THE UNIVERSITY OF
WARWICK

warwick**publications**wrap
highlight your research

http://wrap.warwick.ac.uk

Exploring the impact of a flexible, technology enhanced teaching space on pedagogy

Emma King[a], Mike Joy[b], Jonathan Foss[b], Jane Sinclair[b] and Jirarat Sitthiworachart[c]

[a] *Learning and Development Centre, University of Warwick, Coventry, UK.*

[b] *Department of Computer Science, University of Warwick, Coventry, UK.*

[c] *School of Informatics, Walailak University, Nakhon Si Thammarat, Thailand.*

Address for correspondence: Emma King, Learning and Development Centre, Senate House, University of Warwick, Coventry, CV4 7AL, UK. Email: e.l.king@warwick.ac.uk Phone: 024 7657 5341

Approaches to teaching and learning are increasingly influenced by the introduction of new technologies and innovative use of space. Recognising the need to keep up-to-date many institutions have created technology-rich, flexible spaces. Studies so far have concentrated on how students use such facilities; however, their availability also strongly impacts on teaching staff, presenting new possibilities and challenges. To encourage the development of activities that make the most of these resources the University of Warwick launched the Teaching Grid (2008), a flexible space with state-of-the-art technology. Advisers support colleagues in developing and delivering novel, experimental teaching sessions. This paper reports on use of the facility during its first three years, considering the effects on pedagogy of experimental use of space and technology; this is correlated to an increase in number and variety of teaching and learning activities which, it is suggested, enhances the student experience.

Keywords: teaching spaces; educational technology; innovation; continuing professional development; Higher Education

Introduction

Universities are under increasing pressure to provide teaching environments that are responsive to a variety of learning styles.

> 'With the increasingly diverse student body and fast socio-economic changes affecting every aspect of life, including the way we teach and learn, there is a growing need to provide spaces that satisfy various needs, accommodate different learning styles, influence students' attention, motivation to learn, and their way of thinking.' (Jankowska & Atlay 2008, 276)

As well as responding to these varied needs Schneckenberg (2009) suggests that academics are faced with the challenge of responding to students' demands for activities that incorporate technology. This study explores how a novel facility at the University of Warwick allows staff to respond to these needs through flexible use of space and technology.

The University's 2015 Strategy (University of Warwick 2007) contains an explicit goal to 'Consider different uses of spaces to enhance the teaching and learning process'; in support of this agenda, the University created the 'Teaching Grid' as a space for teaching staff to explore emerging ideas, methods and techniques (Edwards 2006).

The Teaching Grid aims to support the University's strategic objectives to enhance teaching quality and develop excellence by:

- enabling staff to explore new teaching methods in a safe and supported environment;

- facilitating innovative approaches to support teaching and learning;

- offering a flexible environment to respond to changing needs within a blended learning context; and

- providing a locus to encourage collaborative working between service departments that support teaching activities.

The Teaching Grid offers staff two physical spaces:

- a collaboration area in which colleagues can meet to explore new technologies and develop teaching strategies;

- an experimental teaching space (ETS) where technologies and teaching ideas can be actively tried out with students.

[Insert Figure 1 here]

This study focuses specifically on the ETS, which offers:

- **A customisable physical space**, allowing staff to create a variety of teaching environments to support different patterns of interaction.

- **A rich collection of technologies** – to support different levels of active student involvement.

Kirkpatrick (2001) identifies the importance of allowing staff to share and learn from one another about emerging pedagogies and their relationship to new technologies and reconfigurable spaces, and this is reflected in the Teaching Grid's philosophy. The ETS provides an environment in which academics feel able and confident to experiment, as necessary to allow individuals to develop their teaching practice (Errington 2004; Pajo & Wallace 2001). Providing such a space clearly demonstrates the University's support for experimentation.

[Insert Figure 2 here]

One of the barriers to the adoption of technology by academic staff, as identified by Annan (2008), is the lack of appropriate support. Critical to the Teaching Grid model is the *support* component, in the form of a team of advisers who can offer guidance around effective use of resources and help to ensure that time in the facility is spent valuably.

The design and continuing development of the Teaching Grid have been informed by liaison with academic and technical services in the University, as well as with external Higher Education teaching development agencies (HEA, JISC, SEDA).

Why this study

Temple (2007) highlights limited research into the use of flexible spaces to support teaching and learning in Higher Education. Similarly, despite a positive viewpoint, few institutions have been able to provide detailed evidence about successful implementation of e-learning and its impact on teaching practice (Blin & Munro 2008). If these innovations are to be adopted staff require time and opportunity to experiment (Rogers 2003). This study reports on the use of the Teaching Grid during the first three years of opening, exploring whether a flexible space and availability of multiple technologies impacts on pedagogies adopted by teachers. The findings of this study can help inform whether investment in these spaces, both in terms of institutional funding and individuals' time, are effective in developing teaching and learning practices.

Flexible space

JISC (2006) suggests that:

'…a learning space should be able to motivate learners and promote learning as an activity, support collaborative as well as formal practice, provide a personalised and inclusive environment, and be flexible in the face of changing needs.'

Flexible spaces have the potential to impact on pedagogy, with different learning environments being used to support different types of activities (Fisher 2005). Warger and Dobbin (2009) suggest that these spaces force academics to reconsider the roles and relationships between staff and students, shifting practice from a teacher-centric to a student-centric approach. Flexible spaces support a shift from didactic approaches to active learning (Harrison 2009) by:

- allowing teachers to move beyond a standard classroom configuration in which there are fixed places for teachers and learners; and

- supporting creative pedagogies in which learners takes active roles in discovery and creation of knowledge.

'Frequently, therefore, what emerges – almost by accident, or naturally – from these OSL [Open Space Learning] environments is a facilitated ensemble in which students, working in groups, create their own knowledge.' (Monk et al. 2011, 120)

However Thomas (2010) reports that not all the strengths of how a learning space will be used to improve learning can be identified at the start. This suggests that a flexible space provides opportunities for innovative teaching and learning development unconstrained by preconceptions.

'… learning spaces need to be adaptive, malleable – almost fluid.' (Thomas 2010, 209)

The Teaching Grid aims to accomplish this by offering the ETS, a flexible space that can be adapted for each session, or even within a session to meet evolving needs of learners.

Evidence suggests that we can expect to see a difference between the methods adopted by academics making use of the flexible aspects of the ETS compared to those using the room in a more static or traditional manner.

Technology

Breslow (2007) suggests that integrating technology into teaching and learning supports a shift from passive to active pedagogies in which the student-teacher relationship is redefined. This is echoed by Laurillard (2008) and Norton et al. (2000) who reflect that technologies can support teachers to deliver flexible opportunities that actively involve students through a constructivist approach.

Further to this, Norton et al. (2000) report that a mismatch between teaching methods and technology can lead to non-adoption; in order to support teachers to make regular use of technology academics need to be given the opportunity to consider how it matches their chosen pedagogies. The ETS aims to address this need by providing the chance for staff to explore the applicability of new technology to their pedagogical approach.

Research aim

This study builds on previous research that suggests that flexible space and integrated technologies impact on the nature of teaching and learning activities, moving towards a more active student centric approach. The aim was to explore whether the availability of resources within the Teaching Grid, principally a flexible space and varied technology, impacts on the pedagogies chosen by academics.

Methodology

Staff using the Teaching Grid were asked to provide a written case study reflecting on the innovative teaching session undertaken. Focusing on these reports, we adopted a phenomenological approach in which descriptions of lived experience are central. The case studies were analysed to identify emergent themes, providing a coding framework to explore key features. Further details of the process used are given in Joy et al. (2013). The case study and thematic analysis approach strikes the necessary balance between conducting effective evaluation and not overburdening staff with overly-demanding, rigorous evaluation procedures which may hinder innovation (Pearshouse et al. 2009).

Case studies

The case studies were written by academics (with guidance from Grid staff) after using the Grid, and thus contained a possibly subjective view of their interaction with the facility. Each case study included some or all of the following:

- *Teaching/learning activity* including details of the type of learners involved, the use of physical space, and the methods, resources and technology employed.

- *Learning outcomes* (personal and/or student) of the activity, and how effective the activity was considered to be in achieving these outcomes.

- *Established practice* – what the usual teaching practice was before running the activity in the Teaching Grid.

- *Teaching development* – what considerations prompted the different/new Approach.

- *The teacher's perspective* – what the academic learned from the experience of using the ETS, and how they thought it would affect their future practice.

- *The students' perspective* – feedback from students[1].

The data set included 119 case studies and spanned all faculties within the University (Table 1).

[Insert Table 1 here]

The predominant users of the space were the faculities of Arts and Social Sciences, and Service departments. Services included the Learning and Development Centre (who are responsible for staff training), Student Careers and Skills, and IT Services.

Analysis

We adopted a grounded theory based approach to analysis (Bryman 2004) identifying three core categories: *resources*, *space,* and *teaching and learning* activities. We then took a sample of 20% of the case studies and used these to iteratively develop keywords for each category that addressed the emergent themes (reported in Tables 2, 3 and 4)[2].

These keywords were refined to ensure no duplicates, check consistency in definitions, and exclude features considered constituent to a majority of teaching sessions within Higher Education, such as teacher presentations. The keywords were applied double blind to all case studies and inconsistencies resolved, drawing on a third impartial coder if necessary.

[Insert Table 2 here]

[Insert Table 3 here]

[Insert Table 4 here]

---

[1] This framework is also reported in Joy et al. (2013).

[2] These keywords and definitions are also reported in Joy et al. (2013).

Findings

The defining characteristics of the Teaching Grid are the flexible space and available technologies. This study explores the impact of these features on teaching and learning by investigating patterns and correlations evidenced by the case studies, and conveyed by the keywords.

This study shows that:

- flexible use of space correlates with an increase in the number of teaching and learning activities within a single session;
- flexible use of space correlates with collaborative use of space;
- collaborative use of space correlates with an increase in the number of teaching and learning activities; and
- number of technologies used correlates with the number of teaching and learning activities.

Flexible use of space correlates with an increase in the number of teaching and learning activities within a single session

Out of the 119 case studies, 59 were identified as making use of the flexible space to provide more than one layout within the session, while 60 of the case studies did not make use of this feature (Table 5). Perhaps unsurprisingly, the mean number of teaching and learning activities when the space was used flexibly was significantly higher than the number reported when it was not (T=-2.463, p=0.015).

[Insert Table 5 here]

The teaching and learning activities were filtered to those that were found to occur in at least ten per cent of the case studies, and the distribution of the use of flexible space in each of these categories examined (Table 6).

[Insert Table 6 here]

The results showed that many of the teaching and learning activities were equally distributed between the use of flexible space and no flexible use of space. However, the case studies making use of the flexible space also made more use of experiential activities, role-play, team teaching, and workshops. These activities suggest a more interactive and student centric approach which may not have been possible in a traditional classroom. Staff took advantage of being able to adapt the space to offer different learning environments appropriate for the practicalities of the activity. For example, in a session exploring quantitative research methods and statistical analysis software, screens were arranged in a 'U' shape with students sitting in the centre in order to provide a clear view of all the screens. In another activity, concentrating on using Second Life, students were arranged in pairs with each pair physically separated as much as possible, in order to ensure students communicated through Second Life rather than physically.

The ability to dynamically change the layout of the space was strongly identified as practically beneficial:

> 'The tutors found that if they had an idea for a new layout during the course – or if a new idea was suggested to them – it ALWAYS worked to modify what we expected to do and go with the flow. In this way you can move with the way the groups work instead of interrupting their thinking.' (Student Careers and Skills)

Flexible use of space correlates with collaborative use of space

This study also found that when the space was used flexibly it was also likely to be used collaboratively (Table 7).

[Insert Table 7 here]

The benefits were exhibited in terms of flexibility of the space for groups. For example, activities in the space may dynamically change through a session, such as between group activity and plenary sessions (Theatre Studies). The groups might take advantage of the space to arrange themselves according to preferences:

> 'Groups with a predominantly egalitarian and informal style could use 'soft' areas and those who were more formal could use desks. Interestingly, when 'soft' areas were available, groups used them for more creative and balanced tasks.' (Student Careers and Skills)

Collaborative use of space correlates with an increase in the number of teaching and learning activities

Out of the 119 case studies, 83 were identified as making use of the space to provide students with the opportunity to work collaboratively, while 36 of the case studies did not make use of this feature.

The teaching and learning activities were filtered to those that were found to occur in at least ten per cent of case studies. The case studies where the space was used collaboratively showed higher incidences of many of the teaching and learning activities, particularly with the more interactive and student centred approaches (Table 8).

[Insert Table 8 here]

Most of the case studies stated that the success of activities depended on the ability to configure the ETS so that it could support student groups. In some cases, there was an immediate positive impact on the activity. 'The room layout with its various activity zones had an energising effect on the session' (Learning and Development Centre). In others the effect was viewed as logistic, such as the ability for the teacher to move between groups to provide support (Warwick Medical School, Theatre Studies). The interaction between groups was also perceived as important:

'What worked nicely with the space was that they were able to see the outcomes at the same time and hear one another which was important as they were reflecting on their own performance and contrasting that with the other teams.' (Centre for Cultural Policy Studies)

Number of technologies used correlates with the number of teaching and learning activities

The results showed a significant correlation between the number of technologies used in a session and the number of teaching and learning activities (r= 0.189 p=0.039). An increased number of technologies was correlated with an increased number of teaching and learning activities (Table 9)[3].

[Insert Table 9 here]

One activity, delivered to Theatre Studies students exploring stage design, demonstrates a particularly rich use of the space and a variety of technologies with a very clear educational purpose:

'I took the opportunity to use the full rectangular space in the Teaching Grid, plus all seven ceiling-mounted projectors and one of mobile, large, flat-screen units. Four of the projectors were used to project full-set images, from four seminal productions, onto four of the large, wall-sized, white curtain-screens around the long space. These images remained visible throughout the seminar while, beside each of these, a series of further images were projected allowing me to demonstrate key moments in the use of the theatre space, costumes, properties and lighting.' (Theatre Studies)

One of the strengths of a facility such as the Teaching Grid is that it allows the teacher to explore technologies in an environment unconstrained by the limits imposed by a

---

[3] A more detailed exploration of insights into the combination of technologies and teaching and learning activities can be found in Joy et al. (2013).

traditional teaching space, and with support staff available to offer advice. This potentially enables technologies to be used in a deeper, more effective way. There was strong support for the effectiveness of technology combination, including an unequivocal 'I would definitely alter my structure of the session so as to maximize the uses of all the technologies' (Systems Biology).

Further to this one tutor articulated that it was the combination of space and technology that was central to the benefits offered by the ETS, reporting that it allowed '…tutors to match the students' learning styles to the motivations of the class'.

Conclusion

The Teaching Grid provides a space in which colleagues from across the University can experiment with new teaching ideas that make effective use of space and technology, and identify what works within their context. Academics made use of this flexible, collaborative and technology rich space provided to explore a range of teaching strategies and support a wide range of student needs. Staff valued the flexibility for supporting group work. They displayed enthusiasm for making the most of the technology and commented on the value of being able to combine the use of flexible space and multiple technologies.

The findings from this study echo Temple's (2007, 239) view that 'The university, space and learning are intimately connected…' and '… it seems possible that relatively small improvements may be amply rewarded in learning benefits.' The flexible spaces provided in the Teaching Grid allow staff to adopt a range of pedagogies catering for all learning styles, as suggested by Monk et al. (2011). In combination with

this flexible space the range of technologies creates opportunities for teachers to develop multiple opportunities in response to individual learning needs (Laurillard 2008).

The Teaching Grid is a unique teaching development resource, nationally and internationally. The contribution of this study is an understanding of the different ways in which teaching practice has been influenced by the resources available within the Teaching Grid. This provides an insight into the benefits offered by developing such a facility within Higher Education institutions in support of enhancing the student experience. Follow-up of Teaching Grid users suggests that the facility is already successful in influencing academics' teaching practice beyond its walls. Already we know that use of the Grid has influenced the provision of teaching and learning technologies in the Arts faculty and the refurbishment of teaching spaces across the institution. In the following few years we expect that process to accelerate, supported by a meaningful evidence base provided by the Teaching Grid.

Areas for further research

There are a number of areas emerging from this study for further exploration including:

- a comparison between the nature and number of teaching and learning activities used in sessions within the ETS with those used in a traditional teaching space;
- the relationship between number of technologies and number of teaching and learning activities to discover if each technology is used to support a single activity or if these are being used in combination; and
- students' attitudes towards the sessions held within this new teaching space.

Acknowledgement

Notes on contributors

Emma King is a Learning and Development Adviser at the University of Warwick. Her research interests are staff and educational development, technology enhanced learning and the impact of space on teaching and learning. Email: E.L.King@warwick.ac.uk Tel: 024 7657 5341.

Mike Joy is an Associate Professor (Reader) in Computer Science at the University of Warwick. His research interests focus on educational technology and computer science education. Email: M.S.Joy@warwick.ac.uk Tel: 024 7652 3368.

Jane Sinclair is an Associate Professor in the Department of Computer Science at the University of Warwick where she is a member of the Intelligent and Adaptive Systems research group. Her main research interests are in educational technology and formal methods. Email: J.E.Sinclair@warwick.ac.uk Tel: 024 7652 3986.

Jonathan Foss is a Post-Doctoral Researcher in the Department of Computer Science at the University of Warwick. His research interests include educational technology, adaptive hypermedia and web personalisation. Email: Jonathan.Foss@warwick.ac.uk Tel: 024 7657 3797.

Jirarat Sitthiworachart is a Lecturer in the School of Informatics at Walailak University, Thailand. Her research focuses on educational technology, deep learning, and e-assessment. Email: sjirarat@wu.ac.th Tel: +66 7567 2268.

References

Annan, L. 2008. Facilitating adoption of technology in higher education. *Distance Learning* 5: 13-17.

Blin, F., and M. Munro. 2008. Why hasn't technology disrupted academics' teaching practices? Understanding resistance to change through the lens of activity theory. *Computers & Education* 50: 475-490.

Breslow, L. 2007. Lessons learned: findings from MIT initiatives in educational technology (2000-2005). *Journal of Science Education & Technology* 16: 283-97.

Bryman, A. 2004. *Social research methods*. Oxford: Oxford University Press.

Edwards, R. 2006. The Learning Grid at the University of Warwick: a library innovation to support learning in higher education. *SCONUL Focus* 38, 4-7.

Errington, E. 2004. The impact of teacher beliefs on flexible learning innovation: some practices and possibilities for academic developers. *Innovations in Education & Teaching International* 41: 39-47.

Fisher, K. 2005. Linking Pedagogy and Space. http://www.eduweb.vic.gov.au/edulibrary/public/assetman/bf/Linking_Pedagogy_and_Space.pdf

Harrison, A. 2009. *Emerging technology and learning spaces.* London: DEGW.

JISC. 2006. *Designing spaces for effective learning: A guide to 21st century learning space design.* Bristol: HEFCE.

Jankowska, M. and M. Atlay. 2008. Use of a creative space in enhancing students' engagement. *Innovations in Educational and Technology International* 45: 271-279.

Joy, M.S., J.G.K. Foss, E.L. King, J.E. Sinclair, J. Sitthiworachart and R. Davis. (2013). Incorporating technologies into a flexible teaching space. *British Journal of Educational Teachnology.* Advance online publication. d.o.i:10.1111/bjet.12040

Kirkpatrick, D. 2001. Staff development for flexible learning. *International Journal for Academic Development* 6: 168-176.

Laurillard, D. 2008. Technology enhanced learning as a tool for pedagogical innovation. *Journal of Philosophy of Education* 42, 521-533.

Monk, N., C. Rutter, J. Neelands and J. Heron. 2011. *Open-space learning : a study in transdisciplinary pedagogy*. London: Bloomsbury Academic.

Norton, S., C. J. McRobbie and T. J. Cooper. 2000. Exploring secondary mathematics teachers' reasons for not using computers in their teaching: five case studies. *Journal of Research on Computing in Education* 33: 87-109.

Pajo, K. and C. Wallace. 2001. Barriers to the uptake of web-based technology by university teachers. *Journal of Distance Education* 16: 70-84.

Pearshouse, P., B. Bligh, E. Brown, S. Laithwaite, R. Graber, E. Hartnell-Young and M. Sharples. 2009. *A study of effective evaluation models and practices for technology supported physical learning spaces*. Bristol: JISC.

Rogers, E. M. 2003. *Diffusion of innovations*. New York: Free Press.

Schneckenberg, D. 2009. Understanding the real barriers to technology-enhanced innovation in higher education. *Educational Research* 51: 411-424.

Temple, P. 2007. *Learning spaces for the 21st century: a review of the literature.* York: The Higher Education Academy.

Thomas, H. 2010. Learning spaces, learning environments and the dis'placement' of learning. *British Journal of Educational Technology* 41: 502-511.

University of Warwick. 2007. Vision 2015: Teaching and learning. University of Warwick http://www2.warwick.ac.uk/about/vision2015/student_experience/

Warger, T. & G. Dobbin. 2009. Learning environments: where space, technology, and culture converge. In *ELI White Papers*. Washington: Educause.