledge and information

Pre-determined theme 3: Acquiring e-learning skills

The following sections discuss these three aspects respectively supported by the evidence from the literature and from the students’ responses.

6.3.1 Pre-determined Theme 1: Knowledge about wiki technology

In order to discuss the student results regarding their responses to the research question 2: *What is the extent of students’ knowledge about wiki technology?* The findings are categorised into seven themes called 'Emerging themes'. These emerging themes were extracted from the quantitative data after converting the numerical data into qualitative data 'qualitising the data'. These themes are:

Emerging theme 1: Learning materials

Emerging theme 2: Difficulties

Emerging theme 3: Contributions

Emerging theme 4: Interaction

Emerging theme 5: Communication

Emerging theme 6: General characteristics

Emerging theme 7: Gaining knowledge

6.3.1.1 Emerging theme 1: Learning materials

The frequency of selecting 'written materials' was generally high among the students compared to the other learning materials 'audio-visual materials 65% (e.g. movies)' and 'photos and graphics'. The results revealed that the written material had a significant impact on improving their knowledge. The majority of students (Table 5.7) believed that the written and readable information had a major impact on improving their knowledge of biology. This reflects that students tended to learn biology using wiki pages by typing and reading the information more than by showing or adding the other types of learning materials existing in wiki pages. This result is consistent with the study findings of Chao and Lo (2011), which found that most students preferred writing on wikis because they considered it to be more interesting and helpful. The findings also prove that students' familiarity with wikis is still confined to the use of texts in delivering their ideas and experiences.

6.3.1.2 Emerging theme 2: Difficulties

Regarding this theme, data in Section 5.4.2.1 (Emerging theme 2: Difficulties) suggests that students considered the Internet and the equipment to be the main obstacles that hinder the use of the wiki from their point of view. This perception of wikis was collected from students before using it. The frequency of students' responses relating to the difficulties that students faced during the use of the wiki revealed that the lack of computers in the classrooms and other university facilities was considered the main drawback when students wished to use wikis. The second difficulty facing students during the use of the wiki was the lack of a reliable Internet service, with 45% stating this compared to the first difficulty (computers) of 55%. Students were also given another choice as the third difficulty that they may face during the use of wiki and the frequency for this item choice 'searching of the information within wiki pages' was 0%.

These findings prove that students attributed the difficulties to the factors contributing to the use of wiki and not to the method of using wiki itself. Several studies in the literature such as Chao and Lo (2011); Cubric et al. (2008), and Davies (2004) agreed that the Internet and classroom equipment are important and necessary requirements to access wiki pages and to benefit from their content. The importance of having a sufficient number of computers in the classroom leads some authors to describe computers in learning as ‘Mediators’; this is stated by Lee (2010), and Li et al. (2010). The implications of these findings directly affect students’ learning; in other words, the extent of the benefits for students using wikis is directly proportional to the extent of the full technological preparation in the classroom.

6.3.1.3 Emerging theme 3: Contributions

Because students in most cases log on to wiki pages relating to the discussion and the content page, the frequency of students’ contributions to these pages is identified and discussed. Also, it is not enough to know which wiki pages students visited or which ones they added their contributions to; thus, the frequency of the students visiting these pages will support the findings in this regard. The data revealed that a similar number of students, 10 out of 20 (50%) visited both the discussion and the content page at least twice during the week. The same percentage of the students visited and posted on the discussion and the content page more than twice per week. This finding reflects the students’ ability to access wiki. The limitations in accessing the wiki caused students to log on to them on limited occasions (twice per week, or more than twice). Qualitative data shows an evidence of this, student EC03 stated, *“Although I tried to access the wiki from an Internet café and sometimes from my friend’s house.”*

The data also shows that there were no students who posted or visited any of these pages ‘daily’, the same frequency recorded for the students who ‘never’ visited or posted on any of these pages. The frequencies of the fourth choice in both Tables 5.9 and 5.10 show that no students ‘never contribute’ to any of the wiki pages; thus, this result is confirmed by the frequencies in Table 5.11. For further clarification, by looking at Table 5.11 it can be said that all the pages ‘Discussion page,’ ‘Content page’ and ‘History page’ are visited by students, in spite the difference in the number and frequency of visits. Mathematically, if the fourth choice in any of the two Tables 5.9 and 5.10 recorded any frequency, the total number in Table 5, 11 must be less than

twenty. This shows the credibility of the results in the three tables. Students' writing on wiki pages has been investigated by many studies, such as those by Zorko (2009); Kessler (2009); Lee (2010), Li et al. (2010); Chao and Lo (2011); Woo et al. (2011); Hadjerrouit (2012); Chu et al. (2012), and Wu and Hsu (2013). The findings of these studies revealed that students engage with the wiki environment through using the main pages 'Discussion page', 'Content page' and 'History page'. They felt that they were comfortable and it was more beneficial through using wiki technology compared to the face-to-face method that they had experienced.

6.3.1.4 Emerging theme 4: Interaction

The data collected on this theme showed the students' understanding of one of the main characteristics of wiki technology. In other words, the degree of students' interactions with peers in a wiki class gives an indication about their ability to use wikis in learning on one hand and the extent of benefits from each other on the other hand. By looking at Table 5.12 the majority of students found that 'the interaction had relatively good effect' the frequency of this item was 16 out of 20 with the percentage 80%. This was reflected in a number of qualitative responses in different parts of this study. For example:

"Wikis have had a positive effect on my biology learning in terms of my understanding of topics and increasing my academic achievement. This progress can be attributed to several causes, such as wikis' characteristics and the interaction between the teacher and students on one hand and among students in wiki classes on the other" (EC06).

The majority of students attributed their satisfaction with the interaction to the wiki software, which was easy to interact with and aided collaboration. This is consistent with the findings of Zorko (2009). In her study she found that, with regard to peer interaction, all the groups' respondents found the wiki extremely convenient for comparing their work with the work of other groups and learning from each other. Also, Wu and Hsu (2013) stated that students' comments revealed that a wiki is likely to be a useful platform to motivate them and to enhance interaction and communication for wiki writing activities.

The third item in the table revealed a small number (n=3) who thought that "the interaction with other team members had good effect on building their

knowledge”. The first item consisted of the data of one student who had a negative belief about the impact of the interaction with others on his knowledge. Reviewing the qualitative data revealed a number of responses expressing fears about the interaction between the group members, and the necessity of controlling the interaction. This view was supported by the responses by both student IN03 and student IN07 respectively:

“The interaction among students helps to understand the biology if the discussion is organised and controlled by the group leader or by the teacher”.

Overall, these findings give a clear indication of the students’ awareness of the importance of the interaction in the wiki class. This is in agreement with many studies, which emphasise the exigency of the interaction among students as a requirement to benefit from the wiki technology. For example, the interaction helps students to build new skills and knowledge (Hughes and Narayan, 2009) and leads to the development of writing skills (Chao and Lo, 2011). Interaction is therefore considered to be an important component for a successful learning experience and to improve students' motivation to learn (Chen, 2008). In contrast these findings conflicted with the study by Engstrom and Jewette (2005), which suggested that interactions among students are not necessarily happening when they use wikis.

6.3.1.5 Emerging theme 5: Communication

The communication theme is addressed by the seventh question in the multiple-choice questionnaire: *Which type of communication with the group members do you believe helped you to acquire knowledge?* This theme is to make a comparison between three types of student communication ‘face-to-face, synchronously and asynchronous’. The correlation between these three is ‘the impact of group members in knowledge acquisition’. The results in Table 5.13 indicate that the majority of responses (13 out of 20) showed that students tended to communicate with others face-to-face to acquire knowledge. While (20% n=4) preferred to communicate with others synchronously because this method allows them to deliver their messages at the same time. The same percentage to some extent (15% n=3) believed that asynchronous communication helped them to

communicate with the group members to acquire knowledge. This is consistent with the findings of Tetard et al. (2008) who found that the groups that communicated more actively achieved better results, both in terms of quantity and quality.

These findings are proved and confirmed by other data collected previously on students' experience of wiki (Section 5.4.1.1, Sub-theme 2: Limited), which showed the limitation of students' experience of wiki. For example, and for more clarity, the frequency of the third item in Table 5.13 'Face-to-face communications' means that students tend to use the traditional method in their communication, compared to the total of the frequencies for the other two items one and two (total n=7) which confirm the limitation of students' experience of wiki. Also these findings in general do not represent any concern about students' use of wikis in the future because the face-to-face communication is required among wiki users. These facts are in agreement with Mackey (2007) who argued that the use of wikis should be balanced with face-to-face activities. Thus, by using wiki technology alone, students did not necessary learn more effectively. In terms of the relationship between the wiki and face-to-face contact, Benckendorff (2007) found that the majority of the participants strongly agreed that the wiki reduced the need for face-to-face contact among the group members. The reason behind the students' preference for the 'face-to-face communications' is attributed to several factors according to Alzahrani and Woollard (2012). Students in this study used wikis for the first time in their academic life, which gave an indication of the limitation of their familiarity with wikis.

6.3.1.6 Emerging theme 6: General characteristics

The sixth theme reflects a number of important characteristics of wiki. In order to collect the data on various characteristics of wiki that helped students to gain knowledge, there were three items classified as important depending on the students' responses collected previously "*Students' perceptions of wiki*". The first and the second items (as shown in Table 5.14) are considered as the major aspects that helped students to gain knowledge regarding wiki, the percentage was 40% for the first item and the same percentage for the second item. The third item had a slight effect on students' knowledge about wiki; the percentage for this item was 20%. Evaluating the findings in Table 5.14 shows that the frequency of the first item 'The ease of using Wiki' was 8 out

of 20. This finding reflects that almost half of students found that wiki was easy to use; meaning that there are some factors that helped them to use wiki, such as their previous experiences of wiki. Thus, to make sure of the credibility of this result, Section 5.4.1.1, (Sub-theme 1: Good) illustrates that for most of the students, when asked (previously) to identify their level of the previous experiences of wikis, they replied that it was a 'good level'.

Regarding the second item 'Plurality pages of the wiki' (Main page, Content page, Discussion, and history page) Table 5.14 shows that the frequency of this item was eight; almost half the number of students. This finding means that half of the students believed that the multiplicity of wiki pages helped them to gain the knowledge about wiki. This finding can be linked with the findings discussed earlier in Section 6.3.1.3 (Emerging theme 3) the findings showed that all students contributed positively and identified one of the wiki pages which had an impact on their knowledge. Thus, in more detail, the participation of all students in selecting at least one page of the wiki reflects their increased knowledge in handling wiki pages. Consequently, the high frequency regarding the second item in Table 5.14 reflects that the students were familiar with wiki pages that were mentioned in this item (Main page, Content page, Discussion, and History page). Thus, the frequency gives an indication of students' knowledge of these pages that make up the overall system of the wiki.

With respect to the third item 'The ability to edit or entirely remove my own comments' the minority of students thought that their ability to deal with the function of modifying the content of wiki had an effect on gaining the knowledge about wiki technology. Although the frequency of this item was 4 (20%) it represents an advanced skill in using wiki. Also, this result, regardless of the low frequency number, nevertheless represents the practical side of using wiki compared to the first and the second item. In this regard, these findings are similar to other studies, such as Engstrom and Jewett (2005); Jones et al. (2006), and Song and Chan, (2008) who argued that students tend to use wiki because of the ease of use and the accessibility and flexibility.

6.3.1.7 Emerging theme 7: Gaining knowledge

The previous six themes sought to establish the extent of students' understanding of wikis through asking them direct and indirect questions relating to the wiki. Therefore, in order to avoid any loss of information in the data

collected through the previous themes, the present theme 'Gaining knowledge' was intended to compensate any lacking in the information collected previously. This theme in general concentrated on the practical application of the wiki rather than the theoretical understanding of it. In other words, the intention was to consider the students' knowledge about the wiki through the students' responses in terms of to what extent using the wiki helped them to understand the actual use of the wiki, how to use it in learning, and how to benefit from its functions.

As shown in Table 5.15 students were asked to select one of three items to determine the extent of the impact of the use of the wiki to gain knowledge about it. The data revealed that the majority responses (14 out of 20) indicated that using the wiki provided them with some knowledge of how to deal with the wiki. The minority of responses (2 out of 20) presented a belief that their use of the wiki had no effect on their knowledge about the wiki. The rest of the responses (4 out of 20) were more positive about the benefits of the wiki, since it has provided them with a good knowledge of the use of the wiki. The main point gained from these findings is recognising the need to understand the reasons behind the students' responses to the first item, 'The use of wiki had no effect' and the second item 'The use of wiki had a good effect'. Selecting these items because of the responses here was positive (i.e., the students responded regardless of the results being negative or positive). To illustrate this point, reviewing the literature as in the studies by Zorko (2009), and Elgort et al. (2008) identified that three aspects could have an effect on the students' use of wikis and then their subsequent increased knowledge about wiki: characteristics of the student, characteristics of peer to peer interaction and characteristics of student-teacher interaction. Lack of effective communication is considered one of the chief barriers to experiencing the use of, and benefits from, wikis (Naismith et al., 2011). It also has an impact on students' perception of the wiki (Hughes and Narayan, 2009). The number of group members can also have an effect on understanding and gaining knowledge (Foley and Chang, 2006). Also there are various factors that may indicate the reason behind the frequencies in the first and the second items mentioned above, such as factors relating the students' desire to use wiki in learning and factors relating to the students' experience of wiki.

6.3.2 Pre-determined theme 2: Biological knowledge and information

A total number of 31 students participated in the pre- and post-test. This part of the present study contains a pre-test and post-test prepared as achievement tests to measure the students' biological knowledge. Pre-test and post-test results of the students were entered into the SPSS (v20) in order to conduct statistical analyses. The research design of this study was limited with one sample examined before and after the use of the wiki.

The results of this study revealed that the students' achievements significantly improved after the use of the wiki in the first and the last three subjects (4, 5 and 6) including 'Plant Cell, Absorption, Plant Water and Enzymes', but there was no significant difference between before and after the use of the wiki in the second and the third subjects 'Solutions and Osmotic'. As is expected, the students tended to feel confident in their learning most of time during the period of using the wiki and were more positive than before. This result has been inferred by applying Salmon's (2006) five-stage model of e-learning provided a framework which met this result (Section 5.4.4).

This finding (scores after the use of the wiki) is considered to be an indicator of the positive outcomes of students' use of the wiki as a learning tool. The achievement test for each week during the use of the wiki shows that students' scores increased gradually for the majority during the six weeks period which means that the students gained biological knowledge more effectively than before the use of the wiki. The improvement in students' achievement can be seen clearly from the students' scores after the use of the wiki as shown in Appendix 18. This result is also attributed to students increased perceptions and attitudes toward wiki. This was reflected by the response of student EC06.

"Wikis have had a positive effect on my biology learning in terms of my understanding of topics and increasing my academic achievement. This progress can be attributed to several causes, such as wikis' characteristics and the interaction between the teacher and students on one hand and among students in wiki classes on the other".

In contrast, the scores of the minority of students (6 out of 31) before the use of wiki were higher than after the use of wiki. For example, student WT07 obtained 37

marks out of 60 marks after the use of wiki, but the same student obtained 41 out of 60 before the use of wiki. A similar result was observed with another five students. This observation reflects that the minority of students did not benefit from wiki as a learning tool. Several reasons are stated in the literature for the negative results of using wiki as happened with the six students in this study: Leung and Chu (2009) believed that the lack of understanding of how to use wiki is the main reason behind any negative results. There is clearly a lack in competence of individuals as wiki users (Deters et al., 2010) and a refusal to use wiki because the users have previously had a negative experience with it and due to a lack of adequate prior instruction about the best practices for using wikis (Puente, 2007). Negative feelings for the wiki system sometimes resulted from previous bad experiences or the lack of desire to work collaboratively (Karhu, 2011). Students' responses, moreover, reflect the negative results of the six students above. Students' attitudes, for example, revealed that there were two factors representing the obstacles to using the wiki - 'the Internet and training'. An example of these responses:

"I found some obstacles faced me during the use of wiki pages, due to being disconnected from the Internet or if the Internet speed was not adequate"
(EC02).

Reviewing the literature indicates a very close similarity between the study by Chen (2008) and the present study in terms of the duration (six weeks) and the tool used (wiki platform) and other aspects. The present findings are consistent with Chen's study; there was a significance difference in the test scores between the two groups in terms of students' achievements when comparing the week 1 to 6 test scores. Moreover, students felt comfortable in the wiki environment and it was easy for them to use. Also, these findings agreed with part of the study by Li et al. (2010) who applied a pre-test post-test design to discover the students' and teachers' attitudes and perceptions toward collaborative writing with wiki. The findings revealed that the correlation between students' writing attitudes in post-test were significantly related to wiki technology; the coefficients were significant at a $p < 0.05$ level. In contrast, these findings contradict the findings of studies undertaken by Neumann and Hood (2009), which called for the integration of the blended learning with the wiki class in order to benefit from wiki. Also the results from Cole (2009) found that the students' participation on wiki pages was very negative due to several reasons. These reasons ranged from academic pressure

from other courses to issues of self-confidence and finally a total lack of interest; thus, these factors had an effect on student achievement.

The implications of these findings conclude that it seemed that after the period of using wiki, the students' perceptions of their learning had significantly affected their achievement. On the other hand, the students' achievement levels after the period of using the wiki were significantly higher than before. This finding may be evidence of the positive effects of the wiki technology on students' achievements, which may also indicate the success of teaching by this technology in the future.

6.3.3 Pre-determined Theme 3: Acquiring e-learning skills

In order to discuss the student results regarding their responses to the research question 4: *To what extent do the students' acquire e-learning skills during construction of the biology content via wiki pages?* The findings are categorised into one 'Emerging theme' and four sub-themes. The main theme was 'Essential skills' and the sub-themes were the main four axes for this question as following:

6.3.3.1 Emerging theme 1: Essential skills

There is simplicity when dealing with wikis, where any users with access can collaborate and edit the wiki site directly using a simplified mark-up language. However, users must be proficient in some essential skills (Emerging themes). In this regard, these skills according to the data collected from 27 students who participated in this part of this study were identified as the main axes (Sub-themes). These axes are wiki skills, collaborative learning skills, communication skills and searching skills. In order to evaluate students' acquisition of e-learning skills, each one of the questionnaire axes will be discussed separately as follows:

First axis: Sub-theme 1. Wiki skills

Quantitative results from the responses of the first axis of the questionnaire revealed that most students (as expected) identified themselves as strongly benefiting from wiki during the course on acquiring e-learning skills. In other words, the agreement of the majority of students with all items of the first axis considered as a good indicator of students' acquiring of e-learning skills. To return to Table 5.18, it was shown that the average of students' responses for the first axis was 3.685 out of 5, with

5 being “strongly agree”. This provides grounds to say that the students agree on average with the wiki skills they were expected to acquire. This was also echoed in the students’ answers to the fifth research question. Student EC07 stated:

“I believe that wiki technology can be considered as an educational tool that can provide students with a better learning environment, and it can help us in acquiring e-learning skills while searching for biological information”.

This is quite consistent with what was found in the study of Chen (2008), and Su and Beaumont (2010) and with the study of LaFrance and Calhoun (2012) in terms of the benefit gained from Wikipedia as a learning tool. Robertson (2008) stated that ability to access and the ease of use was consistent with the first and fourth item of the present axis. Also, these findings agreed with the conclusions of the study of Deters et al. (2010) in terms of the degree of the participants’ agreements with the wiki as a learning and teaching tool, and also the previous study of Robertson (2008) in terms of the ease of use of the technology/wiki.

Second axis: Sub-theme 2. Collaborative learning skills

The second axis of the questionnaire consisted of nine items. This axis aimed to identify the degree of students’ agreement with its items on how to acquire collaborative learning skills. The overall average of this axis was the highest among the other three axes at 4.161, which means that students had a positive understanding of the collaborative learning methods. This agreement among students’ responses indicates the degree of acquiring one of the e-learning skills, and meets one of the most important skills among the users’ collaborative learning skills. The justification behind students’ higher agreement rates on this axis can be attributed to their desire to learn collaboratively. Much qualitative data underpins and agrees with this result. For example, this finding was reflected in a number of students’ responses:

“In terms of collaborative learning, I found that wiki pages helped me to construct the content of biology through other people’s contribution...one of the defining characteristics of wiki in my opinion is that they create a “spirit of collaboration” among students...using wiki encouraged me to work collaboratively...collaborative learning and working within group is

important to understand the lesson in depth and it could entrench the information" Students IN03, EC02, EC03 and EC04 respectively.

Also, this is an explicit reflection of students' responses collected from both students IN05 and IN06, supports the findings above and shows the degree of interdependence among the three concepts of e-learning, wiki, and collaboration:

"Yes, because recently the higher education in Saudi Arabia has demanded the use of e-learning in all universities through both synchronous and asynchronous learning. For this reason I think wiki will be a good opportunity to meet the higher education requirements and will also help me to acquire e-learning skills at the same time".

"If the students want to learn with wiki technology that means they will access wiki content electronically through using computers, the Internet and then searching on websites, which helps them to acquire e-learning skills".

There is evidence from students' contributions to the wiki pages indicating the students' ability to work together in creating the wiki content, as shown in the screenshot shown in Appendix 25.

According to the literature reviewed, strong evidence was found that was consistent with these findings. Naismith et al. (2011) found that 30 out of 40 students agreed that they had learned more collaboratively in wiki class than on their own. This agreement on learning collaboratively shows the acquisition of e-learning skills as one of the main skills among wiki users. Also, in the study of Al-Mohia (2008), it is seen that the collaborative writing on wiki pages leads to development of e-learning skills amongst students. Wheeler and Wheeler (2009) found that wiki users want to improve their writing on wiki pages because of the fear of criticism from others, which is a process that helps them practically to acquiring the skills that are required to use wiki well.

In contrast, the negative engagement of the participants to work collaboratively may lead to negative results regarding the use of wiki and then these results also will reflect on students' acquisition of e-learning skills. In this regard, several studies confirmed that students preferred to undertake individual work over collaboration using wiki. Carr et al. (2007) concluded that some students are reluctant to use wiki or do online course work. Elgort et al. (2008) indicated that a significant number of students

thought that they could have done the task better on their own without collaborating with others. As a result, this tendency toward individual learning may weaken the acquisition of online collaborative skills.

Third axis: Sub-theme 3. Communication skills

The positive agreement with the items of this axis gives an indication on how communication skills are acquired in relation to the use of wiki. Based on this, the data collected about communication skills revealed that, within seven items that consisted of the third axis of the questionnaire, the average students' responses had the lowest average among the other three axes (2.974 compared to the average of the second axis at 4.161). In general, this result indicates the third choice from the Likert scale of 'Neither Agree nor Disagree'. Descriptively, this means that the majority of the students did not have enough skill, experience and knowledge to decide whether the use of multiple channels of communications will help them in using wiki to learn biology or not. The online communications among students was considered weak, thus, students seem to be uninterested in communicating with each other electronically. This result can be supported through the quantitative data collected by 'questionnaire multiple choice question' for the research question two: *What is the extent of students' knowledge about wiki technology?* sub-question 7 from the questionnaire (please see Appendix 5), the majority of students (13 out of 20) selected 'face to face communication' as the most suitable type of communication with group members compared to 'synchronous and asynchronous' communications as a form of e-communication. In other words, students' tendency to communicate face to face confirms their desire to use traditional communication methods.

For more clarification, in the case of students at ABU (Al-Baha University), the study conducted by Alzahrani and Woollard (2012) revealed that students had used wiki for first time in their academic life, and their experience was very weak and limited in some aspects (i.e., their ability to use the wiki was limited). Thus, students' ability to use communications channels became very limited. This problem can be solved through the use of wiki training programmes and by applying wiki technology in teaching in various colleges at the university.

Reviewing the literature reveals that the findings of Cubric et al. (2008) are inconsistent with the current results, since she found that students used wikis as a

communication channel and a good way of communicating with the whole team. To some extent a similar result was found in the study of Wu and Hsu (2013), whose findings indicated that wikis provided students with opportunities to communicate with each other and improve their language proficiencies. The previous results were positive due to the familiarity of students with wikis, thus, the experience and skills that they learned helped them to build a positive perspective of the wiki and allowed them to benefit from it as a communication channel. Zorko (2009) agrees to with the present results in terms of students' preference with communicating face-to-face. Three students indicated that they did not use the wiki environment for communication with the group members, as these communications were instead face to face.

Due to the importance of the electronic communication between students, whether it is synchronous or asynchronous, the implication of these findings is that the benefit from wiki as a learning tool will be very limited. As such, students operating at this level of communication skill will face some difficulties when following their teachers and peers during wiki use in learning.

Fourth axis: Sub-theme 4. Searching skills

Constructing the content of a wiki is based on the information that is collected by students. This information is usually collected from various sources, thus, to construct good content students must search for information from multiple and trustworthy sources. The fourth axis in the Likert scale questionnaire aimed to find out whether the students have the essential skills to search for information. The quantitative data revealed that the average of 27 responses was 3.833 for the six items in this axis. These items concentrated on discovering the extent of students' acquisition of searching skills. The result confirmed that students have the ability to searching for information relating to biology from various sources. Their participation on the wiki pages showed that the learning materials added to wiki pages included indications of their searching skills.

The students built their answers in the light of using the wiki during the period of applying it to their study. In general, almost half of the students had scores of nearly four. This range according to the Likert classification matched the 'agree' level in terms of acquiring searching skills. These skills can be confirmed by evaluating the students' contribution to wiki pages. By looking at some examples, the screenshot taken (Appendix 28) includes three instances of evidence supporting students' acquisition of

‘searching skills’. This evidence shows the quality, quantity and multiplicity of the information sources. In this regard, the qualitative data collected from students’ answers to research question one clarify and are consistent with the findings mentioned above:

“Yes, using wiki will develop my ability to search for the information and learn about the ways of changing the colour and the size of the font”
(IN12).

This was also echoed in the students (IN13) responses, which reflects the importance of acquiring searching skills to students’ learning (IN13):

“Using wiki will encourage me to search for the information and the new learning materials; this task will help me to remember the biology information for a long time”.

These findings are in line with the study of Turusheva and Turusheva (2006), which stresses the necessity of web-searching skills among students. It is important for students to acquire skills such as working independently and searching for information. Loan (2011) revealed that students face various problems while searching online. One of these problems was searching skills, with a percentage of 23.84%. Moskina (2013) found that students were optimistic about their information searching skills. 50% of the respondents evaluated their information searching skills as good. The disparity among the findings of previous studies emphasises the importance of educating students on how to find the information through developing their searching skills.

6.4 The stage after the use of wiki (the attitudes towards wiki)

The data that was collected regarding students’ attitudes towards wiki represents how the students perceived the wiki after actually using it during their classroom sessions. The focus of the data is on how much the students thought that the wiki was a suitable learning approach and to then note any advantages or shortcomings that they noticed.

The duration of the study was six weeks. They had to learn how to use the wiki and then overcome any obstacles that they might face. Thus, it was expected that their response to the survey question would accurately reflect their attitudes towards the wiki after they were allowed enough time to use it in their learning. During the six-week

period of the study, the students used the wiki to learn six biology units. Their responses about their attitudes towards using the wiki as a learning tool were varied. The variation in the response of the students can be traced back to the variation in their previous knowledge of the wiki and other factors.

One of the methods of gauging the attitude of the students towards using the wiki in learning is to compare the results with their previous perceptions. As mentioned at the beginning of this chapter, data about the students' perceptions was collected during the first week of the study before they started using the wiki. This comparison would offer twofold benefits, which would then support the current study: this allows us to learn about the accuracy of the students' perceptions of the wiki and their acceptance of using it as a learning tool by gauging their attitudes.

In order to discuss the students' results regarding their responses to the research question (*What are students' attitudes toward using wiki technology?*), the findings were categorised into two main 'Emerging themes':

Emerging theme 1: Positive attitudes with subthemes of:

Sub-theme 1: Educational characteristics

Sub-theme 2: Impact on learners

Emerging theme 2: Negative attitudes with subthemes of:

Sub-theme 1: The Internet

Sub-theme 2: Experience and training

Sub-theme 3: The language

6.4.1 Emerging theme 1: Positive attitudes

The majority of responses, nearly 90% of the surveyed students, expressed a positive attitude towards the wiki, particularly because of their satisfaction with its educational characteristics and its impact on their learning, which includes the ability to edit the content, add learning materials and delete or edit contributions. Moreover, the students attributed their positive attitudes due to the free exchange of information, knowledge and ideas. The students' positive attitudes were reflected in the response of student EC05:

“Another point I would mention is that wiki gives me the freedom to edit and to change other people’s contributions if I felt they were wrong, needed modifying or did not relate to the biology topic. From my point of view, I strongly support the idea of using wiki in learning”.

In order to discuss the positive attitudes in detail, two sub-themes should be addressed both separately and simultaneously. These sub-themes as identified in Chapter 5 (Section 5.4.3.1) are: ‘Sub-theme 1: Educational characteristics’ and ‘Sub-theme 2: Impact on learners’.

Sub-theme 1: Educational characteristics

Regarding the first sub-theme, educational characteristics, all of the students (n=14) expressed their positive attitudes towards wiki. Students stated several positive characteristics of wiki as a result of their practical experience with them during the research period (six weeks). Evaluating the data in this regard (for this sub-theme) emphasises the positive attitudes towards wiki in two respects: first, the participation of all students in the survey, and second, the richness of the information that they mentioned. For the second part, students’ responses included the educational characteristics of wiki that they believed it was very important for them to learn. There is evidence from students’ responses supporting the importance of the educational characteristics of wiki such as the response that was collected from student IN06:

“... It will be a good opportunity to exchange experiences and information”.

And the response of student IN07:

“Wiki will allow us to search, understand, remember and discuss the information with my group members in the classroom...promoting searching and discovering of information”.

Also, from the quantitative data there is evidence that shows the desire of students to use wiki in their learning, which can be considered as the basis of the positive attitudes towards wiki. For example, the results of students in the weekly tests (Appendix 18, and Table 5.16) revealed that the marks of the majority of students after the use of wiki were higher than before they used it. In the context of the wiki characteristics in education in particular, student EC06 voiced his beliefs:

“I like using wiki in learning because I can go back to the wiki pages when I want to read or compare with previous information through using the “History” page. Moreover, I found this page to be very important for students and wiki users because it is a useful information store”.

The positive attitudes also reflected the students’ participation levels on the wiki pages. For example, student EC03 stated:

“In my use of wiki while learning biology I can enumerate the benefits as follows: I found them easy to use and to deal with. They are a good method to share educational materials related to the biology topics with other students, such as pictures, videos clips and text”.

The screenshot from the wiki site shows the student EC03’s contribution on the content page. This includes adding learning materials in a professional manner.

Reviewing the literature reveals that several studies are consistent with the present findings regarding students’ positive attitudes in terms of the wikis’ educational characteristics. Benckendorff (2007) found that the results indicate that most students perceived wiki to be a flexible, convenient and fair pedagogical technique for learning. The findings of the study conducted by Deters et al. (2010) agreed with the present findings, concluding that the majority of students felt that the wiki was a useful tool for teaching and learning. Only 4 out of 37 respondents disagreed that the wiki was a useful learning tool and no respondents indicated strong disagreement with the statement. Students felt even more strongly that wiki facilitated group learning and fostered experiential learning. Elgort et al. (2008) found that students found wiki useful for arranging information and sharing knowledge. Most students (88%) thought that the group assignment provided them with a valuable learning experience. 94% of students agreed or strongly agreed that this assignment provided them with a valuable learning experience, with only one person strongly disagreeing.

Sub-theme 2: Impact on learners

The data revealed that, in their responses, the students focused on five aspects directly related to their learning: academic achievement, collaborative learning, acquiring learning skills, knowledge building and finally memorising the information. Fourteen students expressed their attitudes, especially regarding its impact on their

learning through the five aforementioned aspects. The data revealed that students believed that the skill of finding the information from various Internet sites, in itself, helped them to memorise the information, which was because of the personal effort that they originally exerted in finding the information. At the same time, some students stated that the search for information enriches the wiki pages with more learning material, which aids the learning of all wiki users. For example, student EC06 stressed that using the wiki helped his academic achievement; this is mainly due to the interactive nature of the learning process between the students and their teacher and among the students themselves on one hand and as a result of the benefit from the wiki components on the other.

“Wikis have had a positive effect on my biology learning in terms of my understanding of topics and increasing my academic achievement. This progress can be attributed to several causes, such as wikis’ characteristics and the interaction between the teacher and students on one hand and among students in wiki classes on the other”.

The positive attitudes towards the wiki in terms of its impact on learners have been examined in previous literature. Several studies dealt with the five aspects that are mentioned above: academic achievement, collaborative learning, acquiring learning skills, knowledge building and memorising the information. Johnson and Johnson (1994) conducted research on learning with wikis based on 875 case studies, showing that collaborative learning leads to better results, higher achievement and greater productivity than working alone. In the studies of Barkley et al. (2005); Alavi (1994), and Hughes and Narayan (2009) the findings demonstrate that collaboration via wikis promotes and improves learning and is an important factor in academic achievement. From these results it can be seen that collaborative learning has been associated with higher academic achievement and more positive attitudes towards the processes of learning. The other positive attitude found related to building the students’ knowledge, as in the study of the Lyndsay (2006), which found that wikis help groups to come together to share and create new knowledge. Also, the present findings agreed with the findings of O’Shea et al. (2007), who found that students believed that using wiki drew a significant improvement over traditional textbooks. Nearly 55% percent of

students either agreed or strongly agreed that their higher-level learning skills were developed more through the Wikitext process than through their interactions with traditional textbooks.

6.4.2 Emerging theme 2: Negative attitudes

After examining the data that was collected regarding the negative attitudes towards the wiki, it was noticed that the negative attitude could not be attributed to the wiki itself except ‘the language’, but rather the secondary requirements. In other words, most of the negative responses about using the wiki did not mention the negativity of the wiki (i.e., its core structure, its suitability or the role and the functions of its pages). The negativity was consistently caused by three factors classified as the sub-themes. This, in order to discuss the negative attitudes in detail, these three sub-themes should be addressed separately and simultaneously.

Sub-theme 1: The Internet

Sub-theme 2: Experience and training

Sub-theme 3: The language

Sub-theme 1: The Internet

Regarding the first sub-theme ‘The Internet’ in particular, the students identified the Internet as one of the main factors that caused them to have a negative attitude towards using the wiki in learning, although the level of negativity varied in the responses. Some students attributed this to the lack of Internet access inside or outside the campus and to Internet outages. These factors are represented by selected comments made by the students. For example the student EC03:

“Unfortunately, I had negative attitudes towards using wiki in learning due to the lack of Internet in my house. Although I tried to access the wiki from an Internet café and sometimes from my friend’s house the difficulties I had using wiki in the university made them not so useful to me”.

This finding agreed with the students’ responses to the second research question (supporting the quantitative data): *What is the extent of students’ knowledge about wiki technology?* It seems that the obstacles of using wiki caused these negative attitudes among some students though the others had tried to overcome these obstacles. So, for more clarification, the results to RQ2 revealed that 45% of the students found that the

obstacles facing them during the use of wiki pages was due to disconnection from the Internet or inadequate Internet speed. Also from the students' experience of the wiki and from the data collected previously before the use of the wiki, the student IN05 considered that the urgent need for the Internet is one of the disadvantages of using the wiki, which was also observed by Karhu (2011), and Mohammed (2010). Consequence, this response represents a prior negative perception of the wiki in relation to the Internet. This obstacle was found in the study of Cubric et al. (2008). He stated that despite the ease of use of wiki that students had difficulties with remote access and the speed of Internet connections. The implications of the Internet's deficiencies were stated by Wu and Hsu (2013), who observed that a minority of students (5 out of 35) complained that Internet access issues or the use of computers was the cause of their late posting on wiki. All of the previous findings were the main reason behind the students' negative attitudes towards wiki technology.

Sub-theme 2: Experience and training

This issue concerns the lack of experience and the shortage of training. These two elements were observed during some of the students' activities when they used wiki. Due to the experience that can be obtained through a training process and practice, the following discussion will concentrate on the importance of students' training. The data revealed that students' responses focused on the need and the importance of educating the students through providing them with suitable training programmes in terms of how to use wikis in education, how to benefit from its components and functions and finally how to be in line with peers and teachers during its use in a session. The confirmation of this finding came by Li (2012), who stressed that wiki technology training is necessary for students to make better use of its features. Also, these requirements are important and essential for wiki users. This was reflected in a number of students' responses, which stressed the extent of the impact that both training and the experience had the positive use of the wiki. For example:

“To be honest, and because it was the first time I had used wiki in my learning, I found them to be of little benefit at the beginning. The reason behind that in my opinion is that training students is an urgent need if wiki is to be a successful educational method” (EC04).

"To benefit from wiki technology students must be educated on this technology" (EC01).

These negative attitudes were due to the lack of wiki experience among the minority of students (14%3). This result was expected and not surprising because of the pre-existing indicators represented by the students' perceptions of wikis (Section 5.4.1.1, Sub-theme 2: Limited). In other words, the overall frequencies of the students' prior experience of wikis were limited.

The implications of these findings emphasises the importance of focusing on the urgent need to educate students to use the wiki. The literature indicates that having enough information leads to effective use of the wiki as a learning tool and avoids problems that may happen during the addition of learning material. This will help both students and teachers to benefit from wikis. The study of Cubric et al. (2008) discovered that students found using a wiki confusing to understand; they also found it difficult, initially, to upload material and requested more training. The importance of training wiki users was investigated by Mohammed (2010), who found that the results of the trained experimental group led to achievement of a significant improvement in their writing performance on the post-test compared to the pre-test (Writing Performance Test). This significant result is due to the training programmes based on using wiki that the experimental group had received. Although some wikis are easy to understand and use, it is still important to have initial training sessions to allow people to become familiar with this technology (Barajas and Frossard, 2012). Raman et al. (2005) also stated that wikis cannot be used successfully without proper prior training. Another agreement with the present findings in Chu's study (2010, p. 194) found that "the effectiveness of wiki application in learning and teaching depends on careful planning and training of both students and instructors in order to familiarise them with the technology".

In future wiki studies, it is recommended that students be provided with training sessions before they are asked to start using it. Wikis are different from traditional word processors, as students have to follow a certain syntax and format when editing the contents.

Sub-theme 3: The language

As described in Chapter 1, students learn biology in the Arabic language. Moreover, they used the wiki as a learning tool, as it is provided in English. Some of the students faced difficulties in dealing with the wiki, due to poor English language skills. In particular, the wiki pages and icons used in the present study were designed in English i.e. a wiki with different language versions. In this regard, students EC12 and EC13 attributed their negative attitude towards using the wiki, as it is not supported by the Arabic language. These attitudes have been reflected and supported previously from the students' previous experiences of wiki. For example, student IN04 explained his view by stating:

“I think the difficulty of dealing with wiki can be seen in terms of the language, because some wikis are not supported by Arabic. Also the users of wiki need to have at least the basic skills in using computers”.

Similar problems have been found amongst wiki users in the literature (Chao and Lo 2011; Monz, et al., 2011). The implications of these findings directly affect students' learning, in terms of using wiki properly. Therefore, to solve this problem there is an urgent need to either design an Arabic version of wiki or to translate the English terms and icons and then copy the design as an Arabic wiki interface.

6.5 Summary

This chapter has discussed the results of a study sample and compared it with the findings of previous studies that have been conducted in the field of e-learning specifically with regard to wiki applications. This discussion was carried out following a thematic structure that discussed each theme separately. The present findings agreed with many findings of previous studies. Moreover, a few studies were inconsistent in their findings with the present findings due to the circumstances surrounding these studies, e.g. the sample culture, the equipment and facilities used etc. Findings of the previous studies came to prove and confirm the results of this study in regard to both the quantitative and qualitative data that was collected. The findings concentrated on five aspects relating to wiki technology as a learning tool, and the impact of using this technology among the students. These aspects were students' perceptions and attitudes towards wiki, achieving biological knowledge, acquiring e-learning skills and

understanding wiki in several educational aspects. The overall findings were positive in terms of the possibility of using wiki in learning with the importance of considering the negative aspects that have been mentioned during the discussion of the findings.

6.6 Conclusion and recommendations

This research has investigated the impact of using wiki technology on learning among a number of students at Al-Baha University. Its findings may reflect a general picture of the e-learning environment at this university in particular and other universities in Saudi Arabia in general, especially the emergent universities. The study addresses this technology and how it can enhance university students' experience of learning biology. The study also tried to achieve this aim through identifying the impact of using wiki technology as a tool for teaching and learning to improve conditions and learning opportunities among Saudi universities and also takes into account the desire to provide evidence that can help to implement change.

Collaborative learning and constructivist theory was applied in this study in relation to the learning environment for the participants and used the wiki platform as a learning tool. The selection of these two elements among other learning styles and theories came into being because of their suitability, as recommended by the previous literature studies. Before, during and after the use of wiki in learning there were several issues that had been observed, both negative and positive.

By analysing the research findings it can be concluded that, with regard to the students' previous experiences about wikis, the students' experiences revolved around three levels of experience as described in Chapter 5. It is clear that students have a deep understanding and good experience of wikis in terms of accessing the wiki pages, using the components, treating the content and giving examples of wiki. The limitation of students' experience of wikis was identified through their limited ability to deal with the content in terms of modifying other contributions and through knowing the meaning of this technology. A lack of students' experience of using wikis appeared in just two responses; this may be attributed to having not used the wiki before. Students considered that shortage or the lack of the basic requirements of the use of wiki as disadvantages. Three factors can be considered as the main obstacles to the use of wiki:

re-configuration of the class rooms, lack of equipment and Internet outage or unavailability of this service.

These experiences reflected on their ability to search on the information via the Internet and other sources. Students agree that wiki helps them to develop their search skills. Additionally, it assists them in remembering the information and highly motivates them to use the Internet. The data also revealed that there was consensus from all students about the way that the wiki could be used to store the information and then allowed them to find the information smoothly. Another finding collected from students was that by exchanging information through using wiki pages students believed that the wiki motivated students to learn more effectively. The presence of students in groups in the wiki classes was the main factor encouraging them to exchange learning materials and to benefit from others' contributions.

A characteristic of the wiki among Web 2.0 is that it contains several pages, a feature which was described by students as encouraging them to obtain biological knowledge. The students also considered the multiplicity of wiki pages and its content, as well as the technologically advanced feature of this tool as motivational factors to use the wiki as a learning tool. Several benefits and requirements were noted in the students' responses in this regard, remembering the information and fixing it in the students' mind was repeated in their answers. Controlling the group members and managing the discussion were considered essential.

There was agreement among the majority of the students on the role of discussions through the wiki pages or face-to-face in terms of correcting others' information or adding new information and knowledge, and it can be noted that students' responses enriched this part from the data about the impact of the discussion in the wiki class on their learning.

The students described the advantages of wiki technology and their effect on their learning. These advantages can be summarised as follows: promoting students to learn more effectively, creating self-confidence, acquiring learning skills and new knowledge, sharing the experiences and the ideas, searching for the learning materials and helping teachers and students to save time and effort. This gives students the freedom to deal

with the page content and, finally, encourages them to self-learn. The basis of building wiki content revolves around the validity of the information. However, students in their responses concentrated their fears on the construction of weak or untrustworthy content due to incorrect information being added by students themselves or other anonymous users.

The educational characteristics of wiki were varied among students' attitudes towards this technology. They attributed their positive attitudes to having wiki, the ability to store the information in its pages even though the users deleted or emended this information. Moreover, students considered wiki a catalyst to search for the information on the Internet. Also, there is the flexibility to move within the wiki pages, which enables comparison between the learning materials. Finally, students found it very easy to add visual, audio and written materials. Students also identified the positive attitudes towards the impact of the wiki on their learning, namely: building knowledge, increasing academic achievement, creating a spirit of collaboration to construct the biology content, encouraging students to search for information from different sources and acquiring e-learning skills while using the computer and the Internet.

Also there were negative attitudes towards the wiki among students' responses. Some students attributed their negative attitudes to the unavailability of the Internet in the university classes or at home. Another reason behind the negative attitudes was the lack of knowing in terms of how to use wiki which was classified. The students' lack of experience and training led to an important issue 'time-management' while using wiki.

Overall, there is clear desire of students to use the wiki in learning shown in the findings from the current research, with taking into account the importance of overcoming the difficulties that have been discussed in the course of this conclusion. According to previous results, a number of recommendations emerged. The next section shows the main recommendations for higher education in the KSA and recommendations for future research.

6.6.1 Recommendations for higher education in the KSA

Based on the findings obtained in Chapter 5 and through the discussions of these findings in this chapter a number of recommendations can be made with regard to the future implementation of e-learning applications, especially wikis.

1- Recommendations relating to the results of the stage before the use of wikis. The findings in this stage showed that the students' previous experiences were limited in general (Section 5.4.1, Table 5.4). Therefore, to benefit from wikis or other Web 2.0 applications in the future, the students' experiences of these applications should be improved in general (i.e., be at the 'good' level at least). This goal can be achieved through providing the students with intensive training programmes before they use any of these applications in learning.

2- The students' perceptions of wikis were positive in general, and the findings give an indication of the ability to use wikis in learning. Thus, these perceptions revealed the urgent need for equipping classrooms and other university facilities (based on the findings in in Section 4.7.5 Fourth axis, and Section 5.4.1.5 Sub-theme 3). One of the most important issues is to provide a suitable number of computers and the Internet providers with high speed and high quality. Making the Internet available for students allows them to build their knowledge, which could increase and improve their performances and experiences. This was supported and recommended by the study of Alwan (2000) who emphasises the importance of providing Internet access at educational institutions in order to support teachers and students to expand their experience and skills.

3- In Section 5.4.1.4, the findings relating to the interaction among students revealed the need to provide an opportunity for students to understand the process of working within groups in order to benefit from each other. This can be achieved through allowing students to apply a collaborative learning structure.

4- Trusting the content of wikis was the main concern, which referred to the results of students' perceptions of wikis as in the findings in Section 5.4.1.5 (Sub-theme 2). As such, it is very important to create content that is characterised by reliability and credibility with supervision and monitoring by the teacher.

5- The recommendations emanated from the results of stages seen 'during the use of wiki'. Based on the findings in Section 5.4.2.1 Emerging theme 1, and Table 5.7, students focussed on use of the written materials on wiki pages with a little attention

paid to other kinds of learning materials. As a result, it is very important to educate and train students to use other learning materials (audio-visual materials, e.g. movies), especially when we know that visual materials make wiki pages more attractive. This recommendation was stressed by Abebe (2011), who stated that the use of visual materials makes the meaning of the words memorable and long lasting in students' minds.

6- The necessity of overcoming the difficulties such as the lack of the basic requirements to use wikis such as the Internet, computers and training programmes will help students to benefit from wikis. However, the findings contained in Sections 4.7.5, Fourth axis, and Section 6.4.2 revealed several obstacles that face students during the use of wikis. These obstacles should be perceived and then eliminated through appropriate budget allocation.

7- Students assessed their posts in wiki pages in its entirety as a 'sometimes' referring to the findings in Table 5.9, and Table 5.10. To encourage students to participate effectively, teachers and decision-makers in university governance should motivate students materially and morally through various methods of educational stimulation.

8- The quantitative findings in Section 6.3.2 evidenced the positive effect of using wikis on students' academic achievement. In the light of this result, other department (colleges, schools) should consider using wikis as a learning tool.

9- There are other quantitative findings in Section 5.4.2.1 'Emerging theme 5' that relate to encouraging students to use e-communications in order to facilitate contact (e.g. e-mail). Each student should have at least a university email address and this should be one of the requirements when they enrol.

10- Also there are recommendations following the wiki's use, which arose due to the evaluation of students' results after six weeks of using the wiki. 'The stage after the use of wiki' represents the students' attitudes towards wiki technology, and the findings of this stage (Section 5.4.3.1) were positive. As such, it is very important to continue encouraging students to use wikis to learn biology and in other academic curricula.

11- Because of the students studying in the Arabic language, the findings in Section 5.4.3.2 Sub-theme 3 showed that some students spend too long trying to use the English labels of the wiki icons and to contribute to the wiki pages. As a result, the workers in

the ICT, or other departments interested in programming at ABU, should try to translate these terms or design an Arabic wiki interface.

12- There is also a recommendation to those responsible for ABU to help students who do not have the ability to access the Internet from their houses-for any circumstances-by providing free Internet subscriptions. This recommendation came as a reflection of the findings in section 4.7.5 First axis, and Section 5.4.3.2 Sub-theme 1.

Based on the findings obtained from the present study, an important message can be formulated from these findings for the officials in the higher education sector. These findings lead us to identify the role and strategies of the teachers and the lecturers. The conclusion of the findings reveals that teaching and learning through the use of wiki technology as one of the Web 2.0 applications leads to positive results in most aspects of the educational process. Developing and enhancing the learning process through helping students to overcome the educational obstacles can be considered as the key role of the teachers and the lecturers. With respect to the use of the wiki in higher education, teachers must emphasise the urgent need to educate students to use the wiki as an example of the new technology in learning. The implications of these findings directly show that wikis can affect the progress of the students' learning and significantly affect their achievement. Due to the importance of the communication between students and teachers, the teachers should be encouraging students to communicate with the teachers and with each other electronically. Using and/or the help in establishing new e-learning tools (i.e. online courses) can be considered as part of the teachers' roles. These courses in the field of e-learning emerged to serve the educational process such as massive open online courses (MOOCs). MOOCs use Web-based tools and environments-referred to as platforms-to deliver education and classes in a new paradigm without regard for geographic boundaries and time zones and to much larger audiences-in fact, tens of thousands of students (Powell and Yuan, 2013). MOOC aimed at large-scale interactive student participation and open access via the Internet. In addition to traditional course materials such as videos, readings and problem sets, MOOCs provide interactive user forums that help build a community for the students, professors, and teaching assistants (TAs) (Parr, 2013; and Daniel, 2012). MOOCs are a recent development in distance education. Other types of the online courses emerged such as; information and communication technologies (ICT), computer-based instruction (CBI), technology-enhanced learning (TEL), computer-assisted instruction

or computer-aided instruction (CAI), computer-based training (CBT), internet-based training (IBT), virtual learning environments (VLE) and as it called online education or virtual education, web-based training (WBT).

6.6.2 Recommendations for future research

1- The study was limited in terms of the duration ‘six weeks’, this period may have been too short for students to become comfortable interacting with each other in wiki classroom and to understand how to use wiki in learning. A longer period suggested may give better results, so the interactive process can be more deeply.

2- In the present study the students used the wiki technology to learn the biology curriculum, thus, applying similar studies to another curriculum may lead to different findings. Taking into account the suitability of the main issues and elements applied in the current study such as the learning theory and the learning environment when applying similar studies.

3- Conducting a similar study using a wiki application with another application of Web 2.0 such as blogs and forums, in order to compare the impact of these applications on students' biological knowledge. Thus, applying a study as such may provide evidence on which of these applications give a positive results better than the other on the learning process.

4- The wiki is a relatively new tool for learning purposes in ABU and the interface is still in English, as previously stated. The unfamiliarity of this new technology may influence users' willingness to use wikis. Having more time and experience with the new technology as well as translating the interface into Arabic may improve interaction. This recommendation may also benefit Arabic students who are using wikis in learning worldwide.

5- Similar studies could be conducted to examine the impact of wiki on different undergraduate levels, such as students on the first (year 1) or on the last academic level (year 4). The difference on students' academic levels gives different results due to the difference in the experiences of dealing with the Web 2.0 applications.

6- Reviewing the literature revealed that most of the previous studies concentrated on the collaborative writing process. However, the present study concentrated on five elements, including collaborative working. It may be better for further studies if there

was a focus on one of the elements addressed by the current study, such as acquiring e-learning skills.

6.7 Further work

The findings of this study revealed that there is a need of further research which can clarify the impact of the use wiki in learning among students and teachers in Saudi universities in different circumstances from the present study (i.e. different curricula, different academic levels and with female students). Additionally, the results of this study revealed the existence of a number of elements that have a negative effect on the use of the wiki (obstacles and barriers). Thus, there are needs to investigate the impact of wikis in learning in light of overcoming of these obstacles and barriers in ABU and with the same academic level of the students. Furthermore, it is necessary to educate the University's students about the concept of e-learning and its applications through training programmes and the workshops.

6.8 Limitations of this study

There are a number of limitations of this study. The research was conducted at one of the higher education institutions in the KSA; this institution 'ABU' is representative of all other similar institutions in the Ministry of Higher Education. The study sample was the male students from the second level of the science school at ABU. The researcher included only male students in the research sample because of the difficulty of involving the female students according to the policy of the education system in the KSA. This research was conducted in the second semester of the academic year 2012/2013 and the data was obtained during the study period. One drawback of this study that needs to be highlighted is the sample size. The number of students who participated in this study were (n=31). As in every study, these results form an image of the population. In order to acquire safer and more confident results, further studies have to be implemented, and of course, the sample size should include more than 31 respondents. Due to the small sample size, the results cannot be extrapolated widely to contexts that are unlike the instructional situations described here. As such, more research on wikis' instructional and learning possibilities is encouraged, which can help us to build a larger knowledge base. In future research, the researcher recommends

including a larger number of participants. Compared to traditional learning styles, the present study's use of the wiki technology helped the lecturer and the students to save time and effort. Moreover, each participant could learn from home, Internet café or any place they may access and connect to the Internet. A future study would benefit from analysing the time and place of student access to the wiki. Students using the wiki built their knowledge and collected the information relating to the biology topics from a large variety of sources including the Internet. This study did not identify the source of students' learning. A future study could identify this important area.

6.9 Final summary statement

The present study sought to examine the impact of wiki technology on students' learning at ABU. The findings presented clear evidence on the possibility of using the wiki as a learning tool at the university level in general and at ABU in particular. The findings revealed that the wiki technology components and its pages helped the students to acquire the e-learning skills. Students after six weeks of the use of the wiki became more interested in searching and collecting the information and knowledge about the biology topics whether via the Internet or any other sources. The use of a CLE in the present study has a positive effect on students' discussions with each other. The study's findings before and after using the wiki indicated that technical aspects of wiki technology has an influence on the students' perceptions of the wiki, and despite the obstacles faced by the students during the use of the wiki, such as the Internet and computers, they were able to find temporary solutions via the Internet cafés. Students' attempts to access the wiki gave strong evidence of the students' desire and satisfaction to continue the use of the wiki as a learning tool during the research period. The study applied the constructivist theory which is integrated with the collaborative learning in helping students to construct their biological knowledge. It is also observed that students found the use of the wiki helpful to them to achieve and improve biological knowledge that has been reflected in their results in the weekly tests. According to the previous findings collected, the discussions among students via the wiki pages or face-to-face in the wiki class allowed students to build several aspects in their educational life such as modifying and correcting any information that might be incorrect, creating self-confidence and self-assessment. Students in general had a good technology self-efficacy in the wiki environment. Finally, a key advantage of the case study applied in

the present study is triangulation. This means that reliability of the findings is checked by other findings collected from different sources in this study; these sources are the five data collection instruments.

Appendices

Appendix 1: Interviewer-administered questionnaire for pilot study

Consent to participate in interview

Dear student

I am Ibraheem Alzahrani a PhD student in school of education, Southampton University, The United Kingdom. I am currently doing a pilot study to collect the data on the subject “The impact of using wiki technology in learning biology among Al-Baha University students: perceptions, knowledge, e-learning skills and attitudes”

I will be grateful if you could participate in my study. Your contribution in this study will help me to know the current status of the students at Al-Baha University. In terms of identify the extent of their knowledge about wiki technology, In order to find out the possibility of using wiki technology as a learning method. I will ask you a few questions and your respondents will be recorded on a questionnaire form. The interview is about 25 minutes long. You have the right to withdraw from the study at any time, including during follow-up. Your answers will be used for this study purposes.

Please note that, we will use a type of questionnaire called Interviewer-administrated questionnaire, this type based on that I will ask and you answer then your answers will write down on the questionnaire sheet.

Thank you for your input. I will start with the first question.

Researcher: Ibraheem Alzahrani

Southampton Education School, Southampton University, the United Kingdom

E-Mail: attfe2003@hotmail.com

Iaa1e10@soton.ac.uk

Mobile: 0504584485

Appendices

المشاركة في المقابلة

عزيزي الطالب.

السلام عليكم ورحمة الله وبركاته.

يسعدني ان ارجب بك في هذه المقابلة واسمح لي ان اقدم لك نفسي وهدفي من الدراسة.

انا الباحث ابراهيم عبد الله الزهراني , طالب لمرحلة الدكتوراه في جامعة ساوثهمبوت ببريطانيا. احاول في هذه الدراسة التوصل الى معرفه اثر استخدام تقنية الويكي في تعلم مادة الاحياء بهدف ايجاد اسلوب اخر للتعلم عن الاسلوب التقليدي المتبع حاليا في الجامعة.

خلال هذه المقابلة سوف اقوم بطرح مجموعة من الأسئلة عليك وسوف تقوم بالإجابة عنها ما امكن ذلك . سوف يستغرق زمن المقابلة في حدود 25 دقيقة وسوف تكون اجابتك سرية وسوف تستخدم فقط لغرض الدراسة الحالية. مشاركتك هي طوعية ولك الحق في الانسحاب من المشاركة في وقت من غير اي تأثير عليك من الناحية الدراسية .

اسم الطالب (اختياري):.....

التوقيع:.....

Appendices

1- Do you have a personal computer/laptop?

Yes () No ()

2- In which of the following you often use the computer?

Internet café () Home () Others ()

3- Practically, to what extent your knowledge of the Internet?

Excellent () Average () Fair ()

4- Usually, where do you go online from?

University () Internet café () others ()

5- How would you describe your level in editing?

Very good () Good () Satisfactory ()

6- Which of the following types of learning you prefer?

Collaborative learning () Individual Learning ()

7- Do you know synchronous and asynchronous learning?

Yes () No ()

8- How useful would you describe web sites that allow the user to construct the content?

Very useful () Somewhat useful () Not at all useful ()

9- To what extent you understand the term wiki?

Good understanding () Somewhat understand () Don't understand ()

10- Do you know Wikipedia?

Yes () No ()

11- What is the current leaning style in your academic learning?

Traditional Learning () E-Learning () Blended Learning ()

12- Do you believe that the current teaching style is suitable?

Yes () No ()

13- Do you have the desire to study via other teaching style?

Yes () No ()

14- In general, how do you describe the University role regarding to E-Learning?

Very satisfied () Somewhat satisfied () Unsatisfied ()

15- How would you describe the availability of the computers in the University

Available () Somewhat Available () Not Available ()

16- How would you describe the availability of the Internet in the University?

Available () Somewhat Available () Not Available ()

Appendices

Appendix 2: Interviewer for the main study

Consent to participate in interview

Dear student

I would like to welcome you and thank you for your participation in this interview, before we start let me to introduce myself and to give you some information about my study and the aim of the study and how the interview will be conducted.

I am Ibraheem Alzahrani a PhD student at Southampton Education School, Southampton University in the United Kingdom. My study aims to investigate the impact of using wiki technology in learning biology among Al-Baha University students. During the interview I have several questions to ask you related to the wiki technology in order to find out your perceptions of this technology. The interview will take approximately 25 minutes. Your answers will be treated in strict confidence in accordance with the Data Protection Act, and used for the research purposes only. Your participation is voluntary. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time. Your decision whether or not to participate will not affect your course of study.

Your name (voluntary):.....

Signature:.....

Appendices

المشاركة في المقابلة

عزيزي الطالب.

السلام عليكم ورحمة الله وبركاته.

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اسم الطالب (اختياري):.....

التوقيع:.....

Appendices

1- ما خبرتك عن تقنية الويكي بشكل عام؟

1- What is your experience of wiki technology in general?

.....

.....

.....

2- هل تعتقد أن تعدد صفحات الويكي قد تحفزك لدراسة وفهم مادة الاحياء؟ لماذا, ولماذا لا.

2- Do you think the multiplicity of wiki pages may motivate and encourage you to learn and understand biology? Why, or why not?

.....

.....

.....

.....

3- هل تعتقد أن استخدام الويكي في التعليم سوف يساعدك على اكتساب مهارات التعلم الالكتروني؟

3- Do you think the use of wiki pages will help you to acquire e-learning skills?

.....

.....

.....

.....

4- في رأيك هل العمل مع المجموعة سوف يثري مواضيع مادة الأحياء؟

4- In your opinion, does the work within group will enrich the content of biology?

.....

.....

.....

.....

5- هل تعتقد أن المشاركة في المناقشات يساعدك على تعلم مادة الأحياء؟

5- Do you think participating in discussions helps your biology learning?

.....

.....

.....

.....

Appendices

6- ما هي ايجابيات استخدام الويكي من وجهة نظرك؟

6- What are the advantages of using wiki in your point view?

.....

.....

.....

.....

.....

7- ما هي مساوئ استخدام الويكي من وجهة نظرك؟

7- What are the disadvantages of using wiki in your point view?

.....

.....

.....

.....

.....

8- أخيراً، هل تعتقد ان الويكي يمكن ان يكون اداة مناسب للتعلم؟

8- Finally, do you think that the wiki can be an appropriate tool for learning?

.....

.....

.....

.....

.....

Do you have further information

هل لديك اي اضافات

.....

.....

.....

.....

.....

I appreciate your participation

اشكر لك مشاركتك

Appendices

Appendix 3: Questionnaire 5-point Likert scale

Please read each statement and indicate the extent to which you agree or disagree. Tick your responses.

يرجى قرأه الفقرات التالية في المحاور الأربعة التالية واختبار ما تراه مناسباً لك بوضع إشارة ✓ في المكان المناسب والمقابل لكل فقرة. حيث تمثل الفقرات الأرقام من 1 إلى 5 كما يلي:

1	2	3	4	5
Strongly Disagree اعارض بشدة	Somewhat Disagree اعارض الى حد ما	Neither Agree Nor Disagree محايد	Somewhat Agree موافق الى حد ما	Strongly Agree موافق بشدة

المحور الأول: مهارات التعلم باستخدام موقع الويكي.

First axis: Wiki skills.

No	Statement	الفقرة	1	2	3	4	5
1	It is easy to log in to the wiki site استطيع الدخول لصفحات الويكي بسهولة						
2	I can add visual and written materials to wiki pages استطيع اضافة وسائط متعددة الى صفحات الويكي (صور- مقاطع)						
3	Using wiki increases my productivity in writing biology content نظام الويكي يزيد من انتاجيتي في كتابة محتوى الاحياء						
4	The simplicity of the wiki system makes it easier to construct the biology content بساطة التعامل مع تقنية الويكي يجعل من السهل بناء محتوى الاحياء						
5	Using wiki helps me to learn biology استخدام الويكي يساعدني على تعلم الاحياء						
6	I know how to post my comments to the wiki pages لدي المعرفة بكيفية اضافة التعليقات في صفحات الويكي						
7	I can take advantage of the main wiki pages (content page, discussion page) استفيد من وظائف الصفحات الاساسية في الويكي (المحتوى- المناقشة)						
8	History page helps me to review the old contributions صفحة التاريخ تساعدني على استعراض المساهمات القديمة						

Appendices

المحور الثاني: مهارات التعلم التعاوني.

Second axis: Collaborative learning skills.

No	Statement	الفقرة	1	2	3	4	5
1	Working with a group motivates me to best learning	التعلم داخل مجموعة يحفزني على تعلم أفضل					
2	I am encouraged to discuss because of my group	وجودي في مجموعة يشجعني على المناقشة داخل الفصل					
3	Learning in a group encourages me to search for the information	التعلم في مجموعة يحفزني على البحث عن المعلومات					
4	Learning in a group encourages me to search for the information	التعلم في مجموعة يحفزني على البحث عن المعلومات					
5	I feel a wiki class is competitive when work with groups	اشعر بالعمل التنافسي بين افراد المجموعة					
6	I do not feel lonely in the wiki learning environment	لا اشعر بوحداية في مجموعات الويكي التعليمية					
7	I can solve the problems related to the use of wiki when I discuss them with the group members	مع افراد المجموعة استطيع حل المشاكل التي تواجهني في استخدام الويكي					
8	I can solve the problems related to information searching when I discuss that with the group members	مع افراد المجموعة استطيع حل المشاكل التي تواجهني في البحث عن المعلومات					
9	Members' contributions lead me to increase my knowledge of the biology content	مساهمات الاخرين تزيد من معرفتي بمحتوى الدرس					

Appendices

المحور الثالث: مهارات التواصل المتزامن وغير متزامن.

Third axis: Communication skills.

No	Statement	الفقرة	1	2	3	4	5
1	E-mail helps me to interchange the biology content with the other students	استخدم البريد الالكتروني في تبادل محتوى المقرر مع الاخرين					
2	wiki system motivates me to communicate with the other students	نظام الويكي كأداة تعلم يخفزني للاتصال المستمر بأفراد المجموعة					
3	I can use multiple channels to communicate with the group members	استخدم قنوات متعددة للاتصال بأفراد المجموعة					
4	The use of multi-communication methods leads to construct better content for biology	استخدام اكثر من وسيلة اتصال يسهل بناء محتوى افضل للأحياء					
5	The use of wiki mail makes me feel positive about confidentiality and privacy	استخدم بريد الويكي لنقل المعلومات لأنني اشعر بالسرية والخصوصية					
6	Synchronous communications facilitate me to connect with the group members	الاتصال المتزامن يسهل الاتصال ببقية افراد المجموعة					
7	Asynchronous communications facilitate me to connect with the group members	الاتصال الغير متزامن يسهل الاتصال ببقية افراد المجموعة					

Appendices

المحور الرابع: مهارات البحث عن المعلومات

Fourth axis: Searching skills.

No	Statement	الفقرة	1	2	3	4	5
1	I can determine the suitable sources for the biology topics استطيع تحديد مصادر المعلومات المناسبة لمواضيع الاحياء						
2	I have the ability to look for the information in several ways لدي القدرة على البحث عن المعلومات من عدة مصادر						
3	The multiplicity of the sources allows me to ensure the veracity of the information تعدد المصادر يساعدني على التأكد من صحة معلوماتي						
4	I can support my information by visual, written and lesson materials استطيع دعم معلوماتي بالمصادر المرئية والمقروءة والمسموعة						
5	I asked my group members to help me when searching for the biology information استعين بأفراد المجموعة عند البحث عن المعلومات في مواقع الانترنت						
6	I test the validity of my information by going back to more than one source اختبر صحة معلوماتي بالرجوع الى اكثر من مصدر						
7	I can determine the suitable sources for the biology topics استطيع تحديد مصادر المعلومات المناسبة لمواضيع الاحياء						

Appendices

Appendix 4: Questions of the weekly tests

المواضيع والاسئلة لمادة الأحياء خلال ستة اسابيع

الاسبوع	الموضوعات	الاسئلة
1	الخلية النباتية	1/ عرف الخلية الحية؟ 2/ قارن في جدول بين الخلية النباتية والخلية الحيوانية؟
2	المحاليل	1/ ما هي أنواع المحاليل؟ 2/ اذكر ثلاثة من صفات المحاليل الغروية. 3/ إلى كم قسم تنقسم المحاليل على حسب سلوك المذاب في المذيب؟
3	الأسموزي	1 - ماذا يعني الضغط الأسموزي؟ 2 - ما هو دور الاسموزية في حياة النباتات؟ 3 - الاسموزية هي انتقال : (أ) الماء (ب) الجسيمات المذابة (ج) الغازات (د) الطاقة
4	التشرب	1/ صف كيف تتم عملية تشرب النباتات للماء والاملاح المعدنية الذائبة فيه. 2/ هل للتشرب علاقة بامتصاص النبات للماء؟ 3/ هل يمكن لعملية التشرب أن تتم في الأوراق والجذور؟
5	العلاقات المائية	1 - أكمل الجملة التالية: معدل النتج يزداد: (أ) في وجود الضوء. (ب) النباتات المغمورة في الماء. (ج) عندما تكون درجة الحرارة عالية. (د) في وقت هطول المطر. 2 - أي من النظريات التالية لا يمكن أن يفسر صعود الماء والذائبات في الأشجار العالية. (أ) نظرية التعرق والامتصاص. (ب) نظرية الضغط الجذري. (ج) نظرية الخاصية الشعرية. (د) نظرية التماسك والتلاصق.
6	الانزيمات	1/ ما هو الأنزيم؟ 2/ أين توجد الأنزيمات في النبات؟ 3/ في أي درجات الحرارة لا تعمل الانزيمات؟

استاذ المادة/ د. سعيد السكاري

الباحث/ ابراهيم الزهراني

Appendices

The topics and the questions for six weeks teaching

Week	Topic	Questions
1	Plant Cell	1- What does Living Cells means? 2- Compare between plant cell and animal cell.
2	Solutions	1- What are the sections of solutions? 2- Write three of Emulsion Solutions characteristics. 3- What are the types of solutions according to the solute behaviour
3	Osmotic	1- What does osmotic mean? 2- What is the role of osmotic in plant life? 3- Osmosis is the diffusion of: (A) Water (B) Solute particles (C) Gases (D) Energy
4	Absorb	1- Describe how plants absorb and transport water and mineral salts? 2- Can a tree's leaves absorb water just like its roots? 3- What are the three factors that involved in the upward movement of water in plants
5	Plant Water Relations	1- Complete the following sentence: Rate of transpiration increases _____. (a) when there is no light (b) in water (c) when temperature is high (d) in rainy season 2- Which of the following theory cannot explain the ascent of sap in tall trees? (A) Root pressure and Transpiration pull (B) Root pressure and capillarity (C) Capillarity and Transpiration (D) Capillarity and physical force theory
6	Enzyme	1- What are the enzymes? 2- Where in the plant are most enzymes located? At what temperature do plant enzymes work best?

Biology lecturer: Dr Said Alsokari

Researcher: Ibraheem Alzahrani

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Appendix 5: Questionnaire ‘multiple choice questions’

This method is designed to measure the extent of students' knowledge about wiki technology

صممت هذه الاداة لقياس معرفة الطلاب بالويكي

ضع دائرة حول الاختيار المناسب من الأسئلة التالية باللغة العربية من 1- 9.

In the following multiple choice questions, please circle the correct answer from 1-9

1- Which of the following materials helped you to improve your knowledge? 1- أي المواد التالية ساعدك على تطوير معرفتك بمادة الاحياء؟	
1- Written materials	1- المواد المكتوبة
2- Audio-Visual materials (e.g., movies)	2- المواد البصرية والصوتية كمقاطع الفيديو
3- Photos and graphics materials	3- الصور والرسومات

2- During your use of wiki to obtain knowledge what are the obstacles that faced you? 2- خلال استخدامك للويكي ماهي العقبات التي واجهتك؟	
1- Obstacles related to the Internet service	1- عقبات تتعلق بخدمة الانترنت
2- Obstacles related to the computers	2- عقبات تتعلق بأجهزة الكمبيوتر
3- Obstacles related to the search for sources of biology information	3- عقبات تتعلق بالبحث عن المعلومات

3- How would you assess your posts in the discussion page in order to build your knowledge of biology? 3- كيف تقيم مشاركاتك في صفحة النقاش من اجل الحصول على المعرفة المتعلقة بالاحياء؟	
1- Consistently contribute (daily)	1- اساهم بشكل يومي
2- Sometimes (more than two times per week)	2- اساهم احيانا (اكثر من مرتين اسبوعيا)
3- Seldom (two times or less per week)	3- اساهم نادرا
4- Never (did not contribute)	4- لم اساهم اطلاقا

4- How would you assess your posts in the content page in order to build your knowledge of biology? 4- كيف تقيم مشاركاتك في صفحة المحتوى من اجل الحصول على المعرفة المتعلقة بالاحياء؟	
1- Consistently contribute (daily)	1- اساهم بشكل يومي
2- Sometimes (more than two times per week)	2- اساهم احيانا (اكثر من مرتين اسبوعيا)
3- Seldom (two times or less per week)	3- اساهم نادرا
4- Never (did not contribute)	4- لم اساهم اطلاقا

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5- During the use of wiki pages, which page or pages had an impact on building your knowledge?	
5- أي صفحات الويكي كان لها تأثير على بناء المعرفة	
1- Discussion page	1- صفحة المناقشات
2- Content page	2- صفحة المحتوى
3- History page	3- صفحة التاريخ (المشاركات السابقة)

6- What was the effect of the interaction with other team members on your knowledge?	
6- كيف كان تأثير افراد المجموعة على اكتسابك للمعرفة	
1- The interaction had no effect	1- لم يكن للتفاعل اي تأثير على بناء المعرفة
2- The interaction had relatively good effect	2- كان للتفاعل تأثير جيد الى حد ما على بناء المعرفة
3- The interaction had good effect	3- كان للتفاعل تأثير جيد على بناء المعرفة

7- Which type of communication with the group members do you believe helped you to acquire knowledge	
7- اي انواع الاتصال مع افراد المجموعة ساعدك على اكتساب المعرفة	
1- Synchronous communications	1- الاتصال المتزامن
2- Asynchronous communications	2- الاتصال غير المتزامن
3- Face-to-face communications	3- الاتصال وجها لوجه

8- What are the characteristics of wiki that you think helped you to gain knowledge?	
8.1.1 - أي الخصائص التالية للويكي ساعدتك على بناء المعرفة	
1- The ease of using wiki	1- سهولة التعامل مع الويكي واستخدامه
2- Plurality pages of wiki (main page, content page, discussion and history page)	2- تعدد صفحات الويكي
3- The ability to edit or entirely remove my own comments	3- القدرة على التحرير والحذف للنصوص

9- Overall, how effective or ineffective was using wiki in helping you to gain the knowledge about wiki?	
9- أجمالا كيف كان تأثير الويكي بشكل عام على اكتساب المعرفة	
1- The use of wiki had no effect	1- استخدام الويكي لم يكن له تأثير
2- The use of wiki had a good effect	2- استخدام الويكي كان له تأثير جيد
3- The use of wiki had some effect	3- استخدام الويكي كان له تأثير الى حد ما

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Appendix 6: (E-comments)

The screenshot shows a web browser window displaying a WikiBaha page. The browser's address bar shows the URL: wikibaha.wikispaces.com/E-comments%2C+students+attitudes+towards+wiki. The page header includes the text 'BIOLOGY' and 'Researcher: Ibrahim Alzakrani' above a collage of biology-related images. The main content area is titled 'E-comments, students attitudes towards wiki' and contains the following text:

This page consists of students' e-comments about their attitudes towards wiki technology.

• E-comments in Arabic:

1. الطالب رقم

يجب أن يشعر الطالب ويعي فائدة الويكي بالنسبة له كمستعلم ليسهل دافعا وحافزا داخليا لديه ليشترك بفاعلية في الويكي. ويمكن استخدامه كمرجع للمتعلمين وذلك لتسهيل التحرير مثل القدرة على عرض التصوص والصور. وهناك صفحات النقاش لتحرير كل صفحات المحتوى. ولها تأثير ايجابي على تعلم الطلاب لأنه يزيد الاهتمام والمشاركة في الموضوع ومقدار المعرفة التي تحتفظ ويسهل للطلاب الاتصال في التعلم عن بعد. وايضا جمع البيانات واستطلاع رأي الطلاب والتقييم الذاتي

الطالب رقم 2 اتجاهاتي نحو الويكي كانت مفيدة جدا وسهلة الاستخدام والويكي يشجعني على المناقشة داخل الفصل ويساعدني على البحث عن المعلومات. وهناك صفحة المناقشة لها تأثير على بناء المعرفة يمكن استخدامه كمرجع للمتعلمين. تقوم فكرة الويكي على اشراك مجموعة من الآخرين ومن ابرز اسباب نجاحها هو سهولة عملية الانشاء والتعديل واما مجال التعليم فهو دعمها للتعلم

Student EC1:

Students need to know and understand the benefits of wikis, which can motivate one to study and collaborate effectively. Wikis can be used in learning due to their ease of editing, and wikis can also be used as sources and to communicate with other students.

Student EC2:

I have a positive attitude towards wikis. I found them to be a suitable method while learning because of their characteristics, which I discovered while using wikis when learning biology. Wikis encourage me to discuss issues with my peers in the class and to search for enriching information. For example, the discussion page had a positive effect in building my knowledge and I found it easy to edit and modify the other contributions. In terms of collaborative learning, I found that wiki pages helped me to construct the content of biology through other people's contributions.

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Student EC3:

In my use of wikis while learning biology I can enumerate the benefits as follows: I found them easy to use and to deal with. They are a good method to share educational material related to the biology topics with other students, such as pictures, videos clips and texts. Finally, using wikis encouraged me to work collaboratively.

Student EC4:

To be honest, and because it was the first time I had used wikis in my learning, I found them to be of little benefit at the beginning. However, after the second week I found wiki technology very interesting and very helpful, especially when exchanging information with others. I found some obstacles faced me during the use of wiki pages, due to being disconnected from the Internet or if the Internet speed was not adequate. One of the defining characteristics of wikis in my opinion is that they create a “spirit of collaboration” among students.

Student EC5:

I believe that wiki technology can be considered an educational tool to provide students with a better learning environment, and it can help us in acquiring e-learning skills while searching for biological information. In order to benefit from wikis, however, you have to be constantly connected to the Internet and this is the worst problem I faced. Another point I would mention is that wikis give me the freedom to edit and to change others' contribution if I felt it was wrong, needed modifying or does not relate to the biology topic. In my point of view, I strongly support the idea of using wikis in learning.

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Appendix 7: First draft of the interview for (RQ1)

بسم الله الرحمن الرحيم

تحتوي هذه الاستبانة على مجموعة من الأسئلة التي تهدف الى معرفة تصورات الطلاب عن تقنية الويكي وهي احدى تطبيقات الويب الحديث مثل الويكيبيديا.
أمل ابداء وجهة نظركم حيال مدى ملائمة الأسئلة التالية كان تكون فعلا اسئلة لمعرفة التصورات أم لا.

هل السؤال يقيس التصور
هل يحتاج السؤال الى حذف جزء منه
هل يحتاج السؤال الى اضافة
هل يجب حذف السؤال بأكمله

١ ما هي خبرتك عن تقنية الويكي في التعليم؟

1- What is your experience of using Wikis technology in learning?

A good Question *سؤال جيد*

٢ هل تعتقد أن الويكي يمكن ان يزيد من تفاعلك مع الاخرين؟ لماذا، ولماذا لا.

2- Do you think using Wikis increases the interaction between you and others? Why, or why not?

لا اعتقد ان الويكي يمكن ان يزيد من تفاعلك مع الاخرين لان الويكي ليس له تفاعل بين المستخدمين

This question need to replace with the second question

٣ هل تعتقد ان الويكي ساعدك في تعلم الاحياء؟ لماذا، ولماذا لا.

3- Do you think using Wikis helps your biology learning? Why, or why not?

Yes, I think this question is good *هذا السؤال جيد*

Appendices

٨ - ما هي ايجابيات استخدام الويكي من وجهة نظرك؟

8- What are the advantages of using Wikis in your point view?

الحصول على معلومة حديثة وفي وقت قليل
المعروف على مستوى جديدة وقابل للتدوين

٩ - ما هي مساوئ استخدام الويكي من وجهة نظرك؟

9- What are the disadvantages of using Wikis in your point view?

أقل أمن وتبعثر الباحث عن البحث في
الكتب والمراجع العلمية
لأنه يعتمد انه هناك ما دون الويكي

Do you have further information

هل لديك اي اضافات

النسبة حاضرة وتقسيم الصور
مكررة أكثر من صيغة مما تؤكد قياس الفكرة

د/ اياد طه
استاذ مساعد
جامعة الطائف
د/ اياد طه
استاذ مساعد
جامعة الطائف

I appreciate your participation

أشكر لك مشاركتك

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Appendix 8: First draft of multiple choice questions for (RQ2)

QM

10

Questionnaire Form (2)

This method is designed to measure the impact of using Wiki technology on students' knowledge

صممت هذه الاداة لقياس اثر الويكي على معرفة الطلاب المتعلقة بمادة الاحياء

الترتيب الجواب الصحيح

- 1- Which of the following **material** helped you to improve your knowledge?
- 1- Written materials
 - 2- Visual materials (video clips)
 - 3- Photos and graphics materials

أي المواد التالية ساعدك على تطوير معرفتك بمادة الاحياء؟

- ١- المواد المكتوبة
- ٢- المواد البصرية ك مقاطع الفيديو
- ٣- الصور والرسومات

تقدر يدي الى
تنتج عندهم بالبحث
الاداه الويكي

- 2- During your use of Wiki to obtain knowledge what are the **obstacles** that faced you?
- 1- Obstacles related to the Internet service
 - 2- Obstacles related to the computers
 - 3- Obstacles related to the search for sources of biology information

لعقبات

Previous knowledge of wiki
المعرفة السابقة

خلال استخدامك للويكي ماهي العقبات التي واجهتك؟

- ١- عقبات تتعلق بخدمة الانترنت
- ٢- عقبات تتعلق باجهزة الكمبيوتر
- ٣- عقبات تتعلق بالبحث عن المعلومات

- 3- How would you assess your **posts in the discussion page** in order to build your knowledge of biology?
- 1- Consistently contribute (daily)
 - 2- Sometimes (some days per week)
 - 3- Seldom (two times or less per week)
 - 4- Never (did not contribute)

كيف تقيم مشاركاتك في صفحة النقاش من اجل الحصول على المعرفة المتعلقة بالاحياء

- ١- اساهم بشكل يومي
- ٢- اساهم احيانا (بعض الايام اسبوعيا)
- ٣- اساهم نادرا
- ٤- لم اساهم اطلاقا

المشاركة الجيدة

- 4- How would you assess your **posts in the content page** in order to build your knowledge of biology?
- 1- Consistently contribute (daily)
 - 2- Sometimes (some days per week)
 - 3- Seldom (two times or less per week)
 - 4- Never (did not contribute)

صحيح
#

كيف تقيم مشاركاتك في صفحة المحتوى من اجل الحصول على المعرفة المتعلقة بالاحياء

- ١- اساهم بشكل يومي
- ٢- اساهم احيانا (بعض الايام اسبوعيا)
- ٣- اساهم نادرا
- ٤- لم اساهم اطلاقا

قياس معرفته اطلاقا
معرفة مدى اساهمهم بحصصه (ويكي)

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Appendix 9: University of Southampton Ethics Approval Letter

Alzahrani I.A.

From: ERGO <DoNotReply@ERGO.soton.ac.uk>
Sent: 26 June 2012 08:38
To: Alzahrani I.A.
Subject: Your Ethics Submission (Ethics ID:1036) has been reviewed and approved
X-MSK: Off

Submission Number: 1036

Submission Name: Using wiki technology at Al-Baha University

This is email is to let you know your submission was approved by the Ethics Committee.

Comments

1.Thank you very much for your hard work on this. Good luck with your research!

2.Thank you, all my queries have now been resolved.

[Click here to view your submission](#)

ERGO : Ethics and Research Governance Online

<http://www.ergo.soton.ac.uk>

DO NOT REPLY TO THIS EMAIL

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Appendix 10: University of Al-Baha Approval Letter

KINGDOM OF SAUDI ARABIA
MINISTRY OF HIGHER EDUCATION
AL-BAHA UNIVERSITY



المملكة العربية السعودية
وزارة التعليم العالي
جامعة الباحة

قرار

إن المشرف العام على إدارة البعثات والعلاقات الجامعة وبناءً على الصلاحيات المخوطة له استناداً إلى قرار معالي مدير الجامعة رقم ٤٥١٥ وتاريخ ١٤٣٣/٢/١٥هـ القاضي بالموافقة على قيام المبعث / ابراهيم بن عبدالله علي الزهراني برحلة علمية للمملكة العربية السعودية جامعة الباحة .
وتفويضاً لمداد لائحة الانبعاث والتدريب الصادرة بقرار مجلس التعليم العالي محضر الجلسة الرابعة بتاريخ ١٤١٧/٢/٧هـ وما تقتضيه الأنظمة والتعليمات .

يقرر ما يلي:

- ١- الموافقة على قيام المبعث / ابراهيم بن عبدالله علي الزهراني برحلة علمية للمملكة العربية السعودية جامعة الباحة لجمع بيانات علمية عن رسالة الدكتوراه تبدأ بتاريخ ١٤٣٣/٣/٥هـ الموافق ٢٠١٢/١/٢٨ م .
- ٢ - أن لا تزيد المدة للرحلة العلمية عن ثلاثة اشهر .
- ٣ - على جميع جهات الاختصاص تنفيذ هذا القرار كل فيما يخصه .

المشرف العام

على إدارة البعثات والعلاقات الجامعية
د. غاتم بن محمد الغامدي



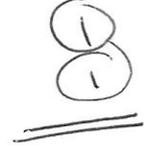
خاتمة

صورة مع النسخة لمكتب معالي مدير الجامعة
صورة مع النسخة لمساعدة وكيل وزارة التعليم العالي للعلاقات الخارجية
صورة مع النسخة لمساعدة وكيل الجامعة للدراسات العليا والبحث العلمي
صورة مع النسخة لمساعدة وكيل الجامعة للشؤون الأكاديمية
صورة مع النسخة لمساعدة مدير عام الشؤون المالية والإدارية بوزارة التعليم العالي

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Appendix 11: Samples of the students' responses about their attitudes towards wiki (In Arabic)

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



س/ ما هي اتجاهاتك نحو استخدام الويكي كأداة تعلم؟؟

ج/ يجب أن يشعر الطالب ويعي فائدة الويكي بالنسبة له كمتعلم ليشكل دافعاً وحافزاً داخلياً لديه ليشارك بفاعلية في الويكي.

يمكن استخدامه كمرجع للمتعلمين .

ويمكن استخدام الويكي وذلك لسهولة التحرير -- مثل القدرة على عرض النصوص والصور .وهناك صفحات النقاش لتحرير كل صفحة المحتوى.

ولها تأثير إيجابي على تعلم الطلاب لأنه يزيد الاهتمام والمشاركة في الموضوع ، ومقدار المعرفة التي تحتفظ ، ويسهل للطلاب الاتصال في التعلم عن بعد.

وايضا جمع البيانات استطلاع رأي الطلاب والتقييم الذاتي

٤٦٧٤.١٤٦٧٤

محمد علي البشري الزهواني

(٨)

ماهي تصور اناك عن لوييكي

معلوماتي عن لوييكي ا-

اعتقد بان لوييكي تقنية جديدة وتكون من حرفة تجار (معلومات

من حرفة وترتبط ريبا كثيرا في عملية التعلم والخطوة لان

تعتبر لوييكي هي من لطلاب ويكسر وتبين لطلاب و يجعل لطلاب

الحتم على البحث في ستمار لتقديم الفائدة والدرعم لك

لك لتبين تقنية لوييكي لا بد من وجود تهيئة لطلاب

على هذه التقنية لكي يتقنوا هذه التقنية من قبل بدر التعلم عن طريق لوييكي

من خلال تجربتي مع تقنية لوييكي :-

تم تطبيق لوييكي لدينا هذا التمر لكن الوقت لم يستفنا الوقت لتعلم لوييكي

تم الدراسة عن طريق لوييكي انا شخصيا كنت اجد صعوبات في بعض الاحيان

لك اخصف (معلومات

مع كل هذا اعتقد انه ساهم في تقبل بعض المعلومات بسهولة لدى لطلاب

للاثر كمنهم اثنان (في هذه مما جعل بعض المعلومات يتقنوا في العقل

لك في تجربتي فانه الوقت هو الكبر ليه تقنية لوييكي

اعتقد لو تم تطبيقها بالشكل الليم وتوعية لطلاب وتثقيفهم طده لتقنيته

سوف تكون طريقة ناجحة

Appendices

Appendix 12: A wiki tutorial before the use of wiki

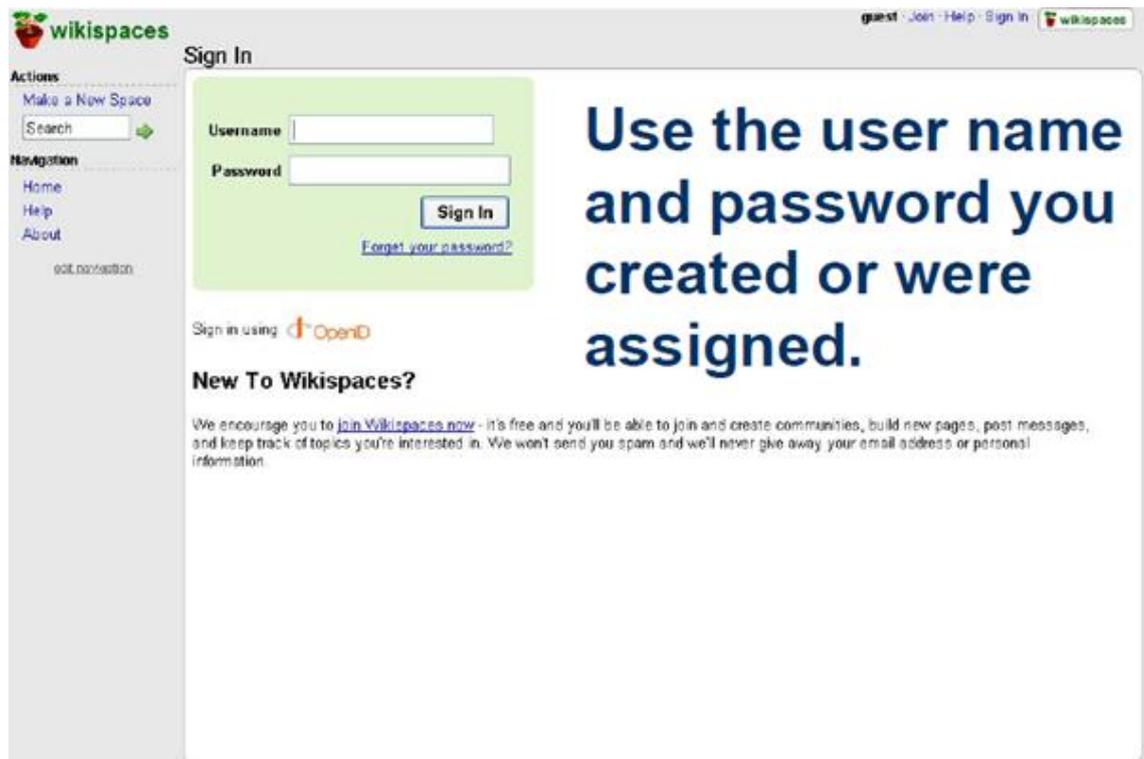
Working with Wikispaces

Create an Account

1. Go to <http://www.wikispaces.com/>
2. Click in the **Get Started** box on the top right of the page.



3. Enter a username. Your username will be visible to the students. I use Mr_Sengia for mine.
4. Create a password.
5. Enter your school email address. This is needed in case you forget your password.
6. Click **Get Started**.
7. You should see this screen when your account is made:
8. Click on the link **Dashboard**.



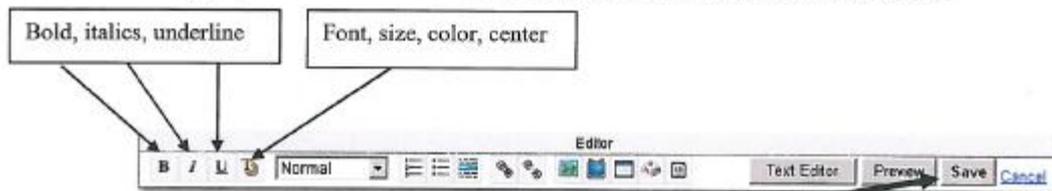
Appendices

Editing Text

1. Go to the page you want to make changes on.
2. At the top of the page click on **Edit This Page**. (the Edit this Page button might be on the left or right side)



3. Enter text onto the page. (Type in directly or paste in from a Word document. Wikispaces **does not** have spell check)
4. Highlight text and click on the editor for different formatting (bold, color, size).



5. Click on **Save** to keep what you have done. (*do not click Save Draft*)
6. Make sure to Save your page every 5 minutes or so. That way if the internet connection goes down you will not lose a lot of work.
7. Do not overdo it with color! People have to be able to read your page.
8. Do not try to Center items too much. Try to keep things on the left margin.

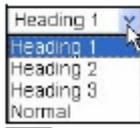
Appendices

An explanation of the formatting toolbar

 Highlight text and select to make text **Bold**

 Highlight text and select to make text *Italic*

 Highlight text and select to *underline* text

 Highlight text and select a heading style

 Highlight text and select to create numbered list

 Highlight text and select to create a bulleted list

 Select to place a horizontal rule

 Highlight text and select to add a hyperlink



You can link to a page already in your wiki or create a **NewPage** directly from here.

 Select to remove any hyperlinks you no longer want

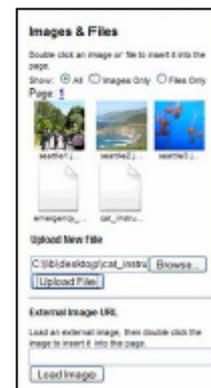
 Select to add files or pictures to your page

- Click on Browse to find the file you want
- Click on Upload File to add it to your collection in this window
- When you are ready to add it to your page, double click on the thumbnail view from the Images & Files window.

 Select to embed media – this feature is for advanced users

 Select to add a table to your page

 Select to Insert a Special Character



You now have enough information to create your first page. When you have finished editing, click on **Preview**, **Save** or **Cancel**.



Appendices

Inserting Images

Find an image you want to use online.

Right click on the image.

Select **Save Picture As...**

Change the file name of the image. Give the image a name followed by **your last name**.

Example : Darwin_Ehrhart



Click Save.

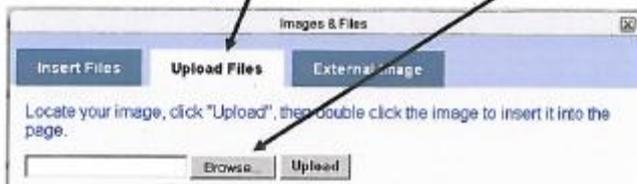
At the top of your wiki page click on **Edit This Page**.

Click on the **Insert Images and Files** icon.



Double check to see if the image you want has already been uploaded by somebody else. If it is already there, double click it and skip to # 13.

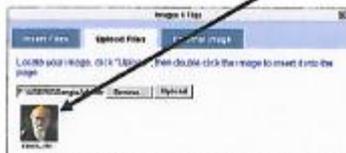
Click on the tab **Upload files** and click on the **Browse** button next to Upload



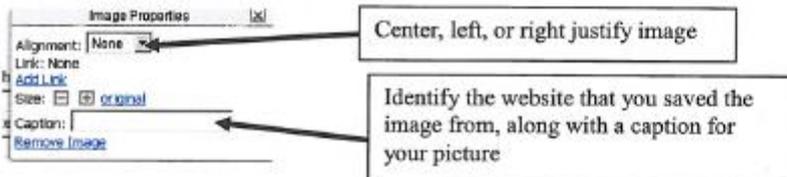
Select the image you want to insert and double click on it.

Click on **Upload**.

Double click the thumbnail of the image to insert it.



The image will appear on your wiki page with an image properties window.



To resize the image, click on the image and click and drag on one of the corner boxes.

Click **Save** to save your page. (You will not see your caption until you save the page)

Appendices

Upload Files

At the top of your wiki page click on **Edit This Page**.
Click on the **Insert Images and Files** Icon.



Click on the tab **Upload files** and click on the **Browse** button next to Upload



Select the file you want to upload and double click on it.
Click on **Upload**.
Double click the thumbnail of the file to insert it.



Click **Save** to save your page.

Appendices

Appendix 13: Screenshot shows the main page of wiki site 'Wikibaha'

The screenshot displays the main page of the Wikibaha wiki. The browser's address bar shows the URL wikibaha.wikispaces.com/الصفحة+الأساسية. The page header features the word "BIOLOGY" in a bold, serif font, followed by "Researcher: Ibraheem Alzahrani" in a cursive script. Below the header is a collage of biological images, including a green leaf, a microscope, a cell, and a microscope slide. The main content area is titled "الصفحة الأساسية" (Basic Page) and contains the following text in Arabic: "صمم هذا الموقع من قبل الباحث بجامعة ساوثهامبتون ببريطانيا الأستاذ/ ابراهيم بن عبدالله الزهراني". Below this text is a large image of the University of Southampton at night. At the bottom of the page, there is a "Contact us" section with the name "Ibraheem Alzahrani" and an email address "attfs2003@hotmail.com". The left sidebar contains navigation links such as "Wiki Home", "Recent Changes", "Pages and Files", "Members", "Discussion", and "Search".

Appendices

Appendix 14: Students' usernames and passwords

Public wikis now require account verification. Please verify your account.

Recent Changes

Pages Messages Comments Files Tags Members

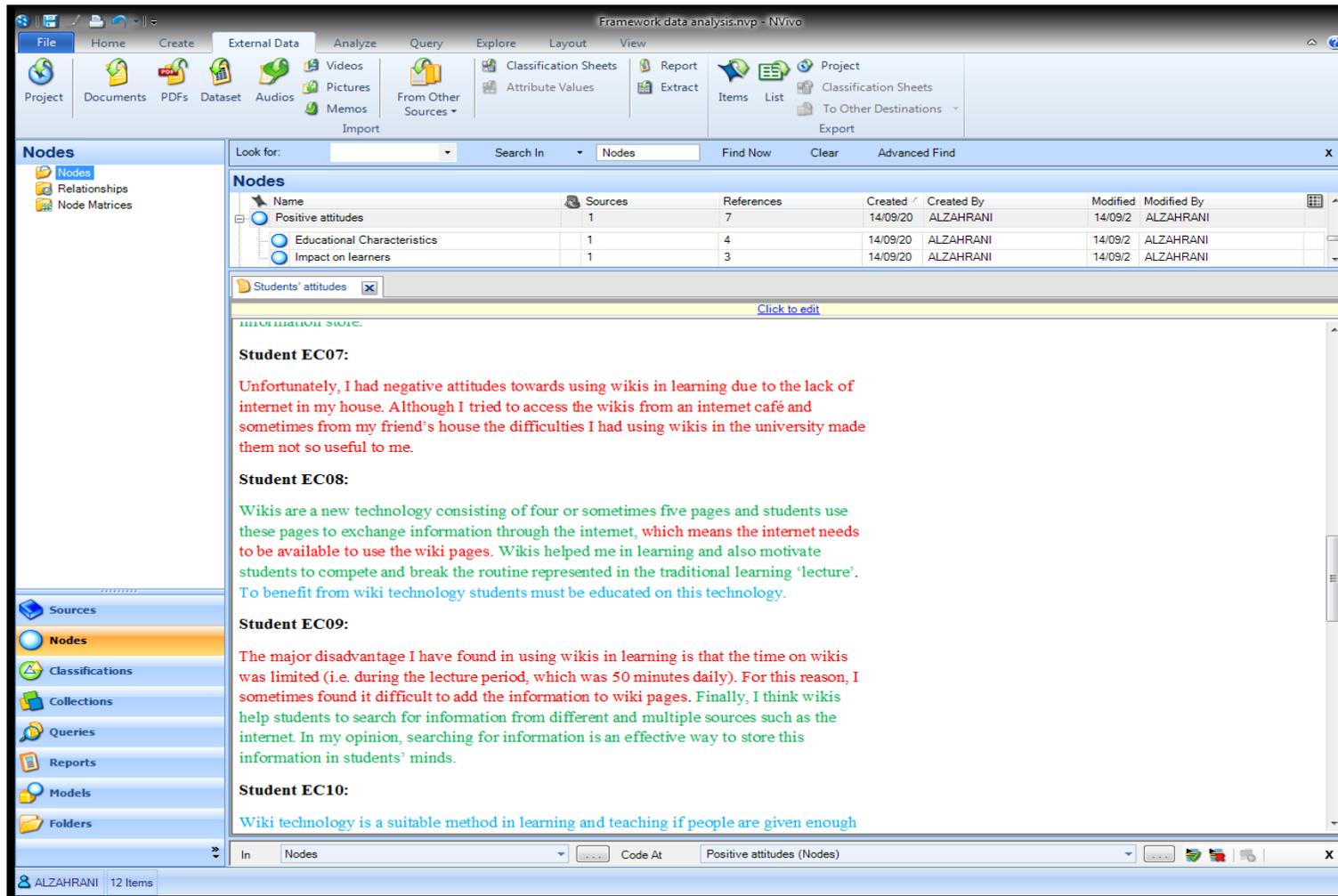
Username: 03/10/2012

▼ Saturday, March 10

home edited (view changes)	wikibaha13	11:03 am
Group One edited (view changes)	wikibaha1	11:02 am
wikibaha24 joined WikiBaha	ibraheemaz	11:01 am
wikibaha23 joined WikiBaha	ibraheemaz	11:01 am
wikibaha22 joined WikiBaha	ibraheemaz	11:01 am
wikibaha21 joined WikiBaha	ibraheemaz	11:01 am
wikibaha20 joined WikiBaha	ibraheemaz	11:01 am
wikibaha19 joined WikiBaha	ibraheemaz	11:01 am
wikibaha18 joined WikiBaha	ibraheemaz	11:01 am
wikibaha17 joined WikiBaha	ibraheemaz	11:01 am
wikibaha16 joined WikiBaha	ibraheemaz	11:01 am
wikibaha15 joined WikiBaha	ibraheemaz	11:01 am
wikibaha14 joined WikiBaha	ibraheemaz	11:01 am
wikibaha13 joined WikiBaha	ibraheemaz	11:01 am
wikibaha12 joined WikiBaha	ibraheemaz	11:01 am
wikibaha10 joined WikiBaha	ibraheemaz	11:01 am
wikibaha9 joined WikiBaha	ibraheemaz	11:01 am
wikibaha8 joined WikiBaha	ibraheemaz	11:01 am

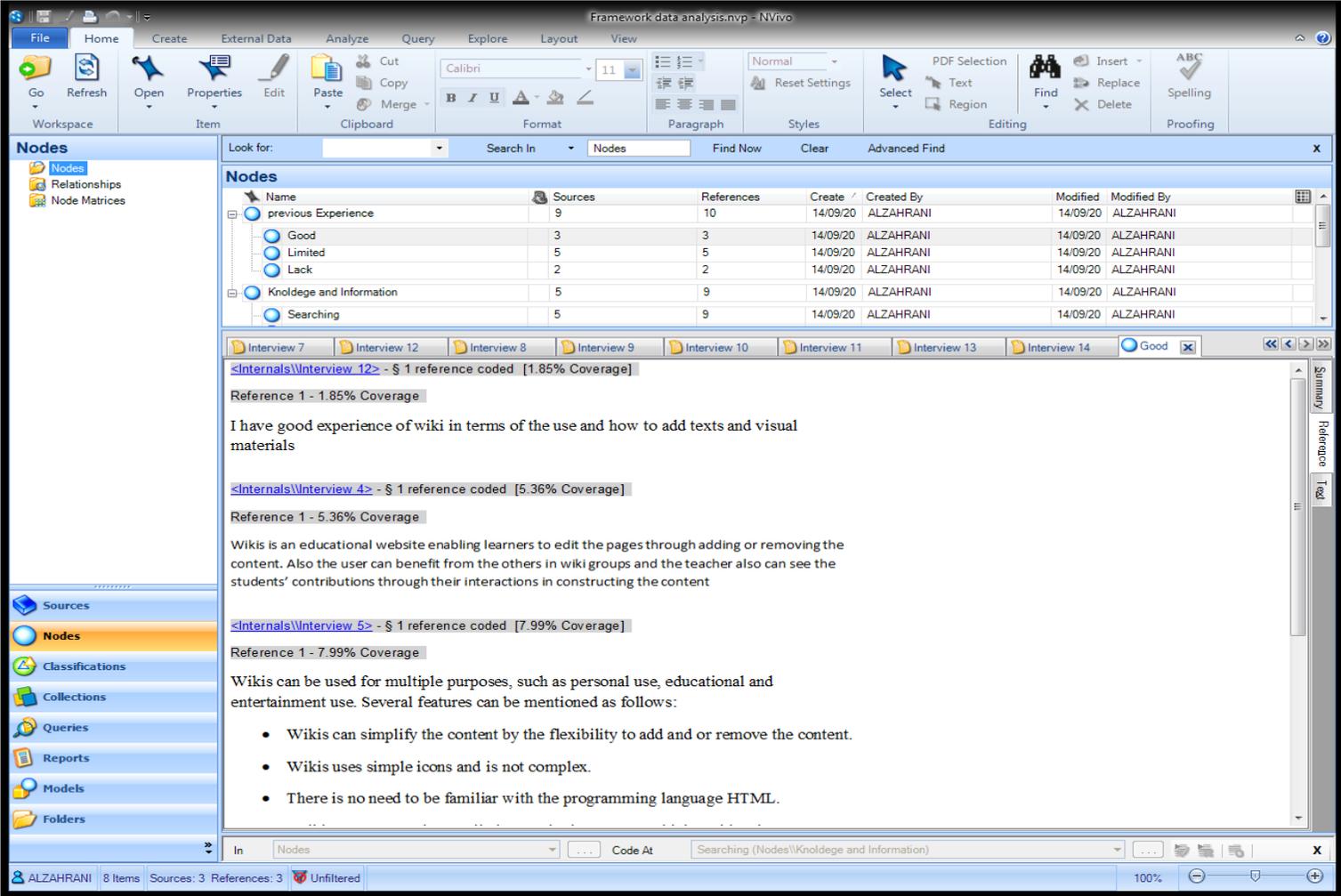
Appendices

Appendix 15: Importing data into NVivo (E-comments)



Appendices

Appendix 16: Importing data into NVivo (Interviews)



Appendices

The screenshot shows the NVivo software interface. At the top, there is a menu bar with options like File, Home, Create, External Data, Analyze, Query, Explore, Layout, and View. Below the menu is a toolbar with various icons for editing and analysis. The main window is divided into several sections:

- Sources:** A sidebar on the left lists sources like Internals, Externals, Memos, and Framework Matrices.
- Table:** A table titled "Internals" displays data for seven interviews. The columns are Name, Nodes, References, Created, Created By, Modified, and Modified By.
- Text Editor:** The main area shows a text editor with Arabic and English text. The English text includes questions and answers about wiki technology and e-learning.
- Bottom Bar:** Shows the current node being viewed, "Nodes", and a search bar.

Name	Nodes	References	Created	Created By	Modified	Modified By
Interview 1	5	6	21/03/20	ALZHRANI	21/03/2	ALZHRANI
Interview 2	2	2	21/03/20	ALZHRANI	14/09/2	ALZHRANI
Interview 3	4	4	21/03/20	ALZHRANI	21/03/2	ALZHRANI
Interview 4	2	2	21/03/20	ALZHRANI	21/03/2	ALZHRANI
Interview 5	2	2	21/03/20	ALZHRANI	21/03/2	ALZHRANI
Interview 6	2	2	21/03/20	ALZHRANI	21/03/2	ALZHRANI
Interview 7	2	2	21/03/20	ALZHRANI	21/03/2	ALZHRANI

1- ما خبرتك عن تقنية الويكي بشكل عام؟
1- What is your experience of wiki technology in general?
 My previous experience of wikis is just about Wikipedia. However my study with Dr Haron will increase my experience gradually, and I will practically apply this experience to understand this technology and to take advantage of it.

2- هل تعتقد أن تعدد صفحات الويكي قد تحفزك لدراسة وفهم مادة الاحياء؟ لماذا، ولماذا لا
2- Do you think the multiplicity of wiki pages may motivate and encourage you to learn and understand biology? Why, or why not?
 Yes, because of the diversity of knowledge sources and the ease in searching for the information.

3- هل تعتقد ان استخدام صفحات الويكي سوف يساعدك على اكتساب مهارات التعلم الالكتروني. لماذا؟
3- Do you think the use of wiki pages will help you to acquire e-learning skills? Why?
 Yes and more than using the traditional learning method.

4- في رأيك هل العمل مع المجموعة سوف يثري مواضيع مادة الأحياء ؟
4- In your opinion, does the work within group enrich the content of biology?

Appendices

Appendix 17: Analysing the quantitative data using SPSS

The screenshot displays the IBM SPSS Statistics Viewer interface. The main window shows the output for 'Question 9'. On the left, a tree view lists various outputs including 'Frequencies', 'Notes', 'Frequency Table', and 'Graph' for each question. The main area contains a table of frequencies and two bar charts.

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
The ease of using Wiki	8	40.0	40.0	40.0
Plurality pages of Wiki (main page, content page, discussion and history page)	8	40.0	40.0	80.0
The ability to edit or entirely remove my own comments	4	20.0	20.0	100.0
Total	20	100.0	100.0	

The first bar chart, titled 'Which of the following materials helped you to improve your knowledge?', shows the percentage of respondents who chose 'Written material' (65.0%) and 'Visual materials (video clip)' (35.0%).

The second bar chart shows the percentage of respondents who chose 'Written material' (40.0%) and 'Visual materials (video clip)' (60.0%).

Appendices

5 likert scale.spv [Document2] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output

- Frequencies
 - Title
 - Notes
 - Statistics
- Descriptives
 - Title
 - Notes
 - Descriptive Sta
- Reliability
 - Title
 - Notes
 - Scale: ALL VAR
 - Title
 - Case Proc
 - Reliability:
- Reliability
 - Title
 - Notes
 - Scale: ALL VAR
 - Title
 - Case Proc
 - Reliability:
- Reliability
 - Title
 - Notes
 - Active Dataset
 - Scale: ALL VAR
 - Title
 - Case Proc
 - Reliability:
- Reliability
 - Title
 - Notes
 - Active Dataset
 - Scale: ALL VAR
 - Title
 - Case Proc
 - Reliability:
- Correlations
 - Title
 - Notes
 - Active Dataset
 - Correlations
- General Linear Mod
 - Notes
 - Profile Plots
 - axes

Correlations

		First axis	Second axis	Third axis	Fourth axis
First axis	Pearson Correlation	1	.703**	.564**	.695**
	Sig. (2-tailed)		.000	.002	.000
	N	27	27	27	27
Second axis	Pearson Correlation	.703**	1	.569**	.693**
	Sig. (2-tailed)	.000		.002	.000
	N	27	27	27	27
Third axis	Pearson Correlation	.564**	.569**	1	.588**
	Sig. (2-tailed)	.002	.002		.001
	N	27	27	27	27
Fourth axis	Pearson Correlation	.695**	.693**	.588**	1
	Sig. (2-tailed)	.000	.000	.001	
	N	27	27	27	27

** . Correlation is significant at the 0.01 level (2-tailed).

Estimated Marginal Means of average

Axis	Estimated Marginal Mean
1	3.68
2	4.18
3	2.98
4	3.85

IBM SPSS Statistics Processor is ready

12:14
02/10/2013

Appendices

Appendix 18: The results of students in the weekly tests before and after the use of wiki (Before the use of wiki)

الاسم Students' name	الخلية النباتية Plant Cell	المحاليل Solutions	الأسموزي Osmotic	التشرب Absorption	العلاقات المائية Plant Water Relations	الانزيمات Enzymes	المجموع Total
WT 01	6	9	7	8	8	6	44
WT 02	6	5	5	5	7	6	34
WT 03	8	6	7	6	6	7	40
WT 04	7	9	8	8	8	6	46
WT 05	7	9	5	4	7	6	38
WT 06	7	5	9	6	9	7	43
WT 07	8	5	5	7	9	7	41
WT 08	5	4	6	6	7	4	32
WT 09	5	8	6	5	7	5	36
WT 10	7	6	9	7	7	8	44
WT 11	5	5	5	6	8	7	36
WT 12	6	5	5	5	7	6	34
WT 13	6	6	8	8	8	8	44
WT 14	4	6	5	7	6	8	36
WT 15	5	5	6	5	8	5	34
WT 16	6	7	8	6	4	6	37
WT 17	4	5	3	6	6	7	31
WT 18	6	7	6	4	7	4	34

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WT 19	5	6	6	7	3	7	34
WT 20	5	4	6	6	7	6	34
WT 21	6	7	7	5	6	6	37
WT 22	5	7	4	5	7	7	35
WT 23	7	5	8	5	7	5	37
WT 24	4	6	5	5	8	6	34
WT 25	5	6	5	5	5	7	33
WT 26	6	6	7	6	5	7	37
WT 27	4	7	5	6	8	10	40
WT 28	5	7	5	4	8	6	35
WT 29	7	5	5	6	5	7	35
WT 30	6	5	6	5	7	6	35
WT 31	5	4	6	4	5	7	31

Appendices

The results of students in the weekly tests before and after the use of wiki (After the use of wiki)

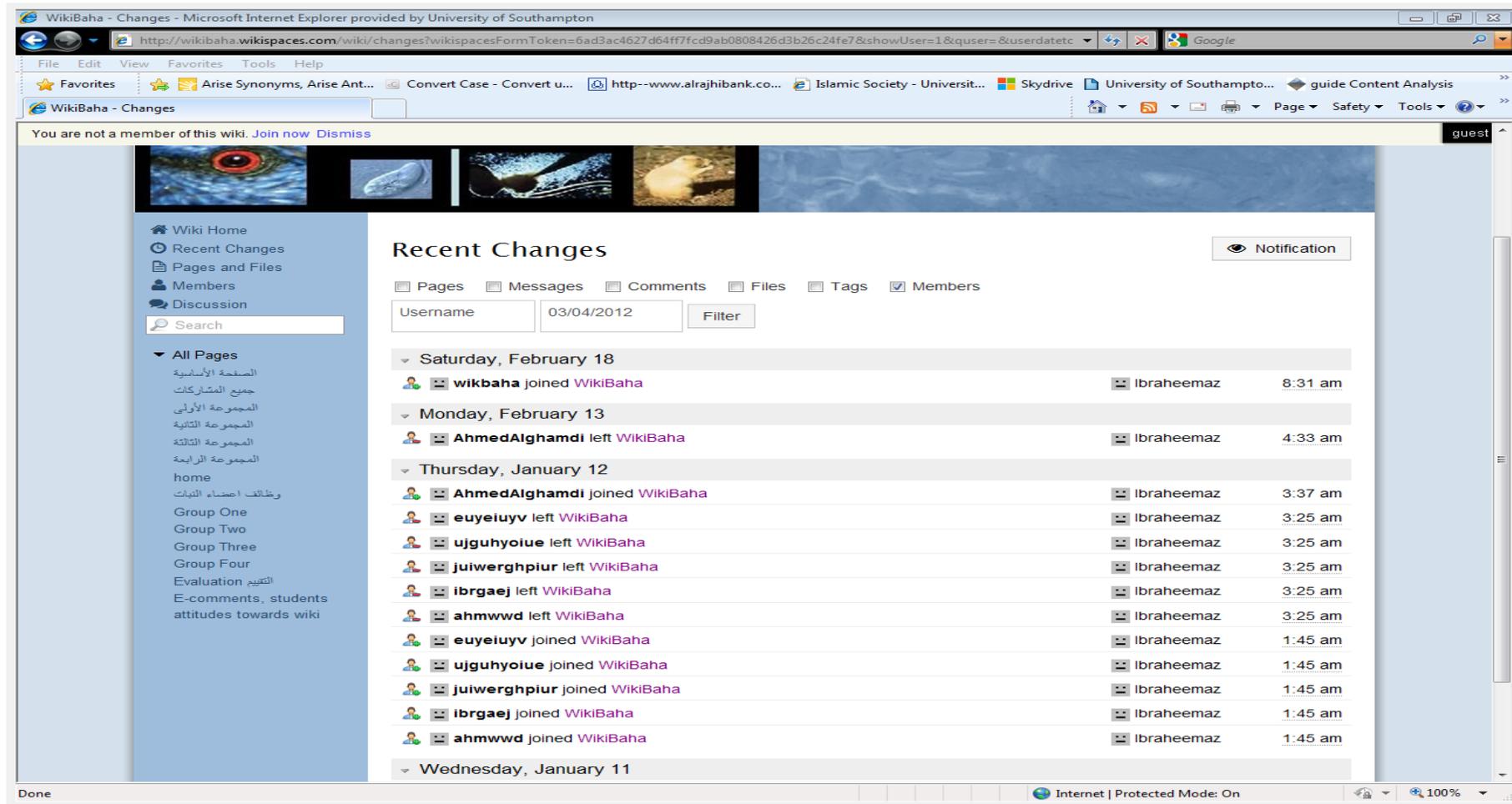
الاسم Students' name	الخلية النباتية Plant Cell	المحاليل Solutions	الأسموزي Osmotic	التشرب Absorption	العلاقات المائية Plant Water Relations	الانزيمات Enzymes	المجموع Total
WT 01	6	6	8	7	7	9	43
WT 02	8	6	5	7	9	8	43
WT 03	7	4	5	5	8	9	38
WT 04	4	7	6	7	9	10	43
WT 05	8	4	6	9	8	10	45
WT 06	6	5	5	7	6	9	38
WT 07	8	5	4	7	6	7	37
WT 08	9	7	6	9	8	8	47
WT 09	4	6	5	7	9	9	40
WT 10	5	7	8	6	8	9	43
WT 11	7	4	5	10	8	9	43
WT 12	5	10	8	8	8	9	48
WT 13	10	6	5	9	8	10	48
WT 14	4	7	6	8	7	9	41
WT 15	6	6	5	7	10	8	42
WT 16	7	5	8	9	6	9	44
WT 17	7	9	9	8	9	10	52
WT 18	7	8	6	8	10	9	48
WT 19	5	8	10	8	8	10	49
WT 20	8	9	9	7	6	8	47

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WT 21	7	6	8	7	7	9	44
WT 22	6	7	6	7	9	10	45
WT 23	9	7	5	8	9	8	46
WT 24	9	5	9	4	8	8	43
WT 25	6	6	7	8	10	9	46
WT 26	5	7	7	10	10	9	48
WT 27	7	8	7	8	9	9	48
WT 28	8	7	7	5	8	9	44
WT 29	7	8	6	9	9	10	49
WT 30	6	6	9	8	10	9	48
WT 31	7	5	6	10	8	9	45

Appendices

Appendix 19: Screenshot shows the first access and use of students to wiki pages ‘Access and motivation’



Appendices

Appendix 20: Screenshot shows the second stage 'Online socialisation'

WikiBaha - المجموعة الثالثة

wikibaha.wikispaces.com/المجموعة + الثالثة

This page is in Arabic Would you like to translate it? Translate Nope Never translate Arabic

Try Wikispaces Classroom now. Brand new from Wikispaces. guest | Join | Help | Sign In

BIOLOGY

Researcher: Ibraheem Alzahrani

المجموعة الثالثة

Edit 29 ...

Please introduce yourself

عبدالله الغصاب
محمد ناصر
مسفر عوض
عبدالله القرني
عبدالرحمن مجذوع

عبدالرحمن مجذوع

عبدالله الغصاب

الاسم/ عبدالله بريك القرني

Wiki Home
Recent Changes
Pages and Files
Members
Discussion
Search

All Pages
الصفحة الأساسية
جميع المشاركات
المجموعة الأولى
المجموعة الثانية
المجموعة الثالثة
المجموعة الرابعة
home

Appendices

Appendix 21: Screenshot shows the stage three: Information exchange

The screenshot shows a web browser window with the address bar displaying "wikibaha.wikispaces.com/Group+Four". The page features a header banner with the word "BIOLOGY" and the name "Researcher: Ibraheem Alzahrani". Below the banner is a grid of biological images including a green leaf, a microscope slide, a person in a lab coat, a blue textured background, a red eye, a blue liquid, a white object, and a yellow animal. A navigation menu on the left includes links for Wiki Home, Recent Changes, Pages and Files, Members, Discussion, and a search bar. The main content area is titled "Group Four" and contains a list of discussion themes in Arabic:

- التأثيرات الضارة للحرارة المرتفعة
- اختلال التوازن المائي في النبات -1
- سقوط الأزهار والعقد الحديث -2
- احتراق وجفاف الأوراق و التمواء الخضراء الحديثة -3
- حدوث احتراق في أنسجة النبات أثناء النمو مثل لفحة الشمس -4
- حدوث تغيرات لا عودة فيها في التركيب الجزيئي للإنزيمات والبروتينات عند اقتراب درجات الحرارة من الدرجة العظمى المبيكة -5

Appendices

Appendix 22: Screenshot shows the stage four knowledge construction

The screenshot shows a web browser window displaying a WikiBaha page. The browser's address bar shows the URL 'wikibaha.wikispaces.com/Group+Two'. The page header features a collage of biology-related images and the text 'BIOLOGY Researcher: Ibraheem Alzaharani'. Below the header, the page title 'Group Two' is displayed in a green box. The main content area is titled 'Micronutrients Elements' and contains a paragraph of Arabic text discussing the importance of micronutrients for plant growth. The text mentions that micronutrients are essential for plants, and their deficiency can lead to stunted growth and reduced yield. It also notes that micronutrients are present in small amounts in the soil and are often taken up by plants through their roots. The text is followed by a list of three points:

- 1- أهمية للنبات 1- يدخل في بناء الأحماض الأمينية
- 2- يدخل في تركيب الأحماض النووية
- 3- يدخل في بناء الكلوروفيل

The left sidebar contains navigation links such as 'Wiki Home', 'Recent Changes', 'Pages and Files', 'Members', 'Discussion', and 'Search'. It also lists 'All Pages' including 'الصفحة الأساسية', 'جميع المشاركات', 'المجموعة الأولى', 'المجموعة الثانية', 'المجموعة الثالثة', 'المجموعة الرابعة', 'home', 'وظائف اعضاء النبات', 'Group One', 'Group Two', 'Group Three', 'Group Four', 'التقييم', 'E-comments. students attitudes towards wiki'.

Appendices

Appendix 23: Screenshot shows Stage five development

المجموعة الأولى

Photosynthesis

يعرف التشرب بأنه قدرة المادة العروية الصلبة الممجة للماء على جذب الماء حول حبيباتها و الاحتفاظ بها و ذلك عن طرق اتحاد من نوع خاص بين المادة الصلبة و الماء
عبدالرحمن موسى صالح

فانبتات يمتص الماء من التربة عن طريق الجذور، ثم يرتفع الماء من خلال ساق النبات إلى الأوراق، عن طريق الخاصية الشعرية. وفي الأوراق يتحلل الماء إلى عتصريه، الأكسجين وفي هذه العملية، يتحد الهيدروجين الناتج . (Photosynthesis) "في عملية حيوية يطلق عليها "البناء الضوئي" (Chlorophyl) (والهيدروجين، بواسطة اليخضور (الكثوروفيل عن تحلل الماء، مع ثاني أكسيد الكربون، الذي تمتصه أوراق النبات من الهواء، لتصنيع سكر، ثم مركبات عضوية، كربوهيدراتية، ودهنية، وبروتينية لغذاء النبات. أما الأكسجين الناتج من تحلل الماء، في عملية البناء الضوئي، فينتقل معظمه في الهواء الجوي . على صيبري

Basic Photosynthesis

LIGHT ENERGY

oxygen

carbon dioxide

water

محمد الفهمي

-: الماء يمر خلال البشرة الموجودة في الجذر وهناك مسارين لحركة الماء خلال الاوعية الناقلة هما

Appendices

Appendix 24: Screenshot shows 'History page'

The screenshot shows a web browser window with the address bar displaying 'wikibaha.wikispaces.com/wiki/changes'. The page title is 'WikiBaha - Changes'. A notification at the top states: 'Public wikis now require account verification. Please verify your account.'

The main content area is titled 'Recent Changes' and includes a 'Notification' button. Below the title are filter options: Pages, Messages, Comments, Files, Tags, and Members. There are also input fields for 'Username', 'Date', and a 'Filter' button.

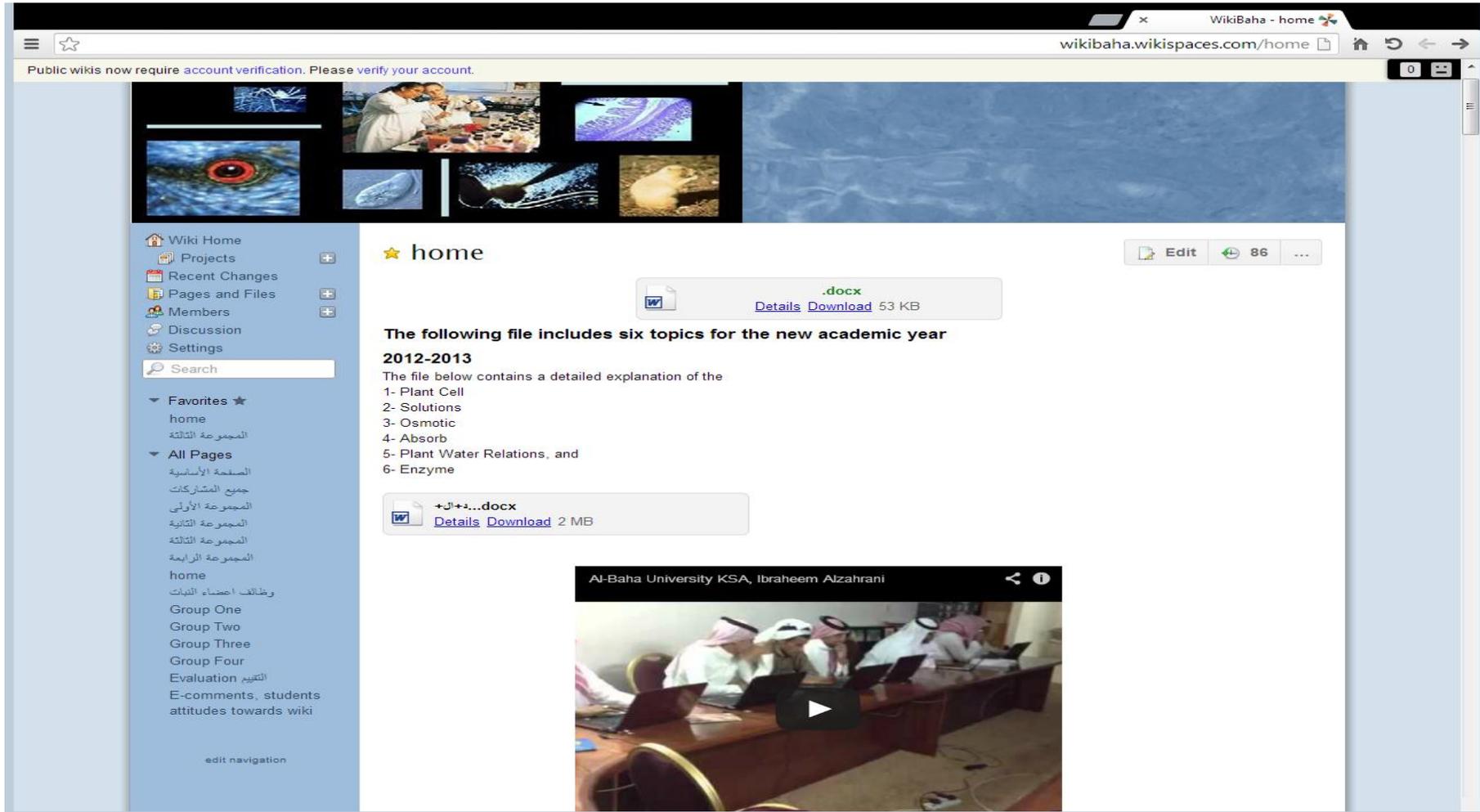
The changes are listed in a table format, grouped by date:

- Yesterday**
 - Group Four** edited Group Four Discussion themes خسارة للحرارة المرتفعة :-1- اختلال التوازن المائي Ibraheemaz 10:43 pm
 - المجموعة الثالثة** edited Please introduce yourself ... عرضجيدالله القرنيمنالرحمن مجدوع Ibraheemaz 10:18 pm
 - المجموعة الثالثة** edited Please introduce you! هذه الصفحة مخصصة للمجموعة الثالثة لكتابة وتحديث مشاركاتهمبنالله Ibraheemaz 10:14 pm
 - جميع المشاركات** edited Discussion Group المحاذيل من مادتين أو أكثر Ibraheemaz 9:40 pm
- Wednesday, September 4**
 - المجموعة الثانية** edited Student name: wikibaha 06 ... تختلف تج ... النبات . على النبات تترايد تترايد عملية الايض ... النبات Ibraheemaz 6:15 pm
 - Group Three** edited ... تنشط الإنزيمات مثل العناصر الصغرى تحمل كمصادر للطاقة ... Ibraheemaz 6:11 pm
 - المجموعة الثانية** edited صفحة مخصصة للمجموعة الثانية لكتابة وتحديث مشاركاتهمسعيد آل هادييعد الرفاعييعد الرحمن الشدوي Ibraheemaz 12:14 pm
 - المجموعة الثانية** edited , الشحنة على دقائق الغروي بحسب الوسط الذي توجد فيه ,مثل البروتينات و هي غرويات ... فإنا تو ... Ibraheemaz 12:13 pm
 - Group One** edited (view changes) Ibraheemaz 12:06 pm
 - Group One** edited Student Student name: wikibaha التربة حبيبات التربة Ibraheemaz 12:05 pm
 - Group One** edited Group Student name: wikibaha 03 Group One يلي على العسيري - التغيرات المفك Ibraheemaz 12:05 pm
- Thursday, May 30**
 - Group Three** edited (view changes) Ibraheemaz 2:36 pm

On the left side, there is a navigation menu with options like 'Wiki Home', 'Projects', 'Recent Changes', 'Pages and Files', 'Members', 'Discussion', 'Settings', and 'Search'. Below this, there are 'Favorites' and 'All Pages' sections with various sub-links.

Appendices

Appendix 25: Screenshot shows students working together in creating the wiki content



Appendices

Public wikis now require [account verification](#). Please [verify your account](#).

Recent Changes

Pages Messages Comments Files Tags Members

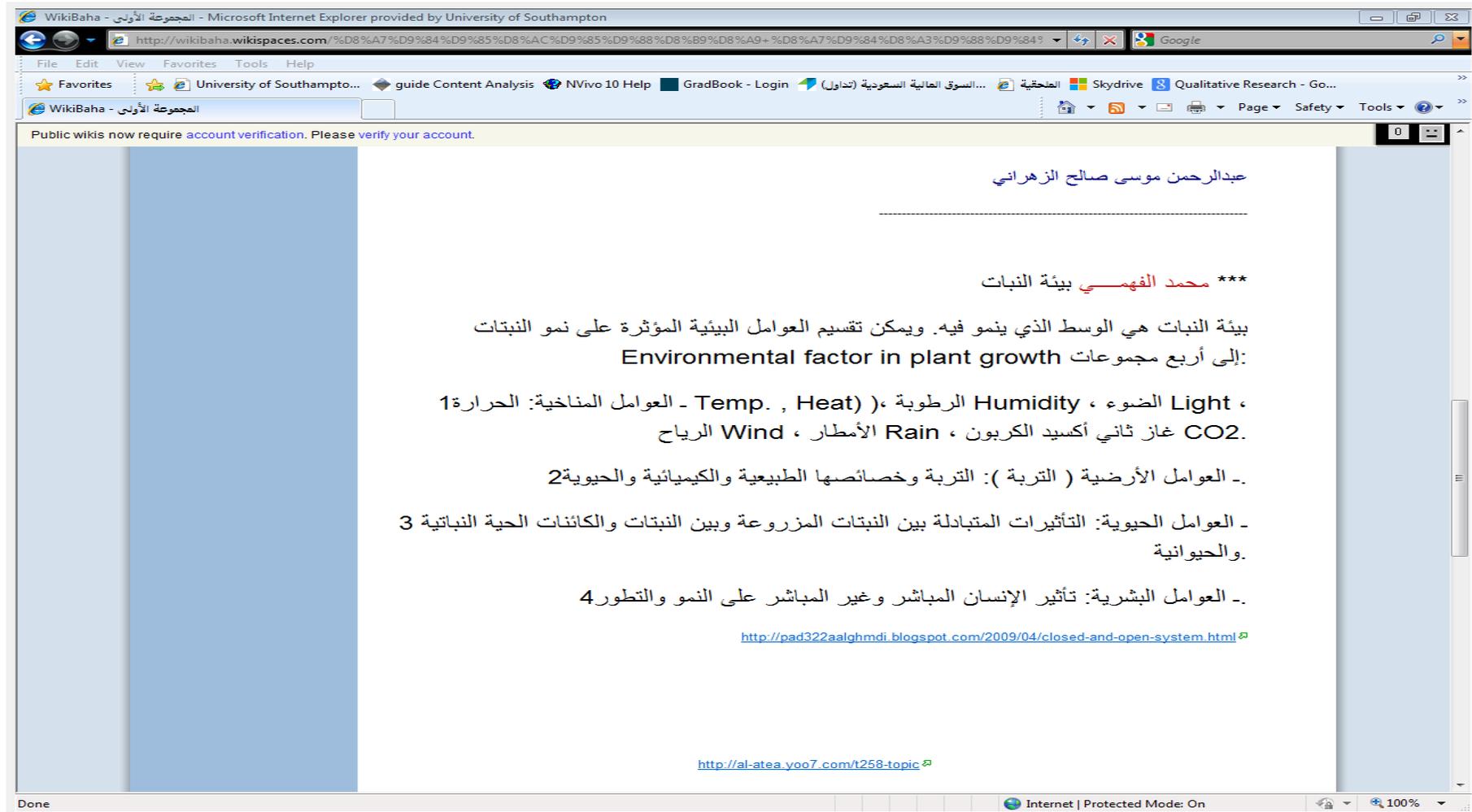
Username: 10/03/2012

▼ Saturday, March 10

		wikibaha24 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha23 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha22 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha21 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha20 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha19 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha18 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha17 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha16 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha15 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha14 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha13 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha12 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha10 joined WikiBaha		Ibraheemaz	11:01 am
		wikibaha9 joined WikiBaha		Ibraheemaz	11:01 am

Appendices

Appendix 26: Screenshot shows examples of student's (IN08) participation on wiki pages



Appendices

Appendix 27: The level of quality of the students' (IN13 and IN06) contributions to wiki pages

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WikiBaha - Group Three - Microsoft Internet Explorer provided by University of Southampton

http://wikibaha.wikispaces.com/Group+Three

File Edit View Favorites Tools Help

Arise Synonyms, Arise Ant... Convert Case - Convert u... http--www.alrajhibank.co... Islamic Society - Universit... Skydrive University of Southampto... guide Content Analysis

WikiBaha - Group Three

Ibraheemaz | My Wikis | Help | Sign Out

BIOLOGY
Researcher: Ibraheem Alzahrani

Wiki Home
Projects +
Recent Changes +
Pages and Files +
Members +
Discussion
Settings
Search

Group Three Edit 32 ...

Student name: IN13

مفهوم الاتزيم

التغذية المعدنية في النبات

أمكن معرفة العناصر اللازمة لتغذية النبات وذلك عن طريق استخدام المزارع الرملية والمائية

ووجد أن .

العناصر التي ثبت أن النبات يعاني نقصاً في النمو عند غياب واحد أو أكثر منها هي

الكربون الأيدروجين الأكسوجين النيتروجين الفوسفور البوتاسيوم الكيريت الكالسيوم

Done Internet | Protected Mode: On 100%

Appendices

WikiBaha - Group Four - Microsoft Internet Explorer provided by University of Southampton

http://wikibaha.wikispaces.com/Group+Four

Public wikis now require account verification. Please verify your account.

0 Ibraheemaz | My Wikis | Help | Sign Out



BIOLOGY
Researcher: Ibraheem Alzahrani

Wiki Home
Projects
Recent Changes
Pages and Files
Members
Discussion
Settings
Search

Group Four

Student name: IN06

1- الاختلال التوازن المائي في النبات .
2- سقوط الأزهار والعقد الحديث .
3- احتراق وجفاف الأوراق و النموات الخضراء الحديثة .
4- حدوث احتراق في أنسجة النبات أثناء النمو مثل لفة الشمس .
5- حدوث تغيرات لا عودة فيها في التركيب الجزيئي للإنزيمات والبروتينات عند اقتراب درجات الحرارة من الدرجة العظمى المميتة .

-: التكاثر الضارة للحرارة المنخفضة

1- حدوث الصقيع في المناطق الصحراوية نتيجة انخفاض درجات الحرارة في الشتاء والربيع إلى 5م في الصباح الباكر ويؤدي ذلك إلى توقف العمليات الحيوية للنبات .
2- ينتج عن حدوث الصقيع تجمد للماء في المسافات البينية مما يعمل على تجمد البروتوبلازم وفقدته لخواصه ويحدث أيضاً تمزق لجدر الخلايا .
3- حدوث تزهير مبكر في بعض محاصيل الخضار مما يقلل من كمية وجودة المحصول .

Internet | Protected Mode: On

100%

Appendices

Appendix 28: Screenshot shows examples of the quality, quantity and multiplicity of students' contributions

WikiBaha - المجموعة الثانية

wikibaha.wikispaces.com/المجموعة+الثانية

Public wikis now require account verification. Please verify your account.

0 Ibraheemaz | My Wikis | Help | Sign Out

درجة الرؤية حجم وحدة المادة المنتشرة في المحلول		
المحلول الحقيقي	(نظر الوحدة 1/1000 من الميكرون) جزيئات وأيونات	لا يمكن رؤيتها بأى آلة ابصار عرفت حتى الآن
المحلول الغروي	نظر الوحدة لا تقل من 1/100 ول تزيد عن 1/10 ميكرون	يمكن رؤية بعض خواصها الطبيعية بالانتراميكرسكوب
المعلقات والمستحلبات	(نظر الوحدة أكبر من 1/10 ميكرون) جزيئات متجمعة كبيرة الحجم	يمكن رؤيتها بالميكروسكوب

لاحظ عالم النبات برون أن دقائق الغروي فيحركة مستمرة على خط مستقيم ، إلا أن تلك الدقائق **Brownian Movement** خواص الغرويات **الحركة البروانية** مترجاف قد استدل (Zig-zag)تسطنم بجزيئات الوسط المشتت وبالتالي تغير في اتجاهها ، و ذلك الاتجاه يكون بخط مستقيم ... مما يجعل حركة دقائقالغروي تشبه حركة الزيجزاج Brownian Movement برون على ذلك عندما لاحظ أن حبوب اللقاح المعلقة في الماء تتحرك دائماً حركة عشوائية مستمرة في مسار متعرج ... فسميت هذه الحركة بالحركة البروانية نسبة إليه يحزى سبب هذه الحركة إلى عاملين الأول هو تفاعل دقائق الغروي نتيجةالتشابه الشحنت على كل منها والعامل الثاني هو تفاعل الغروي مع جزيئاتالماء.وكما زادت لزوجة المسائل أي تزايدت جزيئاته كلما قلت الحركة البروانيةالفرغ الذي يمكن أن تتحرك فيه بحركة ... غير يمكن تمييز الغرويات عن المحاليل الحقيقية من خلال ظاهرة تيندال، فعندما يمر **Tyndal Effect** أن صغر حجم دقائق الغروي يحطيفرصة لزيادة الحركة البروانية **ظاهرة تيندال** شعاع ضوئي خلال محلول حقيقي في كأس زجاجي شفاف فإن مسار الشعاع الضوئيلما يمكن مشاهدته خلال المحلول الحقيقي لأن المحلول يشكث الضوء تشتتاً ضعيفاً ،بينما عند مرور الشعاع الضوئي خلال الغروي فإنه يمكن مشاهدة ذلك الشعاع خلاله والسبب في ذلك يعود إلى أن الغروي يعمل على تشتيت الأشعة المرارة خلاله و هذا ما يعرفبظاهرة تيندال نسبة إلى تينيز الغرويات بعدم قدرتها على التداخلالأكشعية شبه المنفذة ، لذلك فإن سرعة انتشار دقائقها البطيء من: **Dialysis و التصفية Diffusion** العالم الفيزيائي جون تيندال **الانتشار** دقائق المحلولالحقيقي ، لكن الغرويات المحمضرة تكون مختلطة بمقادير كبيرة من الإلكتروليت ووجودالإلكتروليت بذلك الفر يعمل على ترسيب الغروي ... لتخليص الغروي و هو إزاء زجاجي يربطعلى فوخته السطحية الواسعة غشاء شبه منفذ ، ثم يبدأ الإتهاء بالمحلول الغروي المرادتصفيته **Dialysis** منالإلكتروليت استخدم جراهام جهاز يسمى المصفى و يملق الإتهاء بآء آخر فيه ماء نقي ... فيسمح الغشاء بنفاذ أيوناتالإلكتروليت و لا يسمح بمرور دقائق الغروي تكبر حجمها حتى يتساوى التركيز داخلالإتهاء و خارجه . فإذا تم تجديد الماء التي تسرب جزء أخر من أيونات الإلكتروليتالي الماء ، و هكذا بدوام تجديد الماء يمكن التخلص من الإلكتروليت تدريجياً ،تتمطوير هذا الجهاز باستخدام الدائرة الكهربائية بحيث تسير **Dialysis** الأيونات مع التيار الكهربائي فتعادر إلى القطب المعادير لها ، وبالتالي تتصلص عن الغروي و هذا ما يعرفبالبلزة

نظر المساحة سطحها الكبير Adsorption (لتدقائق الغروي القدرة على الإستزاز) الإحصاص

ما هي مصدر الشحنة الموجودة على الدقائق الغروية:تحتوي المحاليل الحقيقية على الأيوناتالموجبة والسالبة معاً . كما في محلول كلوريد الصوديوم ، أو قد تكون متعادلةكالمحلول السكر ، بينما دقائق الغرويات تكون دائماً مشحونة بشحنة إما سالبة أو موجبة يمكن الاستدلال على وجود الشحنة الكهربية على دقائق الغروي إذا وقع تحت تأثيرمجال كهربائي (فرق جهد كهربائي) فإن دقائق الغروي تتحرك في اتجاه واحد ، ناحية القطبالموجب أو القطب السالب ، مما يدل على أن الدقائق الغروية مشحونة كهربياً من نوحواحد فقط . وتسمى عملية هجرة : **قُسّر اكتساب الغروي للشحنة الكهربائية بعدة احتمالاتElectrophoresis** الدقائق في الحالة الغروية تمت تأثير المجال الكهربيللكتروفورسز

Appendices

WikiBaha - Group Three

wikibaha.wikispaces.com/Group+Three

Public wikis now require account verification. Please verify your account.

Wiki Home

Projects +

Recent Changes

Pages and Files +

Members +

Discussion

Settings

Search

Favorites ★

home

المجموعة الثالثة

All Pages

الصفحة الأساسية

المجموعة الأولى

المجموعة الثانية

المجموعة الثالثة

المجموعة الرابعة

home

وظائف اعضاء النبات

Group One

Group Two

Group Three

Group Four

Evaluation التقييم

E-comments, students attitudes towards wiki

edit navigation

☆ Group Three

Edit 36

Student name IN17

||

طين طمي	رمل دقيق	رمل خشن	حصى كبير	حصى صغير	نوع المكونات
					بلا حظ ان بلوط الغلين ينمو فوق تربة مختلعة رملية، مروينية، شيسبية وكرانينية في حين لا ينمو فوق تربة كلسية. وهذا يعنى ان طبيعة التربة تتدخل في هذا التوزيع.
					فما هي خاصيات التربة التي يمكنها التأثير على توزيع الكائنات الحية؟
					وما هو دور الكائنات الحية في تشكل التربة وتطورها؟
					وكيف يمكن حماية التربة وتحسين مردودياتها؟
					. الخصائص الغذائية للتربة - 1
					أ- قوام التربة

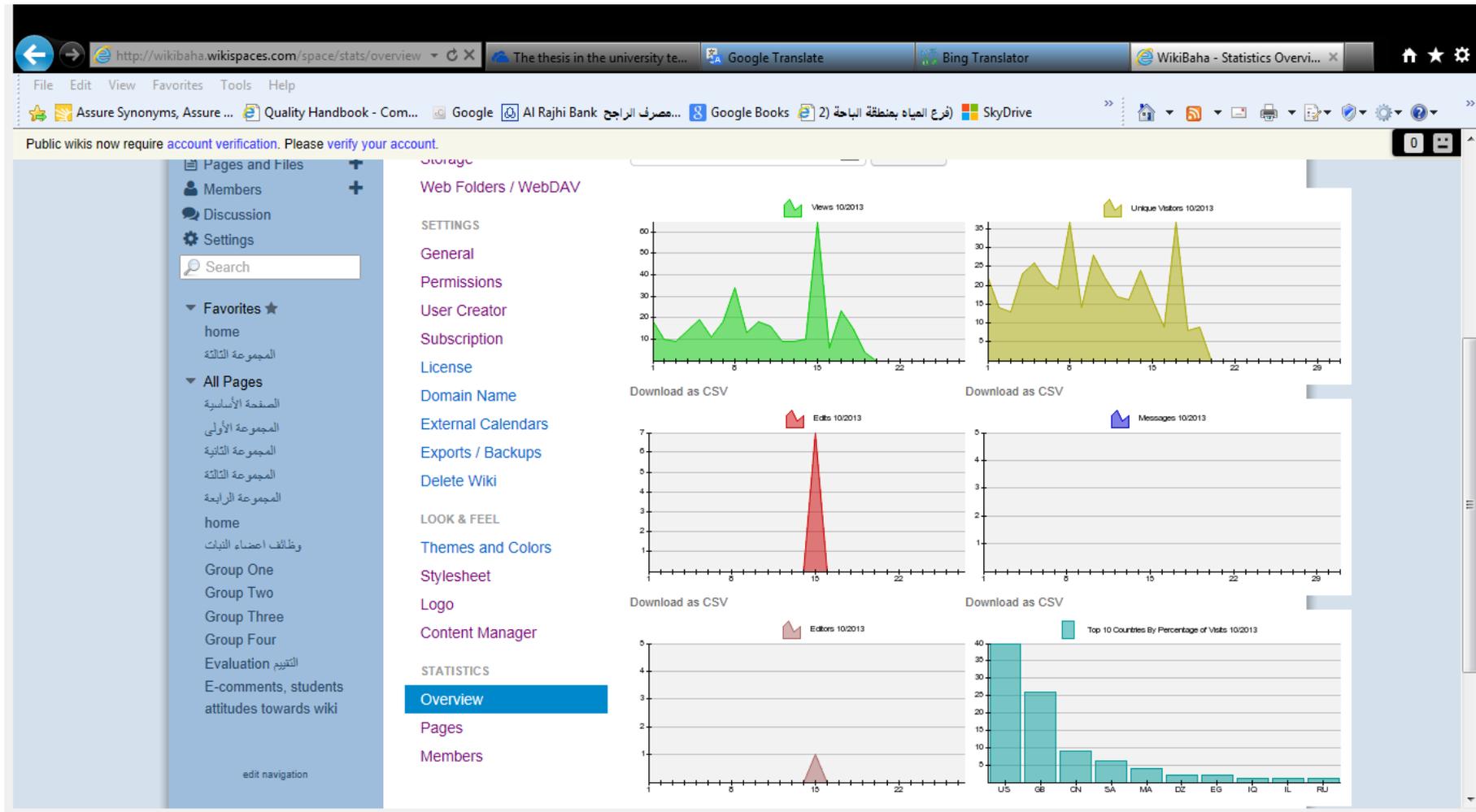
Appendices

Appendix 29: The time-plan for the rest of 2012 and next year 2013

<i>No</i>	<i>Data</i>	<i>Procedure</i>
1	October – December 2012	Data Collection
2	January – April 2013	Data Analysis
3	May – September	Participate on conferences to present the study findings. Present at seminar. Writing up the thesis.
4	October	Revise thesis
5	November	Submit thesis + copies.

Appendices

Appendix 30: The other functions and features that make a wiki more effective.



Appendices

Appendix 31: A definition of Key Terms

This section addresses the key terms that will be used in this research. The purpose of this section is to provide the reader with a full understanding of the meaning of the key elements in the present study (Albalawi, 2007).

Attitude: Attitude relates to the willingness and readiness of students at ABU to learn through using a new method "wiki technology".

Perceptions: Perceptions is the process by which students at ABU organise and interpret their impressions of wiki in order to give meaning and judgements for their perceptions about this technology. According to Slater (2007, p. 99) the term perception means “acting on the sensory information in order to begin to make sense of it—so that localising a sounding object, or visual size constancy would be considered acts of perception”.

Knowledge: knowledge creation can be made through the reflection on the shared information among students. Learners can acquire new knowledge for personal and community benefit (Ball and Freedman, 2004).

Al-Baha City: Al-Baha lies in the south-west of the Kingdom of Saudi Arabia, located at 2,500 metres above sea level. The city comprises 31 administrative centres and has a population of approximately 533,000 (Doha and Samy, 2010).

E-Learning: Electronic learning, this study adopts Rosenberg’s (2006, p. 72) definition “the use of Internet technologies to create and deliver a rich learning environment that includes a broad array of instruction and information resources and solutions, the goal of which is to enhance individual and organisational performance”.

Web 2.0: Web 2.0 is one of the Internet’s applications that allow the user to be more than a reader; he/she can be an editor as well. Web 2.0 is characterised as a social and activity network. Web 2.0 social web technologies enable communication, collaboration, participation and sharing (Melville, 2009).

Wiki: A Wiki is a type of web page that allows users to participate by editing or deleting the content that has been placed on the Internet. The user does not need any specific operating system or any applications software: a simple-web browser is all that is required (Karasavvidis, 2010).

Appendices

The Ministry of Higher Education: The MoHE was established by Royal Decree in 1975 to implement the policy of the Kingdom in higher education. The MoHE is responsible for all universities and institutes of higher education in the Kingdom of Saudi Arabia (Albalawi, 2007).

Higher Education: Higher education is a formal education which allows students who have obtained the certificate-secondary school to complete their education at the universities or other higher education institutions.

The University of Al-Baha: The University of Al-Baha is one of the 13 new universities established in 2006 in the KSA. ABU consists of 11 colleges awarding diplomas, bachelors and master's degrees.

Faculty Member: A faculty member is an educator who works at a university or college and he/she is employed by a formal decision from the MoHE.

Biology Curriculum: The biology curriculum is one of the compulsory curricula in the University of Al-Baha, which students are required to learn during their first academic year.

Collaborative Learning: Collaborative learning is a type of interactive learning among students in groups. For instance, through the Internet via wiki technology this type of learning happens when learners comment, edit and supplement each other's work and reflect on what they have learnt (Leung and Chu, 2009).

Accessibility: The term accessibility is associated with ability of specified people (e.g. learners) to achieve specified goals (e.g. specific learning). Access processes can occur through factor assistance such as assistive technology. Accessibility is often used to focus on people with disabilities or special needs (Peacock et al., 2011). In the current study accessibility refers to the ability of students to access the University in order to attend the lessons regularly.

Emergence Universities: Emergence Universities are the new universities that the MoHE in the KSA established to meet the needs of a growing number of students who desire to complete their academic education.

Appendices

Qualitising data: Converting the quantitative data in a qualitative description
(Tashakorri and Teddlie, 1998).

Appendices

Appendix 32: List of Publications

- Alzahrani, I. and Woollard, J. (2012). The Potential of Wiki Technology as an E-Learning Tool in Science and Education; Perspectives of Undergraduate Students in Al-Baha University, Saudi Arabia. 2nd International Conference on E-Learning and Knowledge Management. International Journal of Information Technology and Computer Science (IJITCS) - ISSN: 2090-1610. Kuala Lumpur. Malaysia.
- Alzahrani, I. (2012). Evaluate Wiki Technology as E-Learning Tool from the Point of View of Al-Baha University students: A Pilot Study with Undergraduate Students in Both Faculties of Science and Education. Glamorgan, Wales, the United Kingdom Education, Learning, Styles, Individual Differences, Network. ELSIN 2012 17th Annual International Conference. June 26th – 28th, 2012.
- Alzahrani, I. and Woollard, J. (2012). The Role of the Constructivist Learning Theory and Collaborative Learning Environment on Wiki classroom, and the Relationship between Them. Riyadh, the KSA: The 3rd international conference in learning and distance learning.
- Alzahrani, I. and Grace, M. (2012). Exploring the current style of teaching biology in the Saudi universities. Singapore: The International Conference on E-Education and Learning Technologies (ICEELT 2012).
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- Al-Abbas, A. (2010). *Leadership Activities and Behaviours that Enable Classroom Teachers*. Master thesis. New Zealand: University of Waikato.
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