



Has mobile technology disrupted the pedagogy of Problem Based Learning: The tutors perspective

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ABSTRACT

Background: At Manchester Medical School (MMS), mobile tablet technology is embedded within problem based learning (PBL). Anecdotally, tutors perceived a disruption to PBL. **Summary of work:** We employed a census survey of phase 2 PBL tutors in MMS. We queried a) demographics b) technological abilities c) perceptions of ipad use, and d) of mobile technology in PBL. Nominal and ordinal data were analysed descriptively, text responses with content analysis.

Summary of results: Response rate was 58%. 82% of tutors thought ipads had changed PBL, commenting that PBL was more interactive (44%). The strongest theme, was that facilitators did not feel ipads had altered preparatory work. Emerging themes concerned the reduction of interaction within group and with facilitators. Facilitators felt groups used their ipads to clarify the setting (20%), define the problem (14%) and document intended learning outcomes(18%). Many perceived students using ipads for individual learning (21%), and group feedback (13%). Few facilitators felt that mobile tablet use had changed the pedagogic order of PBL, but had altered students approach to information gathering and presentation.

Conclusion: This survey has illustrated the influence of mobile technology on the process of PBL, demonstrating tablet use in most of the 7 stages. A strong perspective is that this enhanced this process.

KEY WORDS: Problem-based-learning; Mobile technology; Tablet, ipad

INTRODUCTION

E learning has become embedded in all aspects of both undergraduate and postgraduate education. When considering pubmed alone, 12 papers were published between 1990 and 2000 on e- or m-learning. Between 2005 and 2015, this increased to 1402. This alone illustrates the growth in interest in this field as both technology improves, and the interest of using technology for education increases. AMEE (an International Association for Medical Education) have produced guides regarding potential use, set up and validation of e learning (Ellaway guide 1,)[I] to assist those interested in the advancement.

E learning has been reported to enhance the learning experience, increase knowledge retention, be more acceptable as a learning platform for generation 'C' (Generation C is a term used to describe people who care deeply about creation, curation, connection, and community) and increase interest and interaction in a topic.

The successful Interaction of education with technology has become increasingly important in order to fully utilise the diverse set of resources available, along with the ability to exact agency over the choice of resources used.

The initial description of PBL involved 7 steps or 'jumps'. PBL was designed as an active, immersive learning tool developed to encourage students to develop a responsibility

for their own learning. It was designed to be a collaborative process utilising patient problems to motivate learning, along with acquiring and applying knowledge to the clinical scenario. The classical 7 steps are; 1) Clarify the setting, 2) Define the problem 3) Analyse/ investigate the case, 4) re-structure the problem, 5) Formulate the learning goals, 6) individual learning, and 7) report back to the group [II].

Moust et al [III] have described that since the inception of PBL the way that students engage with the 7 steps has changed. They report that students skip brainstorming and elaboration, thus in effect ignoring any prior knowledge concerning the problem. This has been reported to make future learning less efficient. They report that during synthesis and integration, students often ignored the application of knowledge to the problem, favouring short reports from similar resources. These problems may be exacerbated by lack of tutor training, inadequate tutors or group size, all of which may alter the dynamics of the group. Tutor guidance has also changed, to include not only process information, but also learning outcomes. Coupled by students feeling they are unsure of the depth of knowledge required 'to pass', PBL can become subject matter orientated, rather than process driven. This again may reduce the application of knowledge to a problem, and the integration of new knowledge. The introduction of multimedia has been reported in many contexts to be beneficial to enhance resource acquisition,

tailor learning to the learner, and enhance assessment. Wazir et al [IV] introduced electronic versions of classic PBL cases allowing for the embedding of videos, pictures, and other multimedia. They report a perception of improved interest, interaction, and learning from the students. Samy [V] suggests that the addition of multimedia to PBL enables greater communication, reflexivity, and available resources.

Manchester medical school (MMS) introduced a hybrid PBL curriculum in 2011. This was enhanced by the introduction of a technology-enhanced online learning environment, which was complimented by the introduction of tablet technology (Apple iPads) for student in the clinical years. This allows for an environment whereby PBL remains the main educational technique, with blended learning geared toward m-learning. This environment creates an ideal situation in which to explore the impact of m-learning on PBL. Does the novel addition either detract from, or enhance the learning experience. Regarding PBL, how does technology integrate with the face to face nature of group sessions? Have the 7 steps been altered as described above? Specifically regarding resources available with online integration, it is important to understand student's resource management, and whether the provision of resources actually improves learning. Jeong et al [VI] investigated this question within a PBL environment for pre service teachers, utilising a structured online PBL programme (STELLAR). It became apparent that it was important to initially guide students towards appropriate resources, with resource awareness and agency being crucial to proceed to a higher level of learner. The interaction of novel technology goes beyond the isolated student experience into a need to understand how this affects the delivery of education by tutors. We need to understand the interaction of students with technology and perhaps the need for greater tutor training to utilise potential technology to its best advantage. Tutors of the future will not only be expected to know their topic, but also which resources offer the best information, from books and people to online sites. Tutors will be expected to manage the face to face group with the face to technology interface. As Moust et al [III] point out, tutor engagement, understanding and training are important facets to the success of any novel implementation. They council consideration of tutor perceptions and guided training based on that.

METHODS

Research Questions

Anecdotally, within MMS, the introduction of tablets has been perceived to disrupt the PBL groups. We therefore set out to address these questions.

Do tutors report that the use of tablet technology within PBL alters the seven steps of PBL.

Which of the seven steps of PBL were perceived by tutors to be the most and least affected

Methodology

In the academic year of 2013 following the introduction of tablet technology to MMS in 2011, we employed a census survey of phase 2 (clinical years 3 and 4) PBL tutors. PBL tutors were queried on a) demographics b) technological abilities c) perceptions of ipad use, and d) perceptions of the effect of mobile technology on PBL.

The survey was constructed of closed questions, multiple choice/ checkbox questions, and open free text questions. Information such as age and years of experience were clustered into 'ranges', i.e 31-50yoa/ <2 years experience. Previous personal experience etc was answered as yes/ no.

Tutors were identified through the undergraduate teams databases in the four teaching hospitals of the university. The survey was administered to all tutors. The survey was delivered by email, with a link to an anonymous form hosted by a web server (google). Tutors were emailed with the link on two separate occasions to increase response rates.

Ethical Approval

Ethical approval was sought and granted by the appropriate University research Ethics Committee. Responses were anonymous unless the tutor specifically requested acknowledgement for quoted comments.

Data Analysis

Nominal and ordinal data were analysed descriptively (percentages, range and mean likert scores) Free text responses were analysed with content analysis. The 2 independent coders followed a pattern of initial topic coding, followed by analytic coding. Codes were developed during text analysis, with checking and recoding by the second independent coder.

RESULTS

Response rate was 58%.

Demographics

Tutors from three of the four sectors responded. 62% of the respondents were from the Central sector with the South (Wythenshawe) and Preston contributing 27% and 11% respectively. Tutors were evenly distributed between sexes; Male (49%) and Female (51%), with age ranging from 20 to over 60. Most tutors were between 31 and 50 years of age (71%), with only 1 being over 60. Tutors ranged in their experience from novice (0-2 years), 32%, to experienced (>6 years), 16% with most reporting <4 years experience (46%).

When questioned about their personal experience of PBL and training in PBL, 31 (57%) had personal experience of PBL within their training, with 36 (95%) reporting attendance at training in the techniques of PBL at MMS (table 1). 35 of the tutors were consultants (70%), although there were 8 (16%) junior trainees, and 7 (14%) allied health professionals. Tutors were reasonably evenly distributed between year 3 (44%, 24) and year 4 (61%, 33).

Tutor Computer literacy (table 2 for ordinal data)

When describing their confidence with using a PC with 1 being no confidence and 5 being very confident, mean likert score was 4.4, with 35 (93%) answering 4 or 5, confident or very confident. 35 (63%) said they used windows based machines, although 21 (58%) were very confident or confident with apple technology. A further 10 (26%) were ambivalent (mean likert score 3.68). Only 6 (16%) tutors were not confident with apple technology. 21 (38%) were happy with ipad's as a user, whilst 8 (15%) were not confident with an ipad (mean likert score 3.65). 12 tutors (22%) owned an ipad.

Tablets in PBL (table 1 for nominal data)

54 (98%) of facilitators allowed tablets in PBL. 43 (81%) of tutors thought that ipads had changed PBL, with strongest statement of agreement by 27 tutors, being that ipad's had made PBL more interactive (59%). The strongest theme, in the content analysis, was that facilitators did not feel ipads had altered preparatory work as exemplified by the following comments:

"I don't feel it has been detrimental. In fact the opposite; the students appear to have much better prepared notes on the subjects than I ever had (my scraps of paper), and I only graduated in 2007!"

"Absolutely not. I think the students create better files to support each case by pasting data together".

Other emerging themes concerned the reduction of interaction within group and with facilitator.

"The interaction and sharing of knowledge amongst each other was minimal as well".

"Too much reliance is put on the students saying that they have downloaded information and will email it around rather than discussing it during the session".

Groups mainly used their ipads to clarify the setting (39, 72%), define the problem (27, 50%) and document intended learning outcomes (38, 70%). Many also used ipads for individual learning (44, 82%), and for group feedback (26, 48%). Few facilitators felt that mobile tablet use had changed the pedagogic order of PBL, but had altered students approach to information gathering and presentation with 42 (79%) commenting that students used their ipad to open the case. Few students used the ipad for apps such as mindmaps, file sharing or presentations. 43 (81%) felt students used the ipads to take notes and 38 (72%) to look up information during the sessions. Therefore tutors felt that the step most affected through the introduction of tablet technology was that of step 6, individual learning, with information gathering and presentation as part of this.

Supplementary Material

14 tutors (26%) regularly take supplementary material to the sessions, with 32 (58%) taking material when appropriate to the topic.

"I find that students enjoy their sessions much more when I take an active role and make it more tutorial than PBL. This is easy to do as I am a tutor for sessions that are very closely aligned to my area of specialist knowledge".

This material is presented in several forms with 30 (70%) utilizing case discussions, 9 (21%) as a series of Xrays or ECGs, and 14 (33%) creating a quiz to check understanding. With 34 (64%) expressing a desire to be more active with the process, 52 (95%) said they would access standardized cases or materials should they be available to tutors. Strong themes regarding the role of the tutor were concerning greater role as facilitator, leading discussions and acting as a resource for the students, as exemplified by the statements below:

"Tutors should lead discussions and share information, as in seminars or oxford-type tutorials (in which the tutor leads, explains if necessary, and directs study. A high level of informed participation and therefore preparation is required). An entirely passive tutor is pointless"

"I think the tutor is a valuable resource with lots of experience, and this should be shared in an interactive way otherwise students can get lost in details and irrelevancies and not know how to direct their learning or which sources to focus on."

All tutors agreed they would be willing to learn how to use novel technology if this were of benefit to the students.

Discussion

What has become apparent during the process of carrying out and analyzing this data is that there are multiple issues to be considered when introducing new and novel technologies into education. The first and most important is how does the new technology impact upon the methods of teaching currently being used. When considering PBL, the perceptions of the tutors at Manchester is that the introduction of tablet technology has altered PBL. This has not necessarily been detrimental, but student interaction with the 7 steps has changed, as has the role of the tutor. Students appear to use technology heavily during the clarification of the setting. In this respect access to internet resources proved useful for students to enhance understanding of the case and associated terminology. As Moust et al [III] comment, sessions tended toward minimization of the brainstorming and elaboration steps. These steps rely heavily upon good engagement and interaction within the group. Whilst within this study the tutors perception was that the introduction of tablets had actually made PBL more interactive, there could be the risk of the opposite occurring, with students interacting with their device more than their colleagues. This may be exacerbated by lack of tutor guidance and experience with both the process of PBL, and the use of technology within PBL. With a greater reliance on the 'copy' and 'paste' ability with technology, students may also be more heavily reliant upon notes in group feedback as apposed to understanding the material they have read. Certainly within our groups, tablets were used extensively for

individual learning as evidenced through note taking initially, and reference in feedback. Whilst in the literature it has generally been reported that the introduction of multimedia has enhanced resource acquisition enabling the learner to tailor their learning, and providing greater communication and reflexivity [V], this acknowledges only the strengths of blended learning. As Leng [VII] found, VLE blended PBL appears to stimulate interaction during the preliminary stages, and to a degree during the reporting stage. They also reported that interactions with computers on a central single computer, whilst causing apprehension within tutors, was well accepted by students. When technology is introduced into a group setting in the context of a mobile learning device, can the same statements be made? Is it important as our tutors felt, for the tutor to assume a more active role within the group? Should tutors begin to engage in a different role than that of facilitator? Certainly, one of the comments was that it was difficult to ascertain the level of understanding students had attained, whilst they had the ability to gain answers immediately. When we asked our tutors about the need to reinvigorate PBL, the response was very positive. 24% (14) of tutors regularly took extra learning materials to the sessions with 55% (32) saying it would depend upon the topic. 52% (30) of these tutors presented this information within a case based discussion, 24% (14) would create a quiz with 42% (24) used other material such as Xrays or ECGs etc (some used multiple methods hence >100%). It was felt that these approaches assisted students to assimilate their learning into real life examples. It also gave students the ability to 'bench mark' themselves against their colleagues, and to have an understanding of whether the depth of their learning was adequate. Whilst our tutors already tend towards a more active role in PBL than often encouraged, tutors felt that this role should be enhanced. If tutors were provided with mobile devices to use within sessions, given education to assist with resource agency, and were provided guidance as to the appropriate use of tablets in this environment, tablet use could be a positive addition to enable the reinvigoration of a new PBL. Tutor engagement may also serve to reduce the impact of both the informal and hidden curricula of mobile technology.

In 2014 R Ellaway [VIII] published a paper critiquing the informal and hidden curricula of mobile technology within medical education. Her categorization of learner's uses for their mobile device fell into four domains, logistics, personal, learning tool or learning content. There would appear to be a mismatch between learners experiences and those of the teacher. Part of that may be secondary to a misunderstanding as to whether the learner is using the device for legitimate task learning as apposed to personal or logistical tasks (Figure 1 Ellaway). Part may be due to the fact that there are no explicit guidelines or instructions as to how best to use the mobile device for learning, thus reducing the legitimacy of their use. In Manchester, medical students have been provided mobile learning tablets and encouraged to engage with technology through blended PBL, and other various online resources. Within the context of PBL 99% of tutors will allow students to use their mobile devices

during the session, whilst 78% do not have access to a device themselves. If students are waiting to be given permission to use their tablets through following the lead of their tutor, they may feel uncomfortable in their use. This issue should be addressed during the first session with the introduction of ground rules for the group. Despite legitimizing their use with ground rules, tutors may feel alienated due to their inability to engage with new ways to share information/ look up information.

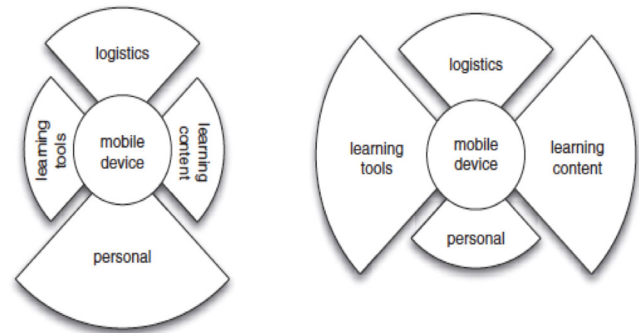


Figure 1. Taken from Ellaway 2014. Clinical teacher and learners may suffer a misunderstanding of the legitimacy of device use from negative expectations of use (Left), to more positive expectations (Right). Ellaway suggested the need to alter the balance between activities rather than eliminating certain forms altogether.

When considering the hidden curriculum, we may encourage and allow tablet use within private study, but as Ellaway [VIII] stated, knowledge tests exclude their use. We conduct sessions where tablets may be used as a resource, but provide reliable internet access in only 40% of sessions. We may also be slow in enabling tutors in the potential uses of tablets as this is not explicitly taught within the PBL introductory sessions at the university. Students must therefore discover and exert their own agency of internet sites. Does the exclusion of technology in 'our' (the tutors) learning of PBL, create a more negative hidden curriculum around their use? Does the exclusion of tutor technology also reduce the ability of tutors to guide students in their effective use of resources. As Jeong [VI] comments, the success of learning is dependent upon how effectively students can access information. There may also be problems with the content of material accessed, due to the volume of potential resources along with the potential to be ill-matched and difficult to comprehend. Some have suggested that by providing pre-selected resources and the tools to handle the information, enables a greater ability to build knowledge and process the information, rather than searching for the information [IX]. This approach may still however not tackle the challenge of the depth of engagement with resources as Wallace [X] discovered. Whilst a cohort of sixth form students were able to navigate hypermedia resources with ease, this group did not engage with the contents of the resources deeply. Students were so busy submitting searches, the queries remained shallow and close to the original search terms. Information was often then cut and pasted rather than

being reframed by the student. This was mirrored in results obtained by Jeong et al [VI] who found that low-achieving students were more likely to just copy and paste alone, rather than engage in more critical reflection of the resources. The requirement to discuss information in a future PBL session may enhance engagement with the resources but will it allow the students to nurture a coherent understanding, and therefore the ability to apply the knowledge to problem solving? As Jeong et al [VI] comment, the key to successful collaborative resource use is to share and integrate individual resources and research endeavors. This will allow for a greater range of information, and different perspectives. The tutors at UoM perceived that students did gather information and present information in a different manner following the introduction of iPad technology but no comments were made as to group resource collaboration. Whilst the current study did not look to determine how, and what type of resources were accessed, nor how effectively students integrated or applied that knowledge within the context of the group, tutors did perceive an increase in interactivity between learners, but again was this productive? Tutors without the specialist knowledge who are facilitating a PBL group, may also not have the expertise to pick up misinformation from inappropriate/ inaccurate resources. These are all very important principles which need to be considered. With interaction between participants being key to successful blended learning within PBL, and accurate knowledge being handled and shared, it is crucial to recognise that any changes which may occur with the introduction of mobile technology need to be considered and addressed. Wagner [XI] suggests that in order that technology-mediated learning has a positive impact upon learning, decisions regarding design are needed to maximise interaction, not only with technology but with each other. Specifically, attention needs to be paid to promote active resource use. Thought to how students are guided throughout education in these tasks would assist in independent agency. Consideration should be paid to how facilitators or tutors will be taught and guided to monitor and assist in this promotion of healthy interactions.

LIMITATIONS

The main limitation of this study was the fact that the fourth sector was excluded from this study. This was due to problems gaining access to tutor emails. Response rates from the 3 other sectors was good. I would not have expected a difference of perceptions through inclusion of this fourth sector as tutors were diverse in experience, age and profession throughout the included sectors.

CONCLUSION

This survey has illustrated the influence of mobile technology on the process of PBL, demonstrating tablet use in most of the 7 stages with the strongest influence on individual learning. A strong perspective is that this had enhanced this process, although it would appear facilitators are already more active than traditional PBL would recommend. Future research needs to be conducted into resource agency and

utilisation along with resource sharing within the group. This will help to further inform the design for further student cohorts.

NOTES ON CONTRIBUTORS

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DECLARATION OF INTEREST

The authors have no conflicts of interest.

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