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Virtual Interactive Practice™: a strategy to enhance Learning and Competence in health care students

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Abstract

This paper reports the processes and initial outcomes of a pilot study which investigated a week long 'virtual' children's ward experience for nursing students. Providing sufficient and meaningful experiences which enable students to quickly and effectively achieve competence in diverse areas of practice is often frustrated by the realities of available clinical experiences. Our response to this challenge was to more fully exploit and evaluate technologies which can be used to provide these learning experiences. Students experienced 'real time' scenario based work involving SIM-MAN; interactive information technology scenarios, critical incidents, master classes, video conferencing, and observational skill development exercises. Evaluation methodologies included observation of student performance, competence self rating scales; analysis of videotaped performance episodes and other data generated through the learning activities and lived experience accounts of participants. Initial findings indicate (1) statistically significant improvements in student competence measured through self reports; and (2) evidence of improvement gleaned from observed accounts, video analysis and qualitative evaluative comments. The final outcomes, including work with a control group, will be available for Conference.

Keywords:

User-computer interface; Knowledge, Attitudes, Practice; Clinical Competence; Health informatics; Education and training.

Introduction

The rapid acceleration in the pace of scientific and technological change, when combined with the ethical and professional challenges of contemporary practice, demands pedagogical strategies which enable students and practitioners to safely and quickly acquire, or relearn, clinical competence in health care practice. While there has been a steady growth in the use of virtual reality in health care education and training over the past decade [1, 2, 3, 4], there is a dearth of published work that analyses the application and efficacy of virtual environments to enhance clinical competence in the Health Care Professions. In particular there is little evidence comparing virtual learning activities with 'real' practice; most studies have compared virtual learning with 'traditional' classroom based teaching. Like many other countries, the British Government's agenda is to ensure that there is a competent workforce which is 'fit for practice" [5, 6, 7]. Due to an ageing workforce, reductions in doctors' hours and the demands of an ever changing, technological and consumer led service, it has been necessary to increase the number and type of Health Care workers undertaking clinically based courses or courses which involve clinical experience [8]. Nurses and midwives form the largest proportion of the health care workforce, with approximately 350,000 registered practitioners. In this context, educators are challenged to provide cost effective and meaningful learning experiences so that an increasing number of under and post graduate nursing and midwifery students can achieve clinical competence without detriment to users of the health services. In addition, the use of virtual and other related simulated and interactive technologies can provide alternative routes to the learning of (a) aspects of care delivery that may be infrequent or rare and therefore cannot be guaranteed experiences during a conventional placement, e.g., paediatric or adult resuscitation; (b) rare but important components of a curriculum which may have associated competence requirements and in which students therefore require exposure [9, 10]; (c) expert examples of specified practice techniques and examinations e.g. preparing and giving injections, naso-gastric tube insertion, chest auscultation and a host of skill-based learning; (d) decision making, team working and management skills.

Using unidentifiable real clinical data, captured from anonymised patients and clients, or identifiable data obtained with consent, clinical competencies can be learned and assessed through the students' interaction with a unique blend of structured web based and simulation interactions. This innovative project has been designed to develop virtual learning technologies which are an academically, educationally and professionally robust, cost effective and efficient means for students to achieve and /or accelerate their clinical competence and decision making skills.

The project aims to test the extent to which some traditional forms of learning and development in the real world of the Health Services could be replicated, substituted, applied or enhanced by virtual or other simulated forms of learning. Methodologically, the project is exploring the crucial pedagogical issues

associated with generic, transferable, specific and context bound competence acquisition, retention and adaptation. The findings reported here outline the first phase of this innovative research based educational project entitled 'Virtual Interactive Practice (VIP™)'.

Research questions

Two key research questions underpin this component of the VIP™ project, namely:

1. When compared with other pedagogies, is skill acquisition enhanced when virtual and interactive strategies are used to facilitate competence based learning?

2. Does Virtual Interactive Practice™ offer a cost effective and efficient means to engineer and accelerate clinical competence?

For the purposes of this project, we have defined virtual learning as "a real learning experience from an interaction, that has no steer or effect(s) on patients' or client outcomes, being separated from the event by time and or distance" [10]. 'Virtual Interactive Practice™' is a designated period of assigned practice where technological, computer and/or simulator based scenarios are integrated to provide coherent experiences with which students can interact. The scenarios are constructed with real patient data; the student interactions and the feedback mechanisms are designed to mimic real practice contexts and responses; and where possible, are situated in specially constructed locations resembling clinical environments.

Competence

The methodological difficulties associated with the measurement of competence are well documented in the literature [11]. The problem is exacerbated by varying definitions of the concept and the associated terms competency, capability, effectiveness and performance. The study used the United Kingdom Nursing and Midwifery Council's definition of competence as this was the one with which students, their tutors and clinically based assessors were most familiar. These are the criteria used for assessment purposes to determine registration/license to practice. Competence in this context was thus defined as 'the skills and ability to practice safely and effectively without the need for direct supervision' [8]. Notwithstanding this definition, the VIP™ project qualitatively considers characteristics associated with competence in health care practice, namely emotional literacy, decision making, ethical practice and values, caring, trust, and adaptability. Given that the students were approaching the end of their nursing programme, this definition was particularly apt and enabled students to give us feedback in the context of their numerous prior learning experiences.

Materials and Methods

For pragmatic reasons, the goal of the pilot work was to enable a group of 18 nursing students approaching the end of their programme to be assigned to a Virtual Children's Ward named Badger Ward, situated in the notional 'Highfield Hospital' for five days practice *in lieu* of a 'real' practice environment. The students were studying to be first level Registered Nurses specializing in the care of children. To achieve this aim, the first phase of the project comprised five distinct elements, namely, (1) the acquisition of the necessary equipment, technical support and learning resource; (2) the selection, design and implementation of the learning activities which were to be the focus of the Virtual Interactive Practice™ week; (3) the development of an ethical framework; (4) the design and implementation of the research evaluation; and (5) the generation of a single day rehearsal using another group of paediatric nursing students approaching the last year of their programme. These five elements were interrelated from the outset and were situated within the overall Virtual Interactive Practice™ strategy. Watkinson, Spencer et al. will separately consider the issues associated with the acquisition and management of the technological aspects of the project and the development of the learning resources.

Design, selection and implementation of the learning activities

It was important to maintain the educational integrity of the students' curriculum so as not to disadvantage these students and to generate evidence which could be compared subsequently with 'real' practice learning and development. With this intent, the learning activities were constructed to complement the domains of the students' existing general clinically based competences. The five domains were communication and interpersonal skills; ethical and professional development; fundamentals of nursing practice; health education and promotion skills; management and decision making skills. Within these domains there were 29 sub competences which formed the basis of student assessment in clinical practice. Following consultation with the students' paediatric tutors, specific learning activities were designed through which these competences could be developed. The scenarios included: dealing with a relative complaint, managing anaphylaxis, drug calculations, health and safety incident at work; respiratory/cardiac arrest, septic cystic fibrosis, meningitis contact tracing, eczema, asthma, patient confidentiality, bereavement/loss and the patient journey.

By linking together digital images (still and video), sounds (breath/heart sounds), and anonymised data in standard clinical format, we were able to construct real patient scenarios which were in some instances augmented by actor based situations (relative complaint), interventions (deteriorating patient SIMMAN) and environmental clues (skill laboratory posers). When constructing the scenarios, we focused upon the desired student interactions and the relationship between the interaction, the assessment of student competence and the learning outcomes underpinning them. We deliberately employed various media through which these interactions could take place, where possible replicating the medium currently or about to be used in practice. This strategy provided stimulation to students and enabled us to begin to gather data concerning the experience and efficacy of these different approaches. For example, in the case of a health and safety incident, there is a requirement to complete an Accident/Incident form which was located within a networked filing cabinet. The completed product is then available for assessment and student feedback. In the Asthma scenario, students were expected to be able to identify respiratory wheeze on aus-

cultation. The interaction was achieved and assessed through programming SIM-MAN and observing video taped performance.

Once the vehicle for interaction and participation had been selected, the scenario was 'story boarded' and the resources identified to achieve the desired effect. For example a video clip of a child with cystic fibrosis with the associated chest X Ray, blood test results indicating sepsis, video of an expert nurse accessing a Percutaneous Endoscopic gastrostomy. The required resources were then obtained from the clinical areas strictly adhering to the ethical framework devised for the project. Once obtained and collated, the resources were then assembled in a web based format, and tested for usability on colleagues. This is to ensure that these scenarios could be accessed with students who have minimal prior computer experience. The timetable for the VIP™ week was then constructed to give a balance of computer time, simulator time and other related experiences in Badger ward, expert tutorials, group work and self directed study. The integrity and coherence of the week was achieved by considering the learning activities both individually and as a collective whole.

During student time in Badger Ward, practices and interventions were adopted which mimicked the reality of ward life in both its ritualistic behaviours and chaotic, unpredictable nature. Badger ward itself comprised a clinical skills laboratory which was equipped for the week as a four bedded paediatric bay complete with relevant equipment, charts, telephones, wall displays, sounds, toys and models. In addition students had access to a 'ward' staff room and 'base room' for the week. During their time in Badger ward students were expected to wear appropriate uniform and operate as a clinical team of three to four adopting the role of 'registered nurse'.

Ethical framework

The collection, storage and use of digital patient data are areas where ethical guidance is emerging. The team developed its own set of Guidelines for the project based on the current legal position in the UK [see 13, 14] and informed by principles from other types of data repositories like the genomic databases. While this topic is too extensive to discuss within the confines of this paper, the team intend to publish our experiences and VIP™ Protocol as we have identified that this is a field with little attributable data and guidance.

Research evaluation

In addition to the normal evaluations of curriculum activity, it was necessary to design an evaluation framework that could fully capture the many nuances of this intervention and address the related research questions. Within the main VIP™ strategy all the key components of an evaluative methodology, namely the structure, process, outcome and impact elements associated with the given interventions will be addressed [see 15]. Literature reviews indicated that there was no evidence of this type of Virtual Interactive Practice™ week having been attempted elsewhere. The dilemma we faced during the pilot activity was the necessity to capture 'real' student experience and reactions uncontaminated by prior knowledge of the content of the week. This meant that we were reliant on self reports of competence and observed behaviours rather than evidence from pre and post intervention performance tests. At this juncture, the student group as a whole had no prior knowledge of the content or nature of the week and therefore responded to events 'naively' based on their constructs of 'virtual' learning and competence. While this may appear as a methodological tension and potential flaw, we considered that at this early stage, the benefits outweighed the disadvantages and experience has demonstrated that we have been able to note the implementation effects of an intervention without the influence of a 'hidden curriculum' or student 'grapevine'. The research design contains the development of observation and assessment tools to incorporate within our subsequent work. These are being constructed from the analysis of the emerging data, particularly the video taped episodes and teacher/student evaluations.

In the reality of practice, events are unpredictable and students have to learn to adapt and respond to events as they unfold. To sustain this degree of reality, some components of the week have to remain unknown to the students and thus cannot be readily 'pre-tested' without careful consideration. These design tensions are typical of exploratory work within the participative, action research, educational evaluative paradigms and during the preliminary phases of experimental studies. The research has the hallmark features of bricoleur activity [see 16].

The evaluation strategy comprised a survey which included: (a) current and retrospective self report competence ratings; which included data concerning student prior experience; (b) satisfaction scores addressing the week as a whole and the individual elements in relation to content, learning experience, realism, and comparison with other forms of learning; (c) specific detail of the SIM-MAN scenarios and experience; (d) video taped observations of activities; (e) data from the computer based tasks; (f) observational notes of key components of the week and 'debriefing' sessions of students and staff to capture the lived experience; and (g) technical notes relevant to the administration and management of the week. For all survey responses, students were given 5 point rating scales from which mean scores were elicited, with 5 being the 'best' score.

In an attempt to measure the impact of the week and to enable some degree of comparison with other students in the cohort, appropriate elements of the self report survey were administered to these and other students in the cohort at the end of their last clinical placement which followed the VIP™ week. At the time of writing, these surveys are about to be administered.

During the single day rehearsal, the survey, process and evaluation forms to be used during the VIP™ week were tested and appropriate adjustments made. The students who participated in the rehearsal agreed not to discuss their experience with any other students and to advise us on the format and structure of the survey forms. It has been evident that these students had kept their word and not discussed their experiences with colleagues.

Analysis

Quantitative data was analyzed using frequencies, descriptive statistics, paired-sample t-test and Wilcoxon Signed Ranks Test (exact significance 1 and 2 –tailed). The self report competency rankings and scenarios were analyzed using the mean scores. Qualitative comments, group interviews and observation data

accounts were content analyzed in relation to pre-determined themes and those generated through the study. These data are then related back to the research questions.

We are mindful that because these students were nearing the end of their programme and had, with one exception, passed their clinical assessments to date, there might have been a natural 'skew' on the competence ratings towards being 'fully competent' (score 5) rather than 'not competent' (score 1). Data from the comparator group may illuminate this point. Indeed, we were aware of potential ethical and professional issues that could arise as a consequence of administering this survey so close to student programme completion and potential registration.

Results

The results presented here are those emerging from the preliminary analysis and first study sample. From the self report assessments of the student competences in the five domains and 29 sub competences taken from the students' clinical assessment competencies, fifteen of the twenty nine demonstrated statistically significant improvements in competence levels. These competences were spread across all five domains. All the remaining competences indicated a tendency towards statistical significance. Each scenario demonstrated a statistically significant change in competence levels as a consequence of the week.

In response to their overall degree of satisfaction with the week as a clinical learning experience, the mean score was 4.18, with 87.5% of the students judging that the content of the week was 'just right'. The twelve individual components received mean score evaluations ranging from 3.65 to 4.3. The highest score was awarded to the respiratory and cardiac arrest team scenario which involved the use of SIM-MAN (4.31) followed closely by tutor support and guidance (4.29). The students rated the realism of the learning experiences from 3.56 (septic cystic fibrosis) to 4.4 (SIM-MAN). The bereavement and loss scenario was the only one where any students (2 out of 17) indicated that they had learnt the skills less efficiently 'than in a real clinical situation'. In the response to the use of SIM-MAN, when asked to identify any factors which could improve the sessions, 76% of the students requested more time with SIM-MAN.

Discussion and Conclusion

The paper has clearly indicated the many nuances to this work which has crucial implications for educational practice and competence development in health care settings. While the study's current participants are nursing students, there is scope for application to other students at pre and post registration/license levels. Furthermore the potential to exploit interprofessional, team working and decision making learning and development is evident. Notwithstanding these possibilities, the paper has demonstrated that there are many technical, ethical and methodological issues to be addressed in this multifaceted project. It is the integration of the various elements to the production of coherent learning experiences which are its unique feature. This integration of relevant expertise and experience is achieved by the team managing the project who together offer expertise in health care informatics, health care education and curriculum design, educational technology, nursing specialties, health care/research ethics and educational/health services research. The role of the tutorial staff cannot be underestimated, particularly their contribution to giving feedback on student performance, adjusting events in the light of circumstance, and the delivery of 'master class' tutorials which arose in response to student performance and interaction.

To address the research and pedagogical questions which underpin this project, particularly those related to the acceleration of clinical learning, competence and the cost effectiveness and impact of these pedagogical tools, further investigative, evaluative work is necessary if VIP™ is to become more than just a 'novel' [17] time limited experience. We believe that VIP™ can be an acceptable, effective, efficient, practicable, accessible and durable learning tool which has the potential to offer 'added value' dimensions to the attitudinal, cognitive and psychomotor components of professional competence. It is with these issues in mind that the Virtual Interactive Practice Project has been designed and is being developed.

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