Original Article

Why we should pay more attention to E-learning

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ABSTRACT

Background: This paper discusses the benefits of designing a blended learning programme that combines the use of self-directed E-learning and collaborative face-to-face sessions in respiratory medicine at the undergraduate level.

Objectives: The paper discusses the Blended Learning Design Tool (BLEnDT©) used to support the design process. This paper presents the findings of the evaluation carried out to identify learning gains and students' attitudes towards the use of tablet devices (iPads) to support the blended learning experience.

Materials and Methods: The sample analysed, included 283 full-time year 1 undergraduate medical students of an average age of 19 years.

Results: The analysis carried out shows the evidence of learning gains as students engaged in the full blended learning programme with the evidence of an association between higher overall marks in the final year exam and the post-quiz scores ($P = 0.006$).

Conclusion: The attitude components collected via the survey 'my learning experience after the interactive session using iPads' also highlighted the interesting findings in relation to the perceived control component with students that own a tablet device ($P = 0.094$) feeling much more in control when using an iPad to support their learning.

Keywords: Blended learning, E-learning, flipped classroom, learning design

INTRODUCTION

Several blended learning definitions and variations in blends have been discussed in the literature[1-3] and suggested the use of this term, highlighting its acceptance among higher education. They define blended learning as an approach which combines E-learning technology with the traditional face-to-face instructor-led teaching.

Oliver and Trigwell[4] define blended learning as a description of particular forms of teaching, embedding the use of technology. According to Whitelock and Jelfs,[5] blended learning is the combination of media and tools embedded within an E-learning environment or the combination of a series of pedagogic approaches, irrespective of learning technology used.

Banados[6] provides a definition of blended learning in the context of higher education highlighting the importance of combining online and face-to-face instruction with the aim to improve the learning experience and reduce the costs wherever possible.

Littlejohn and Pegler[7] introduced a different definition and approach called as 'blended E-learning', which shifts the emphasis from thinking about the online and face-to-face delivery to the design approach as the main focus. Similarly, Valiathan[8] focuses 'blend' on learning or 'intended' learning, identifying the following areas:

- Skill-driven learning, which combines self-paced learning with instructor or facilitator support to develop specific knowledge and skills;

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- Attitude-driven learning, which combines various events and delivery media to develop specific behaviours; and
- Competency-driven learning, which aims to develop the workplace competencies, blending performance and support tools with knowledge management resources.

This is an interesting definition which echoes the recommendations made by several authors emphasising the need to follow a holistic approach to blended learning, moving the focus away from the technology and concentrating on learning design.[3,7,9,10]

Blended learning design

According to Graham,[1] there is a wide range of models of delivery in the design of blended learning programmes with some authors focussing their design on the combination of different types of media, instructional methods and web-based technologies. Some authors also focus the design on the combination of different media (off-line, web-based and self-guided).[11]

In other cases, the emphasis is on the positive effects that blended learning has on pedagogy, cost-effectiveness, access and flexibility.[12-14] According to the meta-analysis carried out by the US Department of Education in 2010,[15] no significant differences in learning gains were found in the studies that directly compared purely online and blended learning conditions.

This meta-analysis included 18 medical related studies at undergraduate and graduate educational levels, including nursing and related areas. The conditions presented in both blended and online studies were very varied which may have contributed to the results. This highlights the need to develop a systematic theory-based approach for the design of blended learning programmes.[15]

As Alebaikan and Troudi[12] pointed out, a programme should be blended in design and not just in delivery. The authors emphasise the need to produce the guidelines and design frameworks to support and simplify the task of implementing blended learning design. In the words of Gibbs,[16] a good pedagogical design must ensure that there is 'constructive alignment' between the intended curriculum, the teaching methods, the learning environment and the assessments methods implemented. Mayes and de Freitas[9] confirm the statement made by Biggs,[16] by emphasising the importance of selecting the learning outcomes carefully, the learning and teaching activities and the assessment methods to accomplish the intended learning outcomes.

Blended learning frameworks and tools

A small number of learning designs and blended learning design frameworks and tools have been found. Alonso *et al.*,[17] developed an E-learning instructional model, which defines an e-lesson as the minimum self-contained learning unit. This model offers a systematic presentation of units following the sequence: Analysis, design, development, implementation, execution and review. The main limitation found in this tool was the lack of direct guidance for the academics when selecting learning activities depending on the learning outcomes intended.

The second design tool found was the Learning Designer Tool[18] produced by the Technology Enhanced Learning Research Programme led by Professor Diana Laurillard at the London Knowledge Lab, Institute of Education London (Learning Designer, 2011).

The Learning Designer Tool allows teachers to input their curriculum requirements and provide the teachers with a balance of different learning activities. The learning design activities are also displayed in a visual way (pie chart). It also provides a break-down of the time spent on different learning activities recommending how much time the teacher may need in order to prepare the materials. The tool does not provide direct feedback on the balance between the online and face-to-face activities based on the learning outcomes.

The final design tool to be discussed in this section is the Blended Learning Design Tool - BLEnDT© produced at the School of Medicine – Imperial College London[19] and used in this research. The pedagogic framework which forms the basis of BLEnDT©, makes use of the learning domains explained previously (psychomotor, cognitive and affective), in order to allocate and classify the learning outcomes required within the specific learning activities.[20-24]

According to BLEnDT©, the more focused the learning outcomes are on developing attitude and high-end cognitive knowledge (conceptual and metacognitive), the more the learning activities fit a face-to-face/online or collaborative/constructivist approach. The more focused the learning outcomes are on skills development as well as on low end cognitive skills (factual and procedural knowledge), the more the learning activity can fit an interactive self-guided/instructional online learning approach.[25]

For example, for a person to perform cardio-pulmonary resuscitation, the person must know the steps of the procedure (cognitive – procedural knowledge), know how the procedure may vary for infants (cognitive – conceptual knowledge), the person must remain calm (affective), co-ordinated movements

must be performed (psychomotor), and the procedures must be adjusted based on the sounds and tactile sensations (psychomotor).[26]

Figure 1 shows three different types of blended learning designs (Blended I, II and III). The X axis represents the activities that are best delivered using self-guided/online learning materials, whereas the Y axis represents the activities that are best delivered using a collaborative approach either face to face or online with Web 2.0 tools.

Blended I, is encouraged when there is a perfect match between self-guided/online activities and collaborative activities. Blended II suggests there is a higher number of learning outcomes falling under the collaborative approach. Blended III suggests there is a higher number of learning outcomes falling under the self-guided/online delivery approach[27] [Figure 1].

METHODS

The course on respiratory medicine delivered to year 1 students of the MBBS course was selected for this research. The learning outcomes of the course were run through BLEnDT©. According to the blended learning design suggested by BLEnDT©, 25% of the learning outcomes of the course were best suited for self-guided interactive learning, leaving the rest 75% of the learning outcomes to be delivered in a collaborative way during the course.

An interactive self-guided module was then developed and delivered via Blackboard before the course. The interactive module focussed mainly on the revision of anatomical concepts related to respiratory medicine.

At the course, the students completed a pre-quiz covering the content delivered on the interactive module and received an iPad to interact with the lecturer using the iPad App: NearPod.

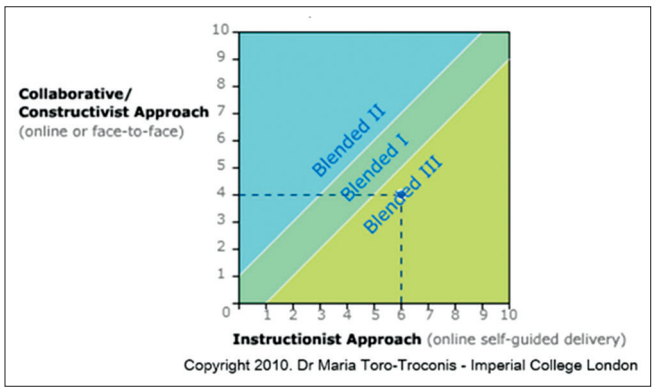

Figure 1: BLEnDT© model. Copyright 2010. Dr. Maria Toro-Troconis. Imperial College London. CC License - CC BY-NC-ND

At the end of the course, the students completed a post-quiz which covered the content delivered at the course as well as a survey titled 'my learning experience after the interactive session using iPads' which is an adaptation of the validated survey developed by Bonnanno and Kommers.[28]

The median and interquartile range was used to summarise continuous variables such as the quiz scores and the different components. The Mann–Whitney U-test was used to compare the scores in two groups. Spearman correlation was used to compare the continuous variables such as the quiz scores and other exam results. Stata version 13 (StataCorp LP, 4905 Lakeway Drive, College Station, Texas 77845-4512, USA) was used for analysis.

Linear regression was used to analyse any association between final year result and the blended learning programme implemented (completion of Blackboard course plus Pre Quiz and post-quiz).

The survey 'my learning experience after the interactive session using iPads' was completed, and the scores for the separate statements were coded in Stata version 13, using reverse scoring for unfavourable statements.

Subjects

Figure 2 shows the different areas involved in the blended learning course, 114 students completed the interactive self-guided module on Blackboard before the practical (male = 58%), 275 students completed the pre and post-quiz (male = 170) and 197 students completed the survey (male = 121).

RESULTS

The different scores collected were analysed looking at all the different components of the blended learning course. Some of the key findings are explained below.

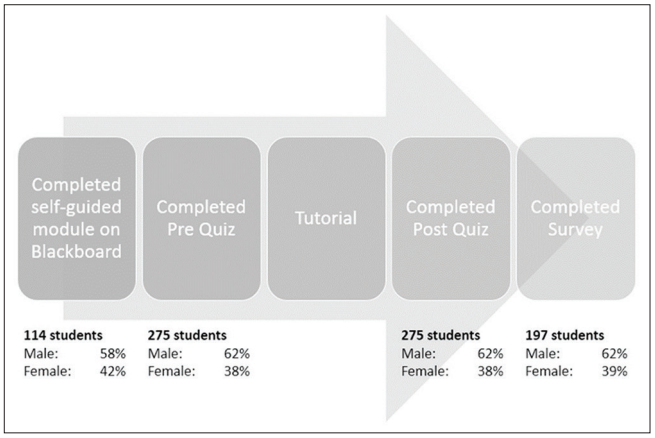

Figure 2: Blended Learning Design course based on BLEnDT© analysis

There is weak evidence of an association between average overall mark in the final year exam and the post-quiz scores ($r_s = 0.201$, $P = 0.006$) [Figures 3 and 4].

There is also very strong evidence of an association between the average mark obtained that year and overall respiratory mark ($r_s = 0.509$, $P < 0.0001$). The overall respiratory mark includes all the courses and tutorials related to respiratory medicine undertaken that year, of which the respiratory medicine course discussed in this paper is one of them [Figure 5].

Linear regression was used to assess the effectiveness of the fully blended learning experience in relation to the student performance in the final year exam.

After taking into account the scores of the students that completed the self-guided module on Blackboard and the pre-quiz, there is marginal evidence of an increase in the final respiratory mark as the post-quiz scores increases.

The attitude components collected via the survey 'my learning experience after the interactive session using iPads'[28] were entered in StataCorp LP using the appropriate codes.

A number of variables were constructed by computing individual scores for the different components: Affective component, perceived use, perceived control and behavioural components. Tables 1 and 2 present the scores for each statement related to the various attitudinal components summarised, forming four computed variables in relation to gender and ownership of smartphones and tablet devices.

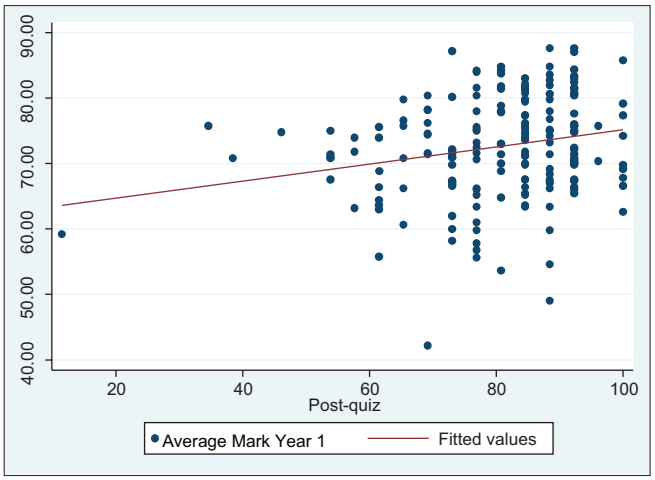

Figure 3: Strong evidence of an association between average overall mark in the final year exam and the post-quiz scores

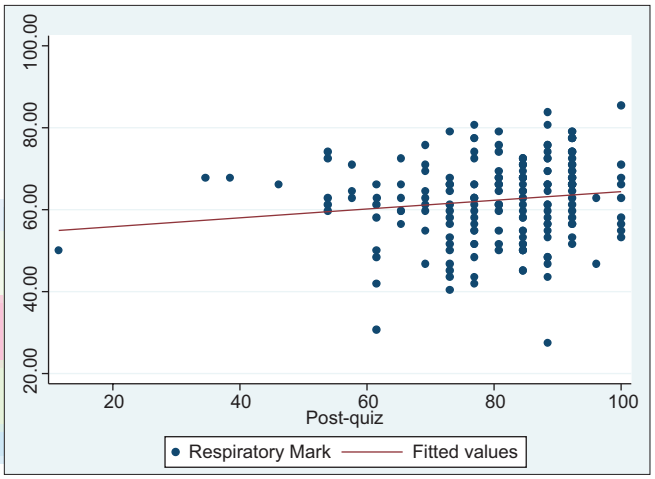

Figure 4: Evidence of an association between the year respiratory mark and the post-quiz scores

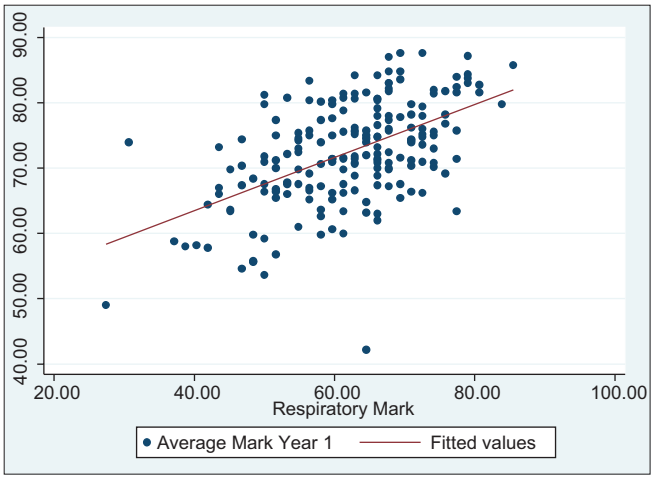

Figure 5: Very strong evidence of an association between average marks obtained that year and respiratory mark

DISCUSSION

Gender-related differences regarding the different attitudinal components presented in the survey 'my learning experience after the interactive session using iPads' in relation to the use of iPads for learning were analysed. Differences in relation to current ownership of tablet devices and smartphones were also looked at. The discussion is organised around the four major components relating to the students' attitudes, and the statistical significance of some of the statements is discussed in relation to the pedagogical implications.

Affective component

The affective component addresses feelings of fear, hesitation and uneasiness experienced before and while learning using an iPad.

There is no evidence of a difference in the affective component between males and females ($P = 0.364$) as well as between students who have and do not have a smartphone ($P = 0.336$). In general, males and females

Table 1: Attitudinal components summarised in relation to gender

Computed components	*P*	Median (IQR) females	Median (IQR) males
Affective component	0.364	27 (27 - 28)	28 (27 - 30)
Perceived use	0.851	16 (15 - 17)	16 (15 - 17)
Perceived control	0.394	23 (22 - 24)	25 (24 - 26)
Behavioural component	0.406	15 (14 - 16)	14 (14 - 16)

IQR: Interquartile range

Table 2: Attitudinal components summarised in relation to ownership of smartphones and tablet devices

Computed components	*P*	
	Smartphone ownership	Tablet device ownership
Affective component	0.336	0.012
Perceived use	0.086	0.679
Perceived control	0.424	0.094
Behavioural component	0.117	0.136

feel confident when using an iPad to interact with their facilitator during the course.

However, there is evidence of a difference in the affective component between those that have and do not have a tablet device ($P = 0.012$). A more positive attitude has been shown by students who have a tablet device (28/30, 95%).

Perceived usefulness

There is no evidence of a difference in the perceived usefulness component between males and females ($P = 0.851$) as well as between students who have and do not have a tablet device ($P = 0.679$). However, there is some evidence of a difference in the perceived usefulness component between those who have and do not have a smartphone ($P = 0.086$).

Perceived control

Students who already have a tablet device ($P = 0.094$) felt much more in control when using an iPad to support their learning and thus felt more capable of performing the demanded actions. There is no evidence of a difference in the perceived control component between males and females ($P = 0.394$).

There is no evidence of a difference in the perceived control component between those who have and do not have a smartphone ($P = 0.424$).

Behavioural component

A positive behavioural component was manifested as a willingness to use iPads for learning. Negative behaviours involved avoidance tendencies.

There is no evidence of a difference in the behavioural component between males and females ($P = 0.406$), between those who have and do not have a smartphone ($P = 0.117$) and between those who have and do not have a tablet device ($P = 0.136$).

Both groups declared that they would not avoid using iPads for learning showing their willingness to engage in learning using iPads.

The survey 'my learning experience after the interactive session using iPads' is a useful instrument from a pedagogical perspective because it addresses attitudinal components. The survey findings have helped to identify key elements that should be looked at more carefully during the design of blended learning activities supported by the use of tablet devices, in this case, iPads.

This study has been extremely important in the evaluation of students' attitudes towards learning using iPads as part of a blended learning experience. The feedback received informed the development and implementation of the School of Medicine Mobile Learning Strategy and subsequently the design and implementation of the Mobile Learning pilot project introduced in 2013.[29] The School of Medicine subsequently issued iPads Mini to students in years 5 and 6 of the undergraduate medical curriculum course at the beginning of the 2013/14 academic term (over 800 iPads Mini for students and 50 to academic staff).

The Ethical Committee at the School of Medicine decided to accept the changes to the traditional course only if all the students were exposed to the same blended learning programme. Therefore, this study was not conducted using a control group which may be seen as a limitation.

The blended learning design and development process supported by BLEnDT© has helped to identify the requirements and potential challenges when implementing blended learning courses supported by tablet devices. These findings helped to shape the direction of the Mobile Learning strategy in clinical years, and it will definitely help to inform the development of future blended learning courses and programmes in early years, supported by the use of tablet devices.

It is worth noting that this blended learning course was introduced in the early years of the medical curriculum following a campus-based approach with a large number of learning outcomes targeting low end cognitive skills. A blended course in a clinical setting

will bring different challenges which may have an effect on the way the blended course is finally designed and delivered. Blended courses at post-graduate level will also tend to target higher order cognitive skills for which the blended learning design approach may differ to undergraduate level.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Graham CR. Blended learning systems: Definition, current trends, and future directions. In: Bonk CJ, Graham CR, editors. The Handbook of Blended Learning: Global Perspectives, Local Designs. San Francisco: Jossey Bass/Pfeiffer; 2006. p. 3-21.
2. Procter C. Blended Learning in Practice. Proceedings of Conference on Education in a Changing Environment 2003. Salford, UK: The University of Salford; 2003.
3. Sharpe R, Benfield G, Roberts RG, Francis R. The undergraduate experience of blended e-learning: A review of UK literature and practice. The Higher Education Academy; 2006 Available from: http://www.heacademy.ac.uk/assets/York/documents/ourwork/research/literature_reviews/blended_elearning_exec_summary_1.pdf. [Last accessed on 2013 Oct 20].
4. Oliver M, Trigwell K. Can Blended Learning Be Redeemed? E Learn 2005;2:17-25. Available from: http://www.wwwords.co.uk/elea/content/pdfs/2/issue 2-1.asp# 3.
5. Whitelock D, Jelfs A. Journal of educational media special issue on blended learning. J Educ Media 2003;28:99-100.
6. Banados E, A blended-learning pedagogical model for teaching and learning EFL successfully through an online interactive multimedia environment. CALICO J 2006;23:533-50.
7. Littlejohn A, Pegler C. Preparing for Blended e-Learning. Connecting with e-Learning. Abingdon, UK: Rutledge; 2007. Available from: http://oro.open.ac.uk/26763/.
8. Valiathan P. Blended Learning Models; 2002. Available from: http://www.purnima-valiathan.com/readings/Blended-Learning-Models-2002-ASTD.pdf. [Last accessed on 2015 Mar 03].
9. Mayes T, de Freitas S. JISC e-Learning Models Desk Study: Stage 2 – Review of e-Learning Theories, Frameworks and Models; 2004. Available from: http://www.jisc.ac.uk/uploaded_documents/Stage%202%20Learning%20Models%20(Version%201).pdf. [Last accessed on 2013 Oct 20].
10. Bliuc A, Goodyear P, Ellis R. Research focus and methodological choices in studies into students' experiences of blended learning. Internet High Educ 2007;10:231-44.
11. Picciano AG. Blended learning: Implications for growth and access. J Asynchronous Learn Netw 2006;10:3.
12. Alebaikan R, Troudi S. Blended learning in Saudi universities: Challenges and perspectives. ALT J 2010;18:49-59.
13. Graham CR, Allen S, Ure D. Benefits and challenges of blended learning environments. In: Khosrow-Pour M, editor. Encyclopedia of Information Science and Technology. Hershey, PA: Idea Group; 2005. p. 253-9.
14. Osguthorpe RT, Graham CR. Blended learning systems: Definitions and directions. Q Rev Distance Educ 2003;4:227-34.
15. U.S. Department of Education, Office of Planning, Evaluation, and Policy Development. Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. Washington, DC; 2010.
16. Biggs J. Teaching for Quality Learning at University. Buckingham: SRHE and Open University Press; 1999.
17. Alonso F, Lopez G, Manrique D, Vinez JM. An instructional model for web-based e-learning education with a blended learning process approach. Br J Educ Technol 2005;36:217-35.
18. Learning Designer Tool. Technology Enhanced Learning (TEL) Research Programme's Learning Designer project led by Professor Diana Laurillard at the London Knowledge Lab, Institute of Education London. YouTube Video. Available from: http://www.youtube.com/watch?v=rJRR8W_C0U4 & lr=1. [Last accessed on 2015 Mar 03].
19. BLEnDT© –Blended Learning Design Tool. Faculty of Medicine – Imperial College London; 2010. Available from: http://www1.imperial.ac.uk/medicine/teaching/elearning/blendt/. [Last accessed on 2015 Mar 03].
20. Bloom B. Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain. UK: Longman Group; 1956.
21. Simpson E. The Classification of Educational Objectives in the Psychomotor Domain: The Psychomotor Domain. Vol. 3. Washington, DC: Gryphon House; 1972.
22. Dave RH. Psychomotor levels in Developing and Writing Behavioural Objectives. Armstrong RJ, editor. Tucson, Arizona, USA: Educational Innovators Press; 1975. p. 33-4.
23. Harrow AJ. A Taxonomy of the Psychomotor Domain. New York: David McKay Co.; 1972.
24. Kratwohl DR, Bloom BS, Masia BB. Taxonomy of Educational Objectives, The Classification of Educational Goals – Handbook II: Affective Domain. New York: McKay; 1964.
25. Toro-Troconis M. Flipped Classroom, Blended Learning and MOOCs. Learning Design in the 21st Century; 2013. Available from: http://www.f.imperial.ac.uk/blog/learntechzone/2013/09/03/flipped-classrooms-blended-learning-and-moocs-learning-design-in-the-21st-century/. [Last accessed on 2015 Mar 03].
26. Horton W. E-learning by Design. San Francisco: John Wiley and Sons; 2006.
27. Toro-Troconis M. Game-based Learning for Virtual Patients in Second Life. Doctoral Thesis, Luleå University of Technology. Luleå, Sweden; 2011. Available from: http://www.tinyurl.com/bsp6soe. [Last accessed on 2015 Mar 03].
28. Bonnanno P, Kommers MP. Exploring the influence of gender and gaming competence on attitudes towards using instructional

games. Br J Educ Technol 2008;39:97-109.

29. Toro-Troconis M, Hemani A, Murphy K. Learning Design in the 21st Century – Blended Learning Design Tool (BLEnDT© and MOOC-it©). In Proceedings of the #designforlearning: From Blended Learning to Learning Analytics in HE. Open University (OU), Higher Education Academy Conference, The Open University Milton Keynes, UK; 26-27 November, 2014.