The use of handheld computers and personal digital assistants in the clinical learning environment in order to support and enhance student learning

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The project team were awarded nine Personal Digital Assistants (PDAs) and Bluetooth keyboards. It also used Microsoft Photo Story to create learning resources and the InPractice software, used for planning and administration, was developed to create a mobile version.

The BSc (hons) Radiotherapy and Oncology (RT) degree at Cardiff University is an integrated degree where students undertake 50% of their learning within the clinical environment. Current practice requires staff and students to leave the clinical departments to undertake reflection and access the current software. However it is rare that staff are able to leave the department immediately, resulting in an often considerable delay in feedback and students having to 'chase after' staff to have their objectives signed off. The outcomes of this project were intended to benefit students, practice based educators and clinical staff by making learning and teaching interactions more timely and effective, utilising staff time more efficiently and ensuring that students can have their competencies assessed with immediate feedback on their clinical learning. A number of learning packages were created to support students' clinical education while on placement, and competencies and objectives were recorded using the InPractice software.

Significant developments

The technology arrived later than planned which meant that the project timeline for achieving the outcomes was 'out of sync' with student placements. It, therefore, became necessary for us to change the student group involved in the project from the 2nd year to the 3rd year group. Although this did not cause any significant organisational problems, the learning packages had been specifically developed with the intention of supporting level I and II learning. It did, however, generate significant discussion amongst the group in relation to how CT anatomy and radiotherapy technique links with patient outcomes and treatment side effects. This has also had an impact on teaching staff with reflection on how the subjects are currently taught looking to more effective constructive alignment.

Issues related to ethical approval delayed the acquisition of additional funding to begin the software development. The CoR were insisting on ethical approval whereas the chairman of the local research ethics committee did not believe that the project needed ethical approval. Months were lost in trying to resolve this issue and impacted on our ability to proceed with software development.

NHS Trusts are, understandably, concerned with issues of protecting patient data and will not allow the use of wireless technology in clinical departments. The wireless facility on the PDAs had to be disabled in order for the technology to be taken into the clinical environment. This meant that alternative methods for downloading information and back-up of assessment and competency data had to be explored.

The learning packages produced with PhotoStory were supplemented with audio information. These proved to be large files which filled the internal memory capacity of the PDAs. SD memory cards were purchased (by the Department of Radiography, demonstrating support for the project) to increase this capacity and enable development of further packages.

Additional funding had been sourced to buy the project team time out of the department to enable development of the various learning packages. This did not, however, have any effect in reality since outsourcing for teaching cover was unsuccessful.
The team underestimated the enthusiasm with which the practice based educators received the PDAs and learning packages. Clinical staff see a significant role for the use of these mobile tutorials in supporting their mandatory continuing professional development activities and have requested access to the packages for their own personal use.

6 final year radiotherapy and oncology students trialled the use of PDAs whilst on clinical placement at Velindre Cancer Centre, Cardiff. Focus group discussion and individual evaluation questionnaires were completed at the end of the trial period. One student did not complete the questionnaire. Of the 5 students who completed the questionnaire, 4 indicated that they found the learning packages to be 'useful' and 1 indicating that they were 'very useful'.

Student evaluations of the benefits of using the PDAs in practice were generally as expected (convenience, availability and accessibility of information, ability to meet individual needs by developing own memory aids and notes) the barriers to their use were highlighted as 'fear of loss or damage' and the need for more text to support the visual information within the learning packages. Students reported feeling self conscious with using audio whilst in the clinical learning environment with staff and patients and even when used, background noise made the use of audio in clinical departments difficult to hear and impractical.

All evaluations reported a preference for text with audio within the learning packages. This was rather unexpected although individual learning styles of participating students had not been identified prior to taking part in the project; it had been assumed that audio alone in support of the visual information would be preferred, especially for the one student in the group with dyslexia. The videos below show example learning pages with and without audio.

http://www.youtube.com/watch?v=G1cYEKC5uHM&feature=player_embedded

http://www.youtube.com/watch?v=rFZ8Huibt98&feature=player_embedded

Evaluations did not request exclusion of audio but identified that it should be supported by text. One student with eyesight problems also noted difficulty with the size of the screen, having 'to strain eyes to see text and images' but still reported to prefer text with audio.

Learning packages developed with Photo Story software were unanimously evaluated as being superior to PowerPoint with Photo Story being deemed more 'interesting', 'user friendly' and easier to manipulate.

One other unexpected outcome was that students reported to be 'distracted by the games' available on the PDA. The team was initially unaware of the presence of games and will now take steps to make them unavailable!

Benefits of this approach for inclusion

One of the initial benefits seen was with staff enthusiasm for the use of technology to support clinical learning. Staff not initially included in the project team requested to be a part of the development programme with a view to making the learning packages transferable to other professional disciplines.

Focus group discussions with the trial group of students suggested that the use of PDAs would have a positive influence on prospective students, addressing the currently topical issue of recruitment and retention of students to radiotherapy training.
There also appears to be a cost benefit associated with use of the PDA for the clinical department, although this was not quantified within the project. The opportunity cost of practice based educators' interactions with students could possibly become a saving for the organisation in terms of time available for clinical duties.

Each student is provided with a lever arch Clinical Progress File (CPR) for collation of clinical competencies and objectives, each of which is signed off and validated by a practice based educator. These heavy files are carried into departments and are often left for some days for staff to sign. This has a number of obvious disadvantages:
- Infection control issues as these are carried between hospital sites,
- The potential for loss and the subsequent impact on the students' ability to provide evidence for graduation,
- The academic department has to meet the cost of providing these folders and forms on an annual basis.

PDAs are more easily cleaned with alcohol wipes which would reduce the risk of cross infection as these are moved between departments and hospital sites. Although there is still the potential for loss, regular downloading and back of data to the network server would substantially reduce the risk of any loss impacting on the student's progress. Initial costs for technology and software development have been met through successful funding bids so savings made by the department from CPRs could be used to purchase more technology.

Students embraced the opportunity for suggesting further learning packages for development for the benefit of students across all academic years. It has been suggested that for some students, engagement with learning can be enhanced through more active practices (Bryson and Hand, 2007) and that pedagogic strategies should be developed to

meet the learning styles of students (Cuthbert, 2005). Academic staff are now considering the value of introducing the development and presentation of learning packages by students as coursework for formative assessment and feedback.

Drawbacks and disadvantages

Issues related to software development have also caused problems as the software consultant was initially reluctant to comply with the initial costings given for development, suggesting that these were now insufficient to cover the required work.

- A compromise was reached with selected areas chosen for mobile development rather than the whole package of software associated with InPractice. However due to this delay, students have had a very limited introduction and time to use this in practice, making formal evaluation difficult to quantify. However the project is ongoing and consequently staff and students will have the opportunity to utilise more mobile applications of InPractice for further evaluation as more funding is secured.

Some issues with the technology were identified:

- The keyboard has to be assigned to the PDA Bluetooth each time it is used and must be kept fully charged in order for the connection to be successful.
- The keyboards proved to be rather bulky for carrying around within the clinical departments and students have suggested that these would be better kept in a central location where they can access them as required. All students felt that the keyboards were easier to use than the PDA keypad itself.
- The capacity of the PDA batteries for holding charge was relatively limited with an inherent risk of data being lost as the battery fails.
- The need for recharging on a daily basis had to be reinforced to students as well as the need for regular downloading of information to the network server,
- To prevent loss of the learning packages, and to preserve memory capacity, these were downloaded to SD cards.

Summary and reflection

As a result of this project, we have found that students have become more engaged with their clinical education; actively seeking ways to improve their understanding of the link between academic learning and clinical practice and suggesting ways to enhance their own performance in clinical assessment by suggesting and self producing PDA learning packages. For staff, an appreciation of student strategies for learning has helped us to develop our pedagogical practices to meet the needs of individual students.

In managing this project, trying to align applications for funding from different sources has been problematical. We realise now that if one or other application had failed, the project would not have been viable. This needs to be considered in more detail for any future project bids.

In addition, co-ordinating activities between clinical and academic staff for the undertaking of this project have been far more difficult and time consuming than originally anticipated. For any future work, a more realistic timescale would need to be agreed in order to achieve the outcomes.

So far, the use of PDAs has been deemed successful, however, the number of students involved has been limited. In order that all students have the opportunity to have access to a PDA for personal use, several issues would have to be considered, such as:

- Could funding be found to provide the technology for every student on clinical placement?
- If not, how would we priorities between individual students?
- Would it be ethical to ask students to purchase their own?

On reflection, one of the most significant impacts of this project to date has been the enthusiastic response to the learning packages by practice based educators and students. This in turn has caused us to reflect on the way the initial teaching of these subjects was delivered.

In summary, it would appear that students and practice based educators have embraced the use of mobile technology in providing a vehicle for the support of students' clinical education and recognise its value in integrating theory with practice in the clinical learning environment.

This project was presented at the Higher Education Academy's Annual Conference 2009 - for a video of the presentation and other resources see HEAT at the Higher Education Academy Conference