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Technology-Supported Active Learning in a Flexible Teaching Space

Jirarat Sitthiworachart [1], Mike Joy [2,*], Emma King [3], Jane Sinclair [2] and Jonathan Foss [2]

[1] School of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand
[2] Department of Computer Science, University of Warwick, Coventry CV4 7AL, UK
[3] Keypath Education, Coventry CV1 2TE, UK
* Correspondence: m.s.joy@warwick.ac.uk

Abstract: Active learning is increasingly of interest within Higher Education. The use of technology provides, in theory, the opportunity for more effective active learning, but in practice the majority of learning technology usage is still for "traditional" approaches. Conventional staff training is failing to address this. The authors' university has provided an experimental technology-rich teaching space (the Teaching Grid) for supporting teachers as they experiment with the delivery of innovative, technology-based teaching. This study investigates teachers' experiences of trialling active learning approaches within the Teaching Grid using four case studies. The results suggest that the Teaching Grid can be effectively used to support teacher professional development, and the experience of using the facility encourages teachers to integrate technology into their future teaching plans. Five factors are identified which contribute to the promotion of active learning. Teachers' perceptions of their experience indicate not only the intention to use technology more but also an increased awareness of its potential and openness to adopt more active, student-focused approaches. The broader significance of this work is to identify an alternative model for teacher development which, in contrast to most current approaches, has a demonstrable positive impact on fostering innovative, technology-based pedagogy.

Keywords: teaching practice; active learning; experimental teaching space; educational technology; higher education

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1. Introduction

Technologies influence learning and teaching outcomes [1,2] and can be used to create interactive learning environments that bring excitement to the active learning process [3,4]. As interest has been growing in new educational methods, active learning is considered by many academics as an important and effective approach to encouraging the development of higher cognitive skills in students, the "deep learning" referred to in Bloom's Taxonomy [5].

Active learning methods can be time-consuming for the teacher and may pose difficulties for implementation [6,7]. There are now many technologies available that can, in theory, assist teachers in developing active learning experiences and which allow students to become actively engaged both inside the classroom and beyond [8,9]. However, there is a major issue with this in practice, with repeated studies indicating that, even after many years of technology adoption, many teachers choose not to engage with it at all or are using it in a very limited way [10]. For example, learning management systems (LMS) can provide a wide range of learning opportunities, offering a gateway for a teacher to adopt a more innovative use of learning technology and to develop new pedagogic approaches; yet, in a study by Hamuy and Galaz [11], 89 percent of teachers who innovated did so for very basic information provision only, and this trend is continuing. Although most higher education institutions now support the use of such technology, the authors of [12] reported

that, in institutions where its use is not compulsory, after three years of the technology being introduced in the institution, 50 percent of teachers still did not choose to use it at all and, after ten years, 20 percent of teachers were still non-users. In addition, the vast majority of teachers who do adopt the technology are not incorporating any innovative or active learning elements.

Professional development and effective training for teachers are often noted as being central to the adoption of technology and its use for more innovative, active learning purposes [13]. Institutions generally provide a range of support such as training courses, online resources, and one-to-one support, with some implementing more novel approaches such as a web-based community for teachers' professional development [14,15]. Despite this, the poor adoption rates and a lack of student-centred application still persist [12], indicating that current teacher development and training approaches are not adequate to overcome teacher barriers.

In a different approach, the authors' university has developed a flexible teaching space (the "Teaching Grid") in which teachers can both learn about educational technology and deliver technology-enhanced teaching sessions while being supported by expert learning technology staff. This facility was specifically designed to provide a "safe" practice space for teachers to:

- Develop expertise in the use of new tools and pedagogies;
- Diffuse and transfer new skills and practices into classrooms across the university;
- Identify barriers and problems in these innovative practices in order to mitigate negative effects and improve prospects for future successful adoption.

This study seeks to understand how the Teaching Grid supports students' active learning, as perceived by teachers who have used the Grid, and how those teachers believe their use of the Grid has affected their future practice.

2. A Flexible Teaching Space

The Teaching Grid provides two main physical spaces. In the first, a collaboration area, teachers can meet with colleagues or Teaching Grid staff to explore new approaches to their teaching and to discuss new technologies. In the second, an experimental teaching space, teachers can try out new ideas with student groups. Both spaces are configurable with movable partitions, furniture, and teaching support devices. The novel mix of flexible space and new technologies, in addition to supporting teacher innovation, provides an environment in which students can engage in active learning unconstrained by the space and layout limitations of conventional teaching rooms. The Grid is permanently staffed by advisors who provide support to teachers using the facility, and this is a key feature of the Grid.

Furthermore, by requiring teachers who have used the Teaching Grid to provide a report on their experiences, diffusion of these new ideas (and any "good practice" arising from them) through the institution and through individual departments is strongly encouraged. The existence of such reports is crucial to the methodology we have employed, as discussed in Section 4 below, since the reports form a source of data which would otherwise be difficult to obtain from the participants.

Technologies Available in the Teaching Grid

The Teaching Grid provides a customizable experimental space and a rich collection of technologies (including hardware and e-learning software, both commercial products and selected novel and innovative tools) and a summary of the usage of these technologies when the data were collected is illustrated in Figure 1. A detailed analysis of the individual technologies has previously been reported by the authors in [16]. Unsurprisingly, projection devices and the Internet make up the technologies most frequently identified, but these are arguably not significant *per se*, since both are likely to be encountered in any rich teaching environment. The next most often cited are laptops (in particular, the use of ScreenFlow technology (telestream.net/screenflow, accessed on 1 July 2022) to record and re-present

activities) and smartboards, suggesting that rich multifunction devices fulfil teachers' needs across a variety of different activities.

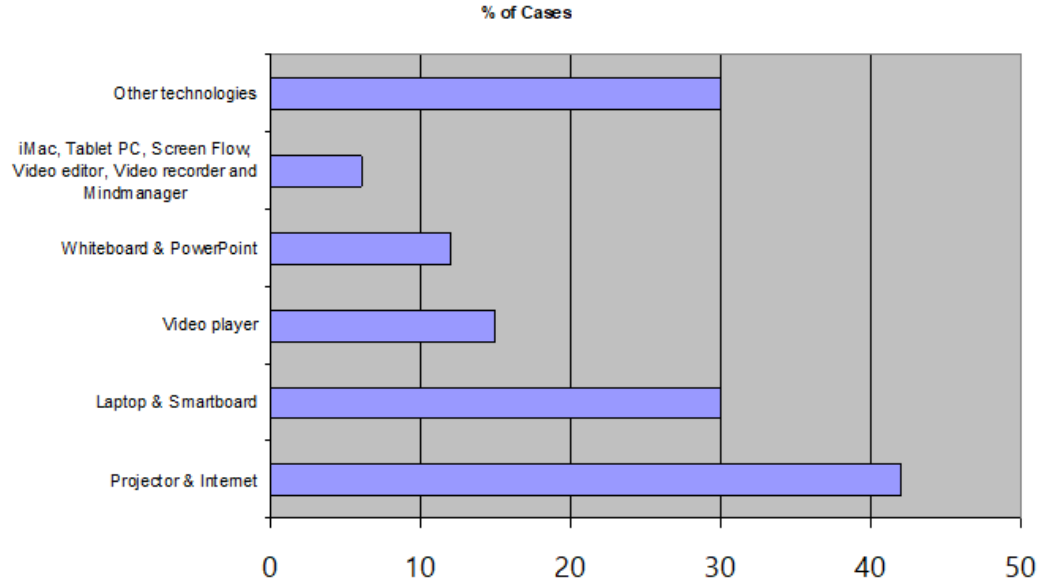

Figure 1. Technologies used.

3. Active Learning

Many studies have focused on students' perceptions of the active learning process, but fewer studies have been published on the teacher experience of using technologies to support active learning [11,12]. Analyses of the effectiveness of the flexible space and the technologies used in the Teaching Grid [16] have been published elsewhere. In this paper, we report the teachers' perceptions of the Teaching Grid experience and how they affect future teaching practice. Based on those perceptions, we propose factors that promote successful active learning.

Active learning is a student-centred learning process that promotes higher cognitive skills [17,18]. It involves students in an interactive learning process and requires them to think about what they are doing by integrating new information into their existing knowledge [19,20]. Students then have opportunities to reflect by analysing, evaluating, or synthesizing that topic, and students are thus transformed from passive listeners to active constructors [18,21]. The main characteristics of active learning are [18,22,23]:

- A1: emphasis on developing higher cognitive skills;
- A2: engaging students actively (for example, in discussions, presentations, and group work) rather than allowing them to listen passively;
- A3: providing timely feedback to motivate learning;
- A4: involving students in writing, reading, and reflecting;
- A5: encouraging students when answering a question to explain and justify their opinions.

Bloom et al. [5] categorized levels of learning in order of complexity, aiming initially at higher education, and the six categories of learning in Bloom's taxonomy can be divided into two levels of learning. Students working at the higher levels of cognitive ability think more deeply and reflect but require a base knowledge and understanding at the lower levels. The cognitive skills described by higher levels in the taxonomy are those that active learning endeavours to promote.

Students are at the centre of active learning, and the role of the teacher becomes one of a facilitator of this learning process [24]. Many authors have suggested a variety of active learning techniques, such as group discussions, debates, problem-based learning, cooperative learning, simulations, games, role playing, field studies, flipped learning, and case studies [19,25,26]. In addition, technology can be used to encourage students to participate in the active learning process [20,27]. Active learning technologies and tools

include web conferencing and virtual worlds [28]; group blogs [29]; the Internet, computer simulations, and game-based learning [30]; and clickers [31].

4. Methodology

In this study, we sought to establish the teachers' perspectives on the Teaching Grid, and to understand:

- How they perceived that the Teaching Grid supported students in active learning;
- How the Teaching Grid "experience" affected their future practice.

4.1. Participants and Data Collection

Data were gathered from a total of 119 reports submitted by teachers on their involvement in the Teaching Grid. These were written by the teachers themselves with guidance from Grid staff after they had used the Grid and were published internally at the university. Due to the nature of these reports, it must be acknowledged that there is a certain amount of potential subjectivity on the part of the teachers. Furthermore, although the teachers concerned were engaged with writing their report (and production of a report was a condition of access to the Teaching Grid), the amount of detail included varied considerably between teachers.

4.2. Data Analysis

Each report sought to identify, for the session to which it related: (i) the intended learning outcomes for the session; (ii) details of what actually took place during the session, including the type of learners involved, the use of physical space, and the methods, resources, and technology employed; and (iii) how the session delivery differed from the usual teaching practice, and why a new approach was chosen.

Each report was pre-processed to identify whether the information contained therein included significant information on the teacher's pedagogic and technological engagement with the session to which it related, and those reports which did not contain sufficient information were discarded. Of the remaining reports, 4 reported a specific scenario and contained a rich narrative. The selected four reports were then treated as case studies to provide four lenses on academic engagement with the Grid, and these we discuss in the following section. The remaining 115 reports were relatively terse and factual, with insufficient rich detail to yield a useful analysis, and hence unsuitable as case studies—a content analysis of the full set of 119 reports has been published elsewhere [16].

5. Four Scenarios

A variety of technologies have been used to support active learning processes. For example, videoconferencing supports collaboration across locations, smartboards enable collective discussions, and dictaphones and video cameras have been used for reviewing individual observations. The most commonly employed learning activities in the Grid are group discussion and class presentation, which allow students to reflect on their own ideas through analysis (comparison), evaluation (making a decision or judgment), and synthesis (creating new ideas). The four chosen scenarios illustrate the range of activities, each one being student-centred and addressing one or more of the higher cognitive skills (summarised in Table 1).

Table 1. Active learning activities.

Module	Active Learning Activities	Technologies	Active Learning Characteristics (Described in Section 3)					Higher Cognitive Skills [17,18]		
			A1	A2	A3	A4	A5	Analysis	Evaluation	Synthesis
Cultural Entrepreneur-ship MA	Group discussion; business simulation scenarios; sharing documents to show team progress; role play; class presentation	PowerPoint, laptop, smartboard, projector	√	√	√	√	√	√	√	√
International Performance Research MA	Group communication via Skype for real-time discussion across locations; blog posts; generating groups' mindmaps	Video conferencing facilities, Skype, blog, YouTube	√	√		√	√	√	√	
Theatre Studies undergraduate	Evaluation of the different stage designs in eight large spaces	Laptop, video, a variety of multimedia	√	√	√	√	√	√	√	
First year undergraduate History	Dynamic group presentation; written short reflections on student performances	PowerPoint, video, laptop, projector, smartboard	√	√		√	√	√	√	

For each of the four scenarios, the teacher specified the configuration of the spaces within the Grid, and these were facilitated by the team of advisors.

5.1. Business Simulation Scenarios in a Cultural Entrepreneurship MA Module

Students studying this module had been split into small teams to manage a "creative enterprise" over a period of one month, and during this period they were presented with a number of challenges to which they were required to respond. Following each challenge, they were required to make strategic decisions relating to the next stage of their management of the enterprise and to report their decisions. Within the Teaching Grid, each team was allocated a space to act as their "Company HQ", equipped with a networked laptop and a projector and screen. In this space, they were required to present reports and to make available other documents they were using (such as financial spreadsheets). Tutors were provided with a "master" space, similarly equipped, in which the outputs of each team could be viewed by all the students so that they could review the decisions taken by the teams and the consequent effects on each team's progress. The space allocated for each Company HQ made possible a role play in which the teams had a sense of their own space in which relevant activities (such as confidential negotiations with potential investors) could be conducted, and the IT facilities provided allowed all information on the team's progress to be collated in a single location. The outcomes for each team were different, and the arrangement allowed teams to view other teams' progress and to compare and contrast how the decisions taken by each team contributed to that team's progress and performance.

In this activity, the spatial dimension of a real-life engagement was mirrored using the flexible space offered by the Teaching Grid. This allowed students to evaluate the performance of individual teams and compare outcomes between teams, thus providing an opportunity to correct and resolve any finance- and strategy-related issues that arose during the course of the simulation.

5.2. Mindmap and Collaboration across Locations in an International Performance Research MA Module

This activity was a collaboration between the authors' university and the University of Amsterdam. At each university, students were divided into groups, and the purpose

of the exercise was for groups at each university to communicate with groups at the other in order to generate mindmaps exploring core aspects of International Performance Research. The activity was seeded by each group choosing a single keyword which was then posted on a blog together with an explanation of no more than a hundred words, plus (optionally) images and other multimedia attachments. Each group then followed this blog post with a further post which took the form of a mindmap prepared by that group. All groups were then able to view the blog posts. The subsequent activity involved groups responding to (other) groups' mindmaps in a non-discursive way—that is, using multimedia items such as videos, songs, poetry, performances, news footage, and so on. Finally, each group worked on a single keyword and the material generated by all the groups on that keyword, and prepared a presentation which was then shared with all the groups via social media, including the blog, YouTube and Skype. In particular, Skype was used for real-time discussion between the groups.

This scenario is important as it shows how student interaction using modern communications and networking technologies can be blended with a variety of multimedia tools, providing students with a path into discussing, assessing, and analysing the key issues contained within the module.

5.3. Exploring Stage Design in a Theatre Studies Undergraduate Module

In this activity, the spatial flexibility of the Teaching Grid was used to create a space in which eight large still and video images could be displayed simultaneously. The module focused on stage design, and set images of seminal productions of Shakespeare's Troilus and Cressida were taken from the then Arts and Humanities Data Service (ahds.ac.uk—decommissioned in 2017). Additionally, laptops were provided containing further material complementing the projected images. This allowed (for example) juxtaposition of images with eye-witness responses to be displayed, and for the changes in approach to set design over a period of thirty years to be displayed in a manner which facilitated comparisons and contrasts to be made.

The importance of this scenario is the blending of a rich variety of multimedia supported by the flexible space. The active participation of students, who were allowed to move between the "stations", supported their evaluation of the different approaches to set design.

5.4. Dynamic Group Presentation in a First Year Undergraduate History Module

Students were divided into small groups (three or four each) and were required to research given topics and present the results using a variety of technologies and presentation formats (including PowerPoint, video, and web content). The Teaching Grid facilitated this by providing the basic technologies (laptops, projectors, etc.) together with space in which these could be applied innovatively. For example, one group applied techniques that are more commonly used in drama, in which the students sat in various poses and by turning the lighting on and off were able to "represent the Enlightenment". Another engaged the audience interactively using a whiteboard. The session was concluded with a question and answer session, following which each student wrote a short reflection on their own performance.

This scenario illustrates how participation with a modest range of technologies specifically supports the development of students' reflective skills.

6. Results and Discussion

Since the infrastructure of the Teaching Grid relies on a combination of technology and flexible space, we structure our discussion of teachers' perceptions accordingly, considering the role of technology, teacher engagement, factors promoting active learning, and overcoming barriers to educational technology adoption. Our four case studies shed light on each of these issues, and we use quotations from teachers as reported in those case studies, to illustrate our discussion.

6.1. Role of Technology

Technology can be used to empower a high-quality learning experience—as one History student commented, "There was greater interaction and a more varied learning experience with different types of media used that made the lecture much more interesting". Students are gaining experience and confidence in using technology to achieve learning outcomes (summarised in Table 1). The roles of technology in supporting learning and teaching activities at the Grid include the following teacher perspectives, which offer us a snapshot of technologies that appear to support students in their active learning.

- Offers the students an opportunity to interact and participate via smartboards: *"In a conventional class, flip charts could have been used but that gave more control to one student as opposed to smart boards which allowed for equal participations by all group members and was more fun. The students' feedback helped it bond".*
- Encourages the development of presentation skills and supports online exploration through presentation facilities and with high-speed Internet access: *"Utilize technology as students are familiar with such matters and are able to use them to enhance their own learning as well as their presentational skills".*
- Delivers high quality pictures with a projector and a document visualizer: *"We had the use of a projector (Document Visualizer) that enlarged very small coins and put them up on the wall. Normally we are only able to look at them with the naked eye or on slides and the detail we could view them in via the projector made it a lot easier to see the coin in the kind of detail to help us really understand the discussion points. This would not have been possible in a normal lecture room"!*
- Supports multi-tasking and complex demonstration through a variety of software: *"These two introductory sessions would have been impossible without the Teaching Grid resources in so far as they enabled multi-tasking and a far more complex demonstration of possibilities than a normal classroom would have permitted. Because the texts are all, at this stage, unedited, students have to make their own research decisions about how to interrogate and explore them".*

Each of these roles uses technology as a *communication facilitator*. Furthermore, for each role, the teacher explained the active participation the technology facilitated.

6.2. Teacher Engagement

Most teachers believed the experience of using the Teaching Grid would affect their future teaching practice. They enjoyed using technologies to increase the effectiveness of the teaching process, and we highlight the following five ways in which the technologies impacted on the process. Each of these ways is illustrated by the views of one or more teachers who adopted that approach.

- *Combination of technologies*: the use of a combination of different technologies co-located in the Teaching Grid is a focus of the activity, and the added value comes from the opportunity to use multiple technologies in a single teaching session. *"The Experimental Teaching Space was therefore arranged to facilitate: Collaborative Presentations; Effective use of PowerPoint; Deployment of text and visual images to demonstrate historical arguments in relation to close analysis of primary sources; Questioning from the student audience and cultivation of debate following the mini papers; Linkage between papers through use of keyword summaries of papers via a Smartboard".*
- *Exploring technology*: the teacher is using the technology available in the Teaching Grid to explore how it can be used in a deeper and more effective way. *"As such, I wanted to try out a different approach to translation, getting the students to work in bigger groups than usual and to compare different versions of the same text to look at specific translation choices. To do this, I decided to use the interactive whiteboards so that students could interact with each other's work, physically moving elements in phrases around. I therefore decided to run a longer session that would involve around 30 students instead of the usual 15–20".*

- Trialling new technology: *"I realized that I still have much to learn about the use of technology, but have started to learn some of the basics: for example, using a video camera (the university requested the presentations be videoed and a copy sent to them). Also, visual projecting skills (these still need more work!)"*.
- *Creative thinking*: the teacher is using technology to improve the class activities. *"It has also made me start to think more creatively about how to include visual stimuli in translation sessions"*.
- *Overcoming technology shyness*: the teacher is "technology shy" and uses the Teaching Grid (and the staff support) as an opportunity to familiarise themselves with the equipment. *"It has helped alleviate the technology shyness and I will certainly experiment more with technology now"*.
- *Promotion of students' eagerness*: the teacher thinks the technology-rich environment can be used to promote and motivate students' enthusiasm and confidence. *"I am going to try to introduce more elements of oral history and the active creation of historical resources into my classes where I can; the impact that this had on the students' confidence and enthusiasm was simply astonishing"!*

Overall, this experimental teaching space with many technologies co-located in one place successfully managed to generate excitement amongst the teachers. Another theme running through the individual cases is *combinations of technologies* and other support mechanisms motivating the teachers. In other words, the teachers are not looking to incorporate single solutions in their future practice, rather they see *blended solutions* enhanced by the new technologies.

One limitation of a study such as this one is that it is difficult to track individual teachers following their engagement with the Teaching Grid to ascertain the extent to which their subsequent practice has been modified and improved. Some teachers leave the university, and some are reassigned to different courses. Furthermore, constraints in timetabling and room allocation mean that teachers are not always able to put their desired course improvements into practice. However, our teachers' comments above signify a desire and willingness to incorporate their experiences in their future practice, although an analysis of how successful this may have been for individual teachers is beyond this study.

6.3. Factors

A thematic analysis of the data collected from the study (the four scenarios) suggests that there are five sets of factors which promote active learning (Figure 2). The description of each of the factors is informed by the data, and we include the key words and phrases from the studies which support this classification. This study, together with previously published studies, suggests several factors which affect how active learning can be effectively promoted in a technology-rich space.

- F1: Space. The design of educational spaces needs to be flexible, future proofed (to enable space to be re-allocated/reconfigured), creative (to energize/inspire learners and teachers), and enterprising (to make each space capable of supporting different activities). Studies [30,32] also reported seven variables that are influenced by the learning space—engagement, enrichment, flexibility, effective use, student learning outcomes, room/course fit, and confidence—and these factors are clearly evidenced by the following student and teachers' comments. *"I liked the flexibility of the space and the relaxed atmosphere which made things more conducive to our learning activities". "Usually I would have used the Training Room and demonstrated software/processes with the projector and then let students have "hands-on". The lay out of the TG did mean that students were easily and readily able to contribute to the production of a group mind map"*.
- F2: Technologies. Arbaugh [33] and Campbell et al. [3] reported that technology can be used to influence students' attitudes and increase their satisfaction. From the teachers' perceptions of technology in this study, and the overall use of technologies by teachers using the Grid, we have evidence for the effective use of several specific technologies. Teachers noted that the ability to choose an appropriate technology which was

immediately available was a highly enabling factor. *"I and the other organizers, were surprised at how much we were able to achieve in the given time because the right technology and working environments were all provided in one space." "If it hadn't been for the technology available here, students would have been very limited in their options on the kind of pictures they could bring".*

- F3: Activities. Cavanagh [34] and Henderson [35] noted that a variety of activities should be considered in order to promote active learning. Some examples of active learning activities at the Teaching Grid are shown in Table 1. The following quote shows that students can develop analysis skills by making a comparison of their group work with the other teams. *"Students welcomed the opportunity to make comparisons and see how other teams had done things differently to them, so being able to understand the same issues from multiple and simultaneous perspectives were a real strength of the set up".*
- F4: People. Vickery [36] noted the seven characteristics of active learners including (i) looking for ways to improve; (ii) looking for creative ways to solve problems; (iii) giving and taking ideas; (iv) helping the team; (v) taking responsibility for their learning; (vi) talking about their learning; and (vii) never giving up, and teachers can help students to develop these characteristics. Successful active learning is determined by the teacher's teaching style. Teachers and students are central to the effectiveness of the Grid, and the enthusiasm and motivation the Grid generated are evidenced by many of the participants, such as the following three teachers. *"In future teaching I will be thinking more about how to successfully integrate technology effectively into everyday teaching". "I was amazed at how immediately and ingeniously they worked with the technology, far more than I would do. I learned to stand back to allow the students to lead when they wished." "Interestingly, I noted that three of the quietest students intervened more frequently and more confidently in the seminars that followed the sessions in the Teaching Grid."*
- F5: Help. Avci et al. [37] and Snyder [18] suggested that one of the important factors promoting successful active learning is a helpful support team. Support by the team of advisers can increase understanding and build confidence in using the Teaching Grid resources. *"Spend time demonstrating the technology otherwise they just don't use it. Have some specific questions/goals for the session as some groups may need more of a nudge than others." "It would have been far more difficult to achieve these outcomes without the support provided by the Grid".*

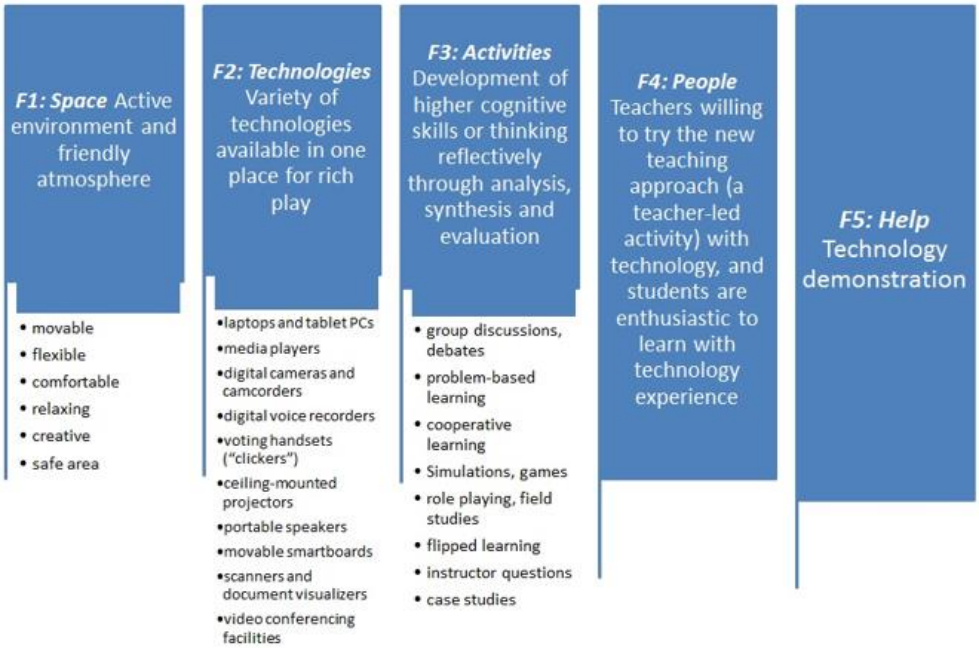

Figure 2. Five active learning factors.

6.4. Overcoming Barriers to Educational Technology Adoption

Traditional teacher development courses and support are, for most teachers, failing to facilitate the use of available learning technology that goes beyond the purely informational [11]. Where adoption is optional, a significant minority of teachers do not use it at all. The reasons behind the disinclination to adopt and the barriers that teachers face are varied and complex; however, the initial major challenge for many is a fear of the technology and possible consequences if things go wrong in front of students [12], and Downie et al. [38] identified "fear and time burden of incorporating TEL and lack of technical knowledge" as one of three major barriers in addition to "institutional culture and infrastructure and support for TEL" and "distraction of TEL and prospect of superficial learning". The consequence of this reluctance to start is an increasingly wide gap between those who use the technology and those who do not, with successive new releases and increasing functionality leaving the latter group even further behind. It seems that, for many teachers, instructional training about how to use the technology is not enough to help them overcome the real or perceived barriers that prevent adoption.

In order to address this problem, the Teaching Grid provides a supported space in which teachers can, firstly, obtain help with understanding the technology and how to plan teaching which uses it and, secondly, conduct their teaching sessions in a safe space with technology experts on hand if needed. The data gathered from the Teaching Grid for this study indicates that this approach is enabling teachers to embrace active, student-centred, technology-focused instruction in a way that other training is not. Comments such as "*I realized that I still have much to learn about the use of technology, but have started to learn some of the basics*" indicate a progression in the use of technology experienced by these teachers.

All the reports provided by the teachers involved the use of technology which was either completely new to the teacher or was being used in a way that the teacher had not previously tried. Further, the expressed intention to continue using the technology and to integrate it further with their practice indicates increased confidence which the teachers felt would allow them to continue the active technology-supported teaching in their usual classrooms. These results suggest that professional development based around supported practice, such as that offered in the Teaching Grid, can offer an effective alternative to more traditional teacher training by facilitating teacher adoption of new learning tools and technologies.

7. Conclusions

This paper reports the use of the Teaching Grid, which supports teachers in the development and delivery of technology-based teaching, and reports the teachers' perceptions of the Teaching Grid experience, which they reported will affect their future teaching practice. The factors that promote successful active learning—including space, technologies, activities, people, and technology help—are identified.

Teacher use of new technologies is principally as a communication facilitator and allows improved engagement with students through enhanced student motivation and allowing the teacher to explore and become familiar with those technologies.

Five specific factors have been identified which promote active learning. These are the design of the learning space, effective use of technologies, activities which promote active learning, enthusiasm and motivation of both teachers and students, and a helpful support team.

The results of this study suggest that a facility such as the Teaching Grid offers a good experimental teaching space with a technology-rich environment. Not only can it be used to support teachers' professional development, but it may also be more effective in promoting real change and effective pedagogic use of learning technology than existing teacher training. The Teaching Grid experience has increased teachers' confidence, influencing them to integrate technology into their future teaching plans. In addition, a variety of technologies trialled in this flexible teaching space are now being used by these teachers in ways that increase students' opportunities to become active learners.

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