

IMPACT OF HUMAN-COMPUTER INTERACTION (HCI) ON USERS IN HIGHER EDUCATIONAL SYSTEM: SOUTHAMPTON UNIVERSITY AS A CASE STUDY

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ABSTRACT: *In this study, Human-Computer Interaction (HCI) perception and impact in the University of Southampton UK, a higher learning environment was measured. We gathered data from respondents (students, administrators and lecturers) via interviews and questionnaires. The aims were to find out the level of HCI influence and the perception of HCI in the school environment. The impact HCI in Southampton University has been positive and it is shown that becoming familiar with HCI concepts improve a user's interaction and efficiency. Not only should a computer be cognitively fit, but also the user should be cognitively/physically prepared to use the system.*

KEYWORDS: human-computer interaction (HCI), usability, higher education

INTRODUCTION

The study of Human-Computer Interaction (HCI) is the study of 'usability'; that is the study of the user's experience with the computer, Carroll (2001). Various theories offer explanations on the evolution of HCI as noted by Bannon (1990); these range from an academic perspective, business perceptions or even that of the everyday user. With the introduction of the internet, in today's economy and learning, the world has become a global village; where information sharing can be moved around the world for little or no cost, Samuel and Adeniyi (2015). With the help of a better understanding of humans and how they interact with computers, developers have been able to find a centre to strike a balance in producing what they perceive the computer users need to make their computer interaction easier.

Hewett et al (1992) defined Human-Computer Interaction (HCI) as a discipline concerned with the design, implementation, and evaluation of an interactive computing system for human use and for studying the major phenomena surrounding them. Also, HCI can be defined as an experience an individual acquires when that individual comes in contact with a computer system. It is an independent discipline which strives to improve the quality of interaction humans have with computers. As the computer has become a critical part of our everyday society, it is, therefore, important to ensure that users have an excellent experience. So many principles have been created to guide computer developers in producing user-friendly systems; HCI has had an opportunity to play a role in providing and influencing user's experience – irrespective of the operating environments. In this study, we would be looking at the influence HCI has on Higher Education and why it is necessary to promote its importance in a learning environment.

With the development of technology within the last three decades, there seems to be a demarcation, between those individuals who were born into a more stable technological environment and those who had to adapt to technological changes. Putting this in perspective, there seems to be a disparity between younger and older computer systems users in terms of how they perceive or use technology. In higher educational learning, for example, there is a blend of people; people of different ages, from different ethnicity, academic or academic orientation. This mixture in higher educational institution gives rise to the curiosity of how people perceive and interact with these systems in a learning situation.

The Research Objectives was to investigate the degree of influence that HCI had on Higher Educational efficiency, exploring how students perceived the role of HCI in their learning process, to what degree it influenced their academic efficiency and also in relation to their administrative and academic staff; in totality, the purpose of this research investigation was to discover whether HCI was really a helping hand or a stumbling block within the case organisation.

LITERATURE REVIEW

Evolution

As technology advances, the requirements of computer users are more demanding, the evolving nature of user requirements is reflected in the multiple tasks that can be performed by devices today e.g. voice control, touch screen devices and many more. According to Grudin (2012), the evolution of HCI from an academic standpoint was a revolution, using the innovation of libraries in the USA as an example and contrasting the effect of this innovation with its European counterpart. He argued that the needs of the users were a catalyst to the evolution and HCI evolution varied in different countries according to their needs. Undoubtedly, HCI advancement is bound to impact different aspects of human life; the society in general, business, and the learning environment (Rosson et al, 2002); where productivity and efficiency of each user, employee or student are profitable and resourceful, Zhang et al (2006).

HCI Issues

Concerning a learning environment, systems need to be efficient, otherwise, users can brand their experience stressful and this can yield less productivity and acceptability. Nevertheless, that is not always the case; making efficiency the number one goal can bring complications. For instance, the Licence Application Mitigation Project (1990) in California, USA tried to speed up the process of giving licenses to increase efficiency and automate the licensing process for which they created a computer interface for people to fill in their details. It was not successful because they did not look into other factors critically such as complexity of the users and their differences. This was because the system developers had one goal on their mind; getting the system to work as soon as possible, and they did not put a lot of effort into the user's aspect, this caused complications after its installation.

Usability issues describe situations where users find themselves having difficulties using a system (Bennett, 1984), and this can lead to human errors. Human errors can be defined as occasions in which intended outcomes are not met due to distractions or the intervention of some chance agency

(Whittingham, 2012). Norman (1988) categorised errors into slips and mistakes, and these are caused by poor interaction between a user and the system. Reason (2000), explained the two approaches in relating to approaching error namely; The Persons Approach, where he explained that, this approach goes all the way to blame to the individuals for the incidents. While the System Approach focused on improving and evaluating the system to reduce the error through provocative inventions. Reason also appraised the Swiss cheese model of system accidents as a very good model used in the systems approach to eliminate latent pathogens. He explained that the Swiss cheese model was used to reduce the amount of errors made by humans by ensuring systems were almost or completely latent pathogens free, Reason (2000) stated that “We cannot change the human condition, but we can change the conditions under which humans work” (p.769). However, In a learning environment, it would be thoughtful of system designers to produce systems that are reducing error provocative situations, and in doing this they have to ensure the system is cognitively fitting the user (Zhang et al, 2006).

HCI Impact in the Medical Environment: Acharya & Oladimeji Case Study

Acharya and Oladimeji (2010) submit that while a percentage of medical deficiencies may be attributed to human factors, e.g. negligence, there is the widely ignored issue of the usability of devices that medical staff often have to operate, i.e. have they received proper training? Are these devices designed for easy adaptation? The impact of HCI in the medical field is significant given that the consequence of these devices not being easily adaptable may be harmful or in the worst cases, fatal.

Acharya & Oladimeji (2010) undertook a case study on an electric hospital bed; a common feature in most hospitals today. The authors note that they could “crash” the bed’s software system, even though crashing the software system should be a programming problem; further adding that once the system was crashed, none of the bed’s buttons worked, not even the cardiopulmonary resuscitation (CPR) button, thus leading a normal operator e.g. a nurse to believe, in ordinary circumstances that a ‘crash’ be attributed to a programming error. In such an instance, this could prove very adverse given that a patient on the bed may need immediate CPR and in the event of an ineffective CPR button, this may undoubtedly lead to the demise of the patient; the authors also note the absence of an error recovery option. Stating that, in the event of a “crash” the only resolution was to unplug the bed by the resort to the bed’s manual of which this paper contends that in the height of such panic, it is unlikely that a nurse under pressure will consider these options. The case study further noted deficiencies in the layout of buttons on the bed’s remote control, noting that often doctors, nurses or even patients were confused as to the workings of the buttons.

The biggest benefit of the incorporation of HCI into any system is the satisfaction of the user. Regardless of the environment, the effective incorporation of HCI into any system guarantees better user experience thus leading the user to maximise his/her utilisation of the system’s potential, resulting in better results. Additionally, the incorporation of HCI into medical devices as exemplified in Acharya and Oladimeji’s case study is very essential to ensuring patient safety and to a large extent increasing patient confidence in the hospital environment. Likewise, having a system not built around the user, this case demonstrates the difficulty the user may face while interacting with the system. If a user is not able to interact properly with a new system, this may result in rejection. In essence, every

device should have a learnability feature that will enable the user to get familiar with the system as soon as they start using it.

The role of HCI in today's computer developmental stage ensures a high rate of computer utilization and friendliness with the user. According to the Chaos Project Report (2004), only 29% of information systems developed succeeded, 18% failed and the rest encountered challenges. The success of a computer system narrows down to the following: the goal of the system, an individual's or the organisational perspective, as well as the user experience when using the system. The success of HCI has also brought about some challenges. Some examples of these include the software developer's ability to build a system that is perfectly able to fit the requirements of a user, as well as meeting the functional requirements (Rogers, et al, 2011).

Furthermore, being able to build a system successfully for a universal user takes a lot of hard work due to the diversity of human variance, different ethics and the understanding and interpretation of information displayed. However, with these challenges, the discipline has grown stronger by overcoming some of these challenges with the progress of technology and the finding of new and innovative solutions, for example, Apple iPhones.

METHODOLOGY & FINDINGS

The research data collecting technique was mainly interview; all interviews were carried out on a face to face basis and audio recordings were taken, with permission from the participants, which last for about 10-15minutes. Furthermore, the non-probability sampling method and the purposive sampling were used to ensure that participants were chosen correctly to answer the question. The samples were drawn from different faculties within the university: Management, Music, Law and Electronics and Computer Science.

The data were later grouped to form a model, where the researcher was looking for the causal conditions, the central phenomena, strategies, consequences and the intervening conditions, from this the theatrical model below was developed.

After data collection, the data were analysed using grounded theory, which is a qualitative underlying approach of what is going on in a substantive area of study that was discovered (Lowe,1998) and (Creswell, 2009). The grounded theory is a 3 stage process namely; open coding, axial coding and selective coding (Strauss & Corbin, 1998).

LOGICAL MODEL:

The model below shows the linking of concepts and categories together in an axial manner to create meaning to data derived from this study. The 6 different sections of the above model illustrate the chains of actions that happened sequentially, starting from the causal conditions to the consequences.

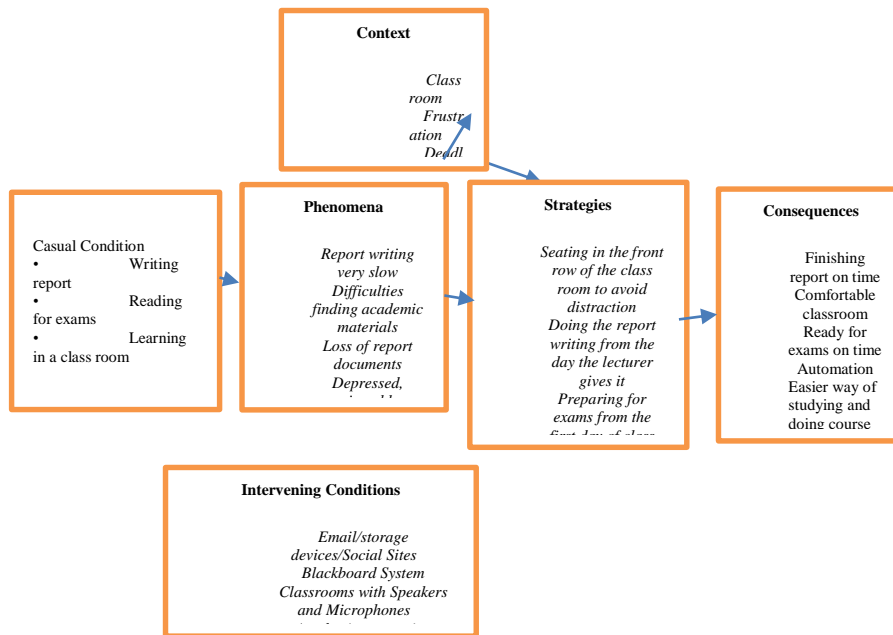
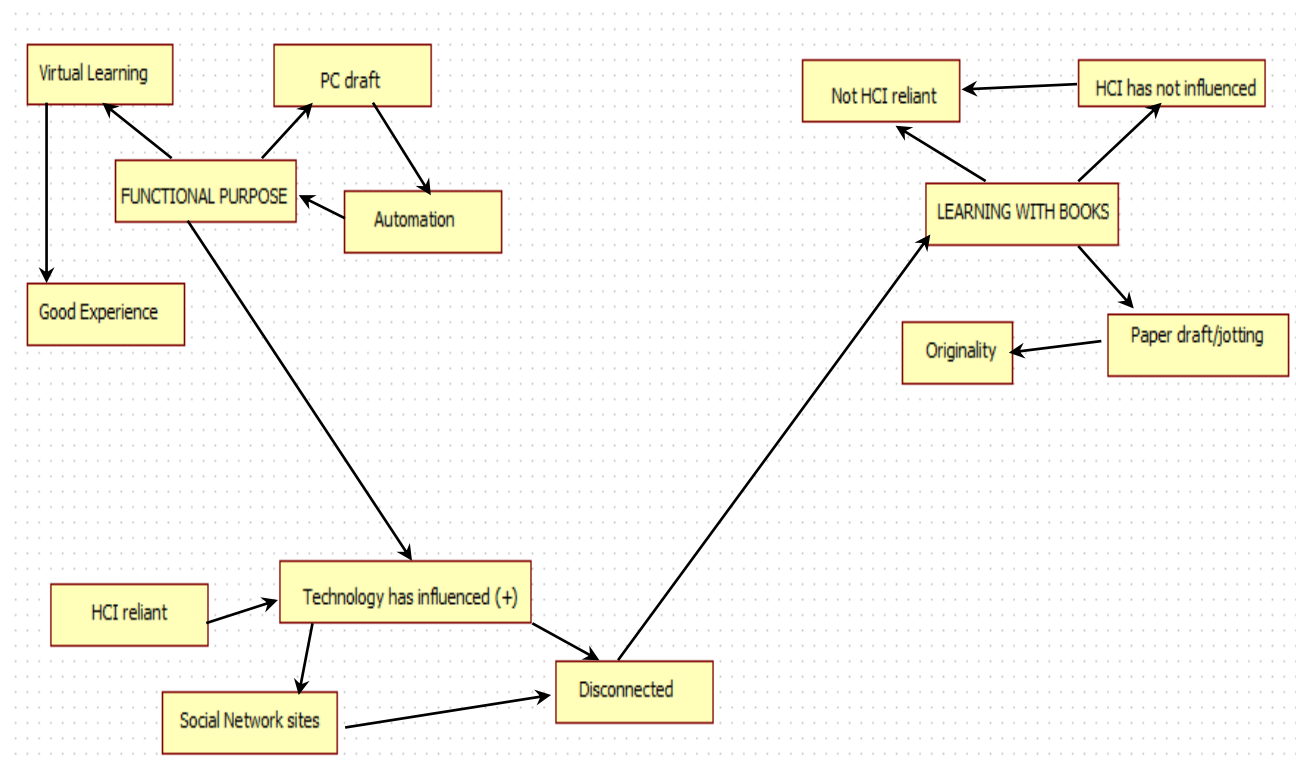


Fig1: Logical Model of research

The Author: The Derived Theoretical Model

The Author: The Derived Theoretical Model**Model Validation**

During the analysis section, a lot of processes were executed to achieve the set purpose for the research, after which every process was reviewed iteratively to improve and ensure consistency and logical compatibility towards achieving the purpose of the investigation.

DISCUSSION

The analysis above suggests that the role of HCI in learning is usually underrated. It is not given its pride of place in a higher educational learning environment. Students do not appreciate or appropriately consider it, except when they run into difficulties and find themselves in situations where HCI is critical for them to succeed. From the analysis, there was an indication that different factors influenced the learning process with regards to the role of HCI.

Related to the Research Objectives

It was observed from the responses that HCI plays a crucial role in today's learning assimilation. This is about how students broke down the information obtained in classrooms and other academics materials. With the rapid developments in technology, it can be said that HCI has definitely "crawled" into the academic institutions, giving cushions to the staff and students by opening out different options to which learning can be experienced and this can be accredited to those people like Huitt (2003) who studied and improved/currently improving the Human Information Processing (HIP)

discipline; from the data analysis, it can be interpreted that a lot of students prefer studying face to face but such learning is enhanced when technological devices and interactions are there to support their understanding.

Another factor that is considered in how students perceive the role of HCI in their learning is its effectiveness. It can be argued, that any good support towards learning will be as effective as support obtained from effective human and computer interaction.

The degree of influence HCI has on students' efficiency can be viewed in different ways, firstly, from the time spent or put in to do academic work and the energy/materials put in to get a certain output. Secondly, we can look at it in the long run, with regards to decrease in input requirement and their output increases or are input requirement the same throughout. Questions related to efficiency reaching its optimum or will there always be continuous appreciation, in other words, looking at the behaviour patterns of efficiency within the learning environment.

According to the general response derived from this study, it was observed that those that used the computer in doing course work supported their statements with "it's time saving, because of spell check and editing". This response can stand in for time spending and resources, in the sense that the respondent would not need a whole lot of time to do the work from paper and then transfer the information onto a computer. Equally writing it on paper might just reduce his speed, when a user gets used to typing on a computer, he/she can write faster on a computer compared to writing on paper. This position is equally supported by Mills (2008). However, some other respondents argued that they would rather do their work on paper; this was because it helped them write and it felt more original. Mills (2008) also explained that on paper ideas are better developed than on a computer, this gives an understanding and support to this respondent.

Furthermore, a respondent from the Law discipline stated that "I preferred reading from books rather than on a screen because I would get a headache". This was not a fault of the system. It can be that such users have vision challenges or that they failed to adjust the screen brightness and or resolution to the optimal level. But this participant will not see it that way. We can blame this to knowledge gaps or attitude challenges. It can also be argued in terms of the blackboard software used by the University of Southampton, a student who has not used it before may encounter some challenges during the first time he or she is using it. Such an individual may attribute the challenges as a result of the use of the new technology and conclude that it is not efficient or usable, instead of the fact that they needed to understand the application to use it effectively.

Nevertheless, some respondents tagged social network as not a source for academic learning and also considering it as a tool for distraction were not wrong per se, because it is all down to an individual, how they perceive it. While some users can easily work from the confinement of a social network system without being distracted or experiencing a drop in their productivity levels, for others the result is the opposite. Those that did not go with the positives can be considered to be used to the traditional ways. From the research all those respondents that preferred reading from books and older traditional ways of studying had one thing in common, they were in the older age bracket and were born when HCI and technology had not yet significantly impacted the educational systems. So they

were brought up using hard copy books and other non-technological means of studying. This is quite understandable.

Finally, from the interviews, it seems the outcomes were influenced by age groups and the younger generation were more disposed to using new technology. The table below shows that the majority of students that accept HCI and technology into their academic lifestyle willingly approve and enjoy the experience over those that were told or compelled to use it. We could see that a lot of students that appreciated the technology and HCI were mostly those in faculties that use it every day.

Summary of Responses

<u>Respondents</u>	<u>Influence and Appreciation</u>
Participants:	<ul style="list-style-type: none"> ● More than half of participants considered social media as a source for learning. ● 50 percent of the participants used it for writing reports and 65percent preferred studying through a computer device. ● The participants that were above 50 years old preferred reading and jotting and doing most of their work still on paper. ● The ESS students preferred doing all their academic-related work on computer devices and were more inclined towards the technological lifestyle. ● More than 80 percent of the participants admitted dependence on technology in academic/other areas of life. ● More than 70 percent of the respondents will be negatively affected by the removal of computer devices from their lives. ● More than 60 percent of the respondents agreed to be reliant on technology and HCI in the learning environment. The weather being compelled or not.

Additionally, from the sample of respondents, the result interprets that HCI had influenced the learning environment significantly and had generally increased the degree of efficiency in their learning environment. The students needed not just the technology to be up to standards but its interaction too, for efficiency and effectiveness towards academic activities. As well as, the Lecturers needed it also for lecture notes preparations and keeping up with schedules. Finally, the administrative staff also benefited too, it helped them plan modules and assign students and other university-related tasks quickly and easily without stress.

CONTRIBUTION AND CONCLUSION

After a thorough review of the analysis and discussion of this study, some theories/concepts emerged. The first one is that “HCI had a significant degree of impact towards efficiency in a learning environment, and the degree of efficiency was dependent on the individual”. This can be expounded in terms of a system being cognitively fit, as well as the degree of positive perceptions attached to the user’s experience during use and these results in greater effectiveness and efficiency.

This research explicitly exposed that, the success of a system and how flexible such success (efficiency) could be applied all came down to the user. For instance, a novice that does not have an idea on how to operate a perfect cognitively fit system, developed solely for a particular learning environment can experience difficulties using it, because the system was not created for his/her faculty or it was created for lecturers only and therefore may not be that suitable for another purpose. An individual who wishes to use this system would require some form of relevant training to enjoy and effectively use it. Another example could be an expert user who runs into problems interacting with the system because of a poor frame of mind at the time of usage of the system. These situations can reduce efficiency but, it is a two-way thing in the end. The system has to be cognitively fit as well as the user being cognitively ready to use the system before the interaction proceeds.

A user must be motivated to be efficient during the interaction. It could also be intrinsic or extrinsic or both, the motivation to use a computer system in doing academic-related work plays a huge role as well as perception. When both of these factors go together, this will increase the user's speed in completing their academic work in a short time, giving rise to efficiency. Moreover, from this, we can agree that familiarity or knowledge also equally enhances efficiency over time. Based on the aforementioned statement, it will not be abnormal for new users who are not familiar with a system to assume that using a computer will make a task more tedious and complex to complete effectively. The three key steps to attaining efficiency in a learning environment can be stated as follows: motivation, perception and familiarity. They follow one after the other and it is recommended that new users or novices should follow this procedure to become computer knowledgeable and competent. So in conclusion, we discovered HCI impacts learning efficiency, but with varying degrees depending on the individual and his/her disposition.

The second developed theories/concept from this study was that "HCI reliant individuals will always hold onto functional purpose when choosing systems". This can be elaborated thus; a user that relies on technology and HCI will always buy their computer at least for a functional reason. From the analysis of the categories and concepts, "functional purposes" and "HCI influenced" categories were always linked together and this was more common with the majority of people that responded with regards to if they relied on HCI when using a computer system. This pattern was frequently occurring during the analysis, so it can be deduced that an individual who knows the value of having an excellent interactive session with a computer system, will always appreciate its presence and will always purchase a system, if not for any other purpose but its functionality. This preference was rated highly by the respondents. In other words, it may perhaps be said that individuals that are influenced by HCI knowingly purchased computer systems at least for its functional reasons. They all wanted to get and use computers, even if it was cheap or of low quality, as long as it got their work done in any circumstance including for learning purposes.

Recommendation

The first recommendation is that since it has been established that computer reduces drudgery and improve learning outcomes, HCI related courses should be introduced not only for the computer and science-related courses but also for every academic pursuit at the university level including for such disciplines like Nursing and Law. This will help increase awareness and make such individuals better adapted to coping in a world that is increasingly driven by technology. This does not mean that all individuals must be highly knowledgeable or must use the highly developed system but the use of

computers with appropriate functionality will improve the quality of life of individuals even in a learning environment. In doing this, there will be positive change by non-computer compliant disciplines in higher education towards the use of the technology and HCI will increase positively which invariably will reduce the demarcation between those who appreciate computer and use it, those who just appreciate it and those who don't appreciate nor use it.

Secondly, as every discipline has its style of reasoning so systems developed for the different faculties should consider that in designing to make the system more user-friendly. The system developed for certain faculties should have extra processes that address their peculiarities and also addresses the diversity in how each of them perceives and accepts a system. Since from the analysis we can indicate that the perceptions differ, it is only reasonable to have extra support to some systems and for the individuals that would need it to guide them through. The reason why these systems should not be having the same process is that those individuals that already have a bit of knowledge concerning some learning supporting systems, will brand this extra support as a waste of time, and this can get them lagging, reducing their motivation and subsequently affecting their efficiency.

Finally, it will be interesting; in the nearest future, that an investigation is carried out on the degree of efficiency HCI has impacted in a learning environment. This will be an interesting path for researchers to go into, where they can look into the efficiency behaviour if it increases continuously, becomes stagnant or diminishes as time passes on. Also, as we observed the different types of preferences to learning, those that enjoy the old school traditional style of learning (board and books) and those that prefer the technological influence in today's learning (virtual). It will be recommended that individuals should not only be dependent on one but should try to be versatile, and adapt to these different situations. This is because of its benefits to them (students and staff) so that they are flexible and easily adapt without any substantial amount of interruption to their learning.

CONCLUSION

In conclusion, it can be said that HCI has impacted the learning environment as it has impacted other corresponding environments. The impact HCI has in the learning environment has been positive, however, the downside to it was that it created room for individuals to depend on it. The positive side to this phenomenon is that becoming familiar with all HCI concepts and appreciating them, improves a user's interaction and this brings about efficiency. As well as, room for more innovative computer-related ideas to make computer systems better for the future or even ideas, innovations or new discipline to support the HCI discipline. Furthermore, there is a significant difference between those who know HCI and appreciate it and those who don't, and this as a result of either the background of the individual or the faculty in which they study. The difference can also be associated with how the students/staff and administrators perceive the role of HCI in their learning/teaching process. Two patterns emerged: some know its value and appreciate its role in their academic endeavours on the one hand and those who only see it as posing challenges and creating learning difficulties. Lastly, as said earlier, not only should a computer be cognitively fit, but also the user should be cognitively/physically prepared to use the system before getting in physical contact with a system.

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