

Evaluating the sustainability of tablet devices in blended learning

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Blended approaches to teaching and learning and higher education often demand the provision of substantial investments in professional development, curriculum change and technological resources. Given the intense effort required for successful courses, focus has turned increasingly on the sustainability of blended learning in higher education. In this study, we adopt an argument based approach to the sustainable use of tablet computers in a university pathway course. After mapping out the argument with key stakeholders, we conduct a participatory action research project that takes into account observations, interviews and personal reflections. Results of the evaluation point to a 'weak argument' for the continued use of tablet computers that demonstrates their use is not sustainable. We conclude with suggestions to turn to issues of curricular alignment and further adoption of argument based evaluation for educational technology.

Introduction

In an era of diminishing funding for educational technology, a focus on sustainability is important as institutions seek to make use of available resources for long-term benefit (Gunn, 2010). In the context of innovations in blended learning, these initiatives tend to be small scale projects (Hubbard, 2005) that have often failed to scale up to an institutional level (Owston, 2013; Gruba & Hinkelman, 2012). The lack of uptake not only indicates a waste of time and resources, but reinforces the idea that for blended learning initiatives to endure, there needs to be a focus not just on sustainability, but a view of such an important aspect at program level (Nworie, 2014).

Despite concerns about the long-term uses of technology in blended learning, little work to date has focused on the evaluation of sustainable practices in higher education (Gruba, Cardenas-Claros, Suvorov, & Rick, 2016). Accordingly, the aim of this paper is to evaluate the sustainability of the use of tablet computers in a blended language learning program. To achieve this aim, we forge a conceptual framework based on a synthesis of work from evaluation and sustainability (Blin, Jalkanen & Taalas, 2016; Gruba et al., 2016). Specifically, we conduct a study grounded in participatory action research (Patton, 2015; Somekh, 2006) within a program that prepares non-English speaking students for entrance into Australian universities. Following a review of the literature, we set out the details of our investigation, explain its outcomes and suggest an agenda for further investigation.

Developing an evaluation of sustainable blended learning

In higher education, the concept of sustainability can be viewed from two different perspectives (Cerone, 2014). Stepanyan, Littlejohn, and Margaryan (2013) distinguish the perspectives as either "education *for* sustainability" or the "sustainability *of* education" (pg. 94). Aligned with issues surrounding the environment, education for sustainability focuses on maintaining the 'economic, social and ecological well-being' of current and future stakeholders. In this context, sustainable development becomes a core aspect of the educational institution's course content, classroom practices and overall curriculum (e.g., Jones, Selby, & Sterling, 2010; Barlett & Chase, 2013). In contrast, perhaps, concerns can focus on the sustainability *of* education. Here, the focus turns to sustaining effective teaching and learning practices; in doing so, researchers seek to take into account how factors such as education, leadership and innovation can positively or negatively influence initiatives depending on how they are implemented (Davies & West-Burnham, 2003; Cerone, 2014). Our paper makes use of the second perspective.

To evaluate the sustainability *of* blended learning, we adopted an 'argument-based approach' that was first created for the purposes of test validation (Kane, 2006; Chapelle, Enright, & Jamieson, 2008). The argument based approach is a two-stage process which entails first developing an argument and subsequently appraising its validity (Kane, 2012). From this foundation, Gruba et al. (2016) proposed that an argument-based evaluation



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framework be extended to the broader context of blended language programs. Here, instead of a focus on validity of assessment scores, the interpretation and uses of the evaluation are applied to the claims made about a blended language program. To map out the evaluation, the first two stages of the argument based approach involve determining the level of focus (micro, meso or macro) as well as a consideration such as purpose, appropriateness, multimodality or sustainability (Gruba & Hinkelman, 2012; Gruba et al., 2016). Once the level, considerations and focus have been determined, the evaluator can then proceed to the four stages of developing the argument which are (1) planning an argument; (2) gathering the evidence; (3) presenting the argument; and (4) appraising the argument.

The planning stage of argument construction starts with explicitly laying out the claims which can be made at different stages of the evaluation. These stages refer to the network of five inferences which include domain definition, evaluation, explanation, utilization and ramification. Starting with the domain definition inference, a claim is then connected to the next inference, evaluation and so on until it reaches the final inference of ramification. It is within this network of inferences that claims are connected to each other. Claims are crucial in the process of argument building as they map out the direction of the evaluation and outline the kinds of evidence required to back each of the claims made (Chapelle, 2014).

In this paper, we employ an interpretative argument to test claims that are made by key stakeholders of a blended language program. For example, we would examine the claims made about sustainability through an interrogation of warrants, assumptions and evidence. After passing the evidence through a series of inferences, we would seek to determine whether the claims that are made are strong, moderate or weak (Golonka, Bowles, Frank, Richardson, & Freynik, 2014).

The second half of our conceptual framework is built on an institutional model of sustainable blended learning (Blin et al, 2016) and rests on four pillars: (1) Environments and tools for learning, (2) Pedagogical and professional development, (3) Community and knowledge building, and (4) Organisational structures as shown in Table 1.

Table 1: Four pillars of sustainable blended language learning

Component	Description
Environments and tools for learning	Sustainable practices are purposeful and tailored to the needs of students and teachers, learning objectives, classroom tasks and activities.
Pedagogical and professional development	Sustainable teaching is grounded in the capacity building of instructors.
Community and knowledge building	Working together and sharing resources amongst teachers enhances the sustainability of blended learning.
Organisational structures	Sustainability entails the involvement of the whole organization across all levels while being flexible and adaptable in light of unexpected outcomes.

Adapted from Blin et al. (2016)

Notably, all pillars are of equal importance and mutually influencing one another. While this model provides a useful starting point to investigate the sustainability of blended programs, as Blin et al. (2016) acknowledge, it is still in its initial stages and requires further development. Therefore, this study also seeks to apply this model to determine its usefulness as a conceptual framework for analysing sustainability; whether it offers a feasible model to articulate sustainability factors or alternatively whether further expansion of the framework is required.

Context of the study

The evaluation project was conducted through a case study of the English for Academic Purposes (EAP) course situated within a foundation studies program of a pathways college in Australia. Designed to prepare international students for entry into universities in Australia and around the world (Benzie, 2015) the popularity of pathway programs and colleges have risen in recent years (Lisciandro & Gibbs, 2016). Emphasising both depth and breadth of knowledge, the nine-month foundation studies program comprises three components which include EAP, two compulsory subjects, and three elective subjects in areas which include Commerce, Science, Arts, Media and the Environment. The EAP is a hurdle subject taken by all students regardless of what subject area they are taking and necessitates a minimum pass of 50% to fulfill university entry requirements. The course is offered in various intakes throughout the year

and is led by an EAP subject head and taught by approximately 30 academic staff.

Divided into two semesters, EAP classes are conducted twice a week with a duration of 90 minutes for each session. The overall emphasis of the EAP course is on developing academic literacy in two aspects: 1) understanding and engagement with academic texts 2) expression of opinions in both written and oral forms. The primary assessment methods are academic writing assignments, oral presentations, and exams. In the first semester students develop their academic writing and presentation skills through a guided, process oriented research project, working collaboratively in groups to produce an argumentative essay. Building on these skills, students will subsequently apply them in the second semester where they work individually on a project-based written and oral task. Similar to the first semester, students are required to conduct research, write an argumentative essay and then conduct an oral presentation based on what they have written. Blended learning is emphasised throughout the college where for the past five years all students and staff have been allocated tablet computers to be used for educational purposes. Accordingly, the teaching of EAP is implemented through traditional face-to-face sessions as well as technology integrated components in the form of tablet computers, Google Docs and Google Drive, a Moodle based learning management system (LMS) and the EAP website developed through Google sites.

Methodology

In line with Chapelle (2014), our evaluation project consisted of planning an argument, gathering and analysing evidence to support it, presenting the argument and appraising it. In the initial stages of the project, we collaborated with key stakeholders to set out the overall argument (Figure 1). The planning stage provided an opportunity to clarify program goals, identify potential weaknesses, set the schedule, and to determine possible sources of data including relevant documents, people and events. We saw the levels as distinguished amongst those at the (1) macro (institutional, policy), (2) meso (departmental), and (3) micro (classroom) levels (Gruba et al., 2016).

An awareness of levels influenced our choices in research techniques. For example, discourse analysis may be used for documents at the macro level, interviews for meso level members of an academic department, and classroom observations to gather information at the micro level of a program.

Returning to key stakeholders, we again sat down with key stakeholders to discuss what was learned in the data collection stage, showed how we understood the results, and considered what actions might be considered to build

sustainability. Finally, we made an appraisal to determine if the overall argument, used to evaluate the sustainability of tablet device uses, was weak, moderate or strong. A weak argument, for example, would be based on anecdotal evidence that had little triangulation with other sources of data. A moderate argument contains verifiable and empirical data from two or more related sources. A strong argument extends the results of empirical analysis to confirmations in the literature or related evaluation projects.

Combined, then, an argument-based approach to blended program evaluation takes into account the structure of the institution at three levels, recognizes focal considerations that are important to stakeholders, and is conducted in four distinct stages that conclude with a reflective appraisal of the argument itself. We further explain the process in detail.

Participants

As the evaluation study is focused on the meso or organisational level, the key stakeholders included the EAP subject head and five full time teachers teaching in the same intake. A summary of the participants can be seen from Table 2. To safeguard the anonymity of participants, pseudonyms have been used as the evaluation may raise potentially sensitive issues regarding the implementation of blended learning at the institution. In addition, any details which might lead to the identification of the respondents was removed or modified accordingly. In addition, Palikat who was a part-time teacher at the same intake was also involved as a participant observer; contributing an additional layer of interpretation to the data collected.

Table 2: Summary of participants

	Participants	Position
1.	Richard	EAP Subject Head
2.	Alice	EAP teacher
3.	Karla	EAP teacher
4.	Kristen	EAP teacher
5.	Patricia	EAP teacher
6.	Rachel	EAP teacher

Planning the argument

Our discussions with key stakeholders resulted in sketching out a set of the warrants, claims and underlying assumptions (Figure 1) that form an overall argument for the evaluation project.

Inference: Warrant	Claims and underlying assumptions (numbered after each claim)
E. Ramification	<i>Attention to concerns of sustainability can inform the promotion and evaluation of blended learning.</i>
↑	<ol style="list-style-type: none"> 1. The project is transferable to other blended learning programs. 2. Outcomes are disseminated in professional forums. 3. The evaluation project interests the broader community.
D. Utilization	<i>The stakeholders make use the evaluation to enhance sustainability.</i>
↑	<ol style="list-style-type: none"> 1. Outcomes resonate and stimulate action from stakeholders. 2. The outcomes identify areas for improved sustainability.
C. Explanation	<i>The findings align with the program and are consistent with an understanding of sustainability within the context of the evaluation.</i>
↑	<ol style="list-style-type: none"> 1. Blended approaches are sustainable with the available resources. 2. Sharing, reuse and repurposing are goals of the institution and program.
B. Evaluation	<i>The analysis identifies departmental attitudes and instances of device uses concerned with the sustainability in blended learning.</i>
↑	<ol style="list-style-type: none"> 1. The analysis is trustworthy and dependable. 2. Program stakeholders provide insights into the use of devices. 3. Effective device use is required in sustainable blended approaches.
A. Domain definition	<i>Key stakeholders, primarily teachers, make use of devices in ways that enhance sustainability in blended learning.</i>
↑	<ol style="list-style-type: none"> 1. Sustainability is important to the viability of blended learning. 2. Blended learning is a key pedagogical design in tertiary institutions. 3. The widespread and integrated use of technology makes blended learning possible in higher education.

Figure 1: Meso-level warrants, claims and assumptions

Of note, the process of sketching out various drafts of the argument helped stakeholders to understand the overall goal of the program evaluation, a point that may lead to the adoption of outcomes (Patton, 2011).

Gathering and analysing the evidence

After negotiating site access and human research ethics approval, we first began with an interview with the EAP subject head to understand the history and context of blended learning implementation within the program. In line with Cowie (2009), Palikat then made extensive field notes of both her own and other teachers' classes in an online reflective journal. After each class, she reflected on

the content and delivery of the lesson noting her thoughts and observations on what went well, what didn't go so well and future improvements to be considered. Similarly, observations of five other teachers' classes focused on the affordances and limitations of implementing blended learning, as well as the influence of technology integration on classroom dynamics. This was followed by interviews with each of the instructors.

Documentation was also collected such as literature on the EAP program, prospectus and other related marketing material. For additional insight into the academic aspects of the EAP, the institution's learning management system, website, curriculum and syllabus documents, teachers' lesson plans and course materials were also analysed.

The analytical strategy employed in this study is based on the multi-methods of data collection used. Recorded data collected from interviews were transcribed in full and analysed. This data, along with those from field notes and observations were coded through thematic analysis (Fereday & Muir-Cochrane, 2006) by categorising them to the four pillars of sustainable blended learning (Blin et al, 2016) where further sub-themes were identified. To reduce potential bias and corroborate the data from interviews and observations, content analysis (Bowen, 2009) of related documents was done for data triangulation (Kress, 2011) purposes.

Pillar 1: Environments and tools for learning

In the first pillar, Blin et al. (2016) argue that the learning environments and tools used by a blended language program be purposeful and tailored to the needs of students, teachers, learning objectives and activities. In terms of learning environments, based on analysis of the EAP syllabus and teachers' lesson plans, the EAP's main focus was on collaborative and individual writing. Thus, the use of a tablet computer to deliver the course content greatly influences the kind of learning environment created.

An interview with the subject leader (Richard) revealed that too many platforms were used (applications, LMS, Google Sites and Google Docs/ Drive) which lacked integration and was 'overwhelming'. Interviews with teachers confirmed this with one teacher commenting that "on the tablet computer switching back and forth from Google Sites to LMS to other documents is frustrating as I need to get out of the website and then into the LMS... easier if all the materials were centralised" (Rachel, Int.01-Oct., Lines 41,46). In addition, field notes and observation data also show the tablet device's lack of multi-window functionality make it difficult for students to carry out essay writing tasks which require referring to other documents such as research articles, lesson materials or rubrics. This has led to the use of additional devices where both teachers and students have been

observed using additional laptops and even mobile phones to carry out class activities.

In terms of using the tablet as a learning tool, data from interviews, field notes and observations revealed that the tablet device's limitations can be categorised into both hardware and software. For hardware, the tablet's limitations were reported to be its small screen size, touch screen feature and lack of a keyboard. A stakeholder remarked that the tablet's design made tasks such as reading "...tedious and takes the joy out of reading" (Richard, Int.01-Sept., Line 40). The small screen also means that both students and teachers are required to do a lot of scrolling, making it difficult to view documents at a glance. As the EAP is largely a writing based course, this means that the touch screen feature makes editing tasks such as highlighting, copying and rearranging words, sentences and paragraphs quite frustrating as revealed through field notes and observations of Palikat's and other teachers' classes. The lack of a keyboard also affects writing tasks where tapping on the tablet device is not as efficient as typing on a keyboard. Thus, this can explain why students in the classes observed have added an additional keyboard to their tablets or brought laptops to address this problem.

Also, due to the tablet computer's limitations, it has been used more for consuming (e.g. following lessons, accessing course materials, going through recommended readings etc.) rather than creating content (e.g. writing, doing audio/ visual recordings). This is consistent with findings from other research (Green, Naidoo, Olminkhof & Dyson, 2016). The second type of limitation relates to the tablet device's iOS software which is incompatible with Android based computers and systems. Interviews with teachers revealed that some were using Android computers which makes working from home and switching between devices difficult. In addition, by opening Google Docs/ Drive which are Android based programs, the tablet device doesn't have complete functionality compared to the desktop version. An interview with EAP teacher, Karla, highlighted this issue as she noted that "...many times the students aren't with documents able to do as much as they probably would have if it was using a laptop" (Karla, Int.01-Oct., Lines 32-33). Clearly, the conflicts in mixing two operating systems weakened the sustainability of the use of the tablet computers.

Pillar 2: Community and knowledge building

The second pillar underscores the need for collaboration and for teachers to continuously evolve and adapt their teaching views and practices, together with the corresponding tools and environments for learning. Thus it can be seen that this pillar can have a direct effect to the first pillar covered previously. Interview data revealed the need for greater collaboration both internally and externally. For internal collaboration, teachers expressed

the need for EAP teachers to work together, know what other teachers are doing, and share their expertise. For external collaboration, this involves both knowing about what other foundation studies teachers are doing as well as working to see how the knowledge students gain from EAP can support other subjects. Thus, there is a need to lessen the silo effect between EAP and the other subjects in the foundation studies program. This collaboration in turn can facilitate knowledge building, where greater alignment with other subjects could benefit both teachers and students. For teachers, this can lead to awareness of selecting more authentic and relevant class materials. For students, this may build on the knowledge gained from EAP by relating it to the other subject areas they are studying. The benefit of this collaboration can be seen from the following interview response:

I'm a fan of using authentic material, authentic texts and if we're making it up then we're not preparing them for realistic application of those skills. In that sense, we need to know what everybody else is doing so that we can relate to them and prepare students to be able to do that in real time, in those subjects and then later on be comfortable enough to perform those functions at university. (Karla, Int.01-Oct., Lines 59-60)

Another aspect of sustainability under this pillar is the need to adapt and evolve according to the changing needs of teachers, students, as well as the EAP course itself. The importance of continuous course refinement was highlighted in teacher interviews. All five of the teachers interviewed expressed a general satisfaction with the EAP curriculum but felt that constant revisions were needed after identifying the course's strengths and weaknesses. However, adaptations and modifications on a more micro level were evident through analysis of teachers' lesson plans and the EAP website. For each of these resources, many of the lesson content presented included more simplified tasks to cater for lower level students and extension activities for higher level classes which teachers could modify as they saw fit. The adaptation of these resources was apparent from both field notes and observations done on classes of different levels, and appeared to influence sustainability.

Pillar 3: Pedagogical and professional development

The third pillar on pedagogical and professional development acknowledges teachers' roles as change agents of new teaching initiatives. As such, sustainability of blended learning rests on their ability to continuously adapt their teaching practices in line with changing classroom environments. Interview data show that teachers do recognize the importance of technology in teaching, especially the role that it plays in online collaborative writing which is central to the EAP

curriculum. However, it was found that teachers displayed varying degrees of technology resistance due to "...insecurity, and lack of confidence in trying to manipulate new kinds of skills..." (Kristen, Int.01-Oct., Line 40). Among the skill areas which teachers felt needed further development include methodology of teaching, materials development in the online format and exploring programs/ tools which can facilitate class activities. The following interview response reflects this third concern:

So for example, if you were not aware that certain programs exist... say you're doing a language quiz where you want them to choose certain answers and get some feedback (a) you've got to know that there are programs that can do that, (b) you've got to have the time to set it up the first place. (Alice, Int.01-Oct., Line 18)

In general, teachers have expressed the need for continuous, and targeted professional development and training on the pedagogical reasoning and application of the tablet computer in relation to the EAP course content. At present the focus of teacher professional development has been more on the technical aspects of setting up and using the tablet computer as well as exposure to educational applications that teachers can use in the classroom. Much less attention has been on demonstrations featuring how teachers can design lessons and tasks to create lessons that 'work' in the online format. Similar conclusions on the lack of training on the pedagogical applications of technology use have been reported in the literature (Kennedy & Levy, 2009).

Pillar 4: Organisational structures

The final pillar relates to how change should be implemented across all levels in relation to broader institutional objectives, and being able to adjust to possible unexpected outcomes in the process. Interview data revealed the need for a top down approach to implementing blended learning initiatives. A teacher's interview response further elaborates this:

So that means as an organization higher up - they do have a vision. I mean they know what kind of approach they're using and then that message needs to be communicated to the teachers and the students. (Kristen, Int.01-Oct., Line 22-23)

Currently there is a lack of policy to formalise blended learning and the use of technology at the college. This was confirmed through interviews with the subject head and teachers, as well as a document analysis of the college portal and website. Interviews with teachers revealed that at present there is a strong encouragement from the upper management to use technology and the tablet computer for teaching. However, the lack of a formal policy on technology use can prove to be

problematic as a key factor for blended learning program sustainability is staff ownership as revealed from an interview with subject head, Richard. Without a formal policy, embedding blended learning into the culture of the institution could be a challenge as teachers may not be aware or share the college's vision of more advanced teaching practices using technology.

Another aspect of organisational structures revealed through interview data is the fluidity of different organisational roles that make up the foundation studies program. For example, the subject head of the EAP functions in the dual roles of management as well as teaching. This was revealed through an interview where he describes how useful it was to first design an EAP lesson and then be able to trial it in class. By playing the same role as teachers, the subject head was able to view the implementation of EAP from their perspective. In this way, mandates or directives from the upper management can then be filtered through this perspective to determine whether the decisions made would best serve the interests of both teachers and students.

One additional role of the subject head related to sustainability is the promotion of blended learning where he has shared what has been done in the EAP course to other teachers and departments; for example, the administration. This in some ways could inspire other departments and foundation studies subjects where they can have a look at the online resources created and ask questions. The positive outcome of this sharing process is revealed in the following interview response:

There has been positive feedback from other departments after having seen some examples of what the EAP has done and inquiring whether a similar approach could be done for their courses. (Richard, Int.01-Sept., Line 27)

Additionally, the subject head can also serve as the 'voice' of teachers by forwarding their concerns to stakeholders at the upper management level. In this way, should teachers have problems or concerns with the use of the tablet computer, these issues can be brought to the attention of the upper management who then can address them. As a result, if the emerging issues with tablet computer use are continuously resolved, then teachers would be more motivated to continue using it as an educational device.

Presenting the argument

Working with key stakeholders, we presented our evaluation of the sustainability of tablet device usage learning in a way similar to the argument structure we had mapped earlier. The domain definition inference is founded on the warrant that key stakeholders, primarily teachers, make use of devices in ways that enhance sustainability in blended learning. A central assumption

here is that the widespread and integrated use of technology makes blended learning possible in higher education. To provide backing for the warrant, we used a combination of literature reviews, interviews and document analysis to support the claim. Through these techniques, the domain definition inference was met accordingly, and the analysis allows for a transversal to the next inference of evaluation.

The inference of evaluation is based on the warrant that the analysis identifies departmental attitudes and instances of device uses concerned with the sustainability in blended learning. The central assumption is that program stakeholders provide insights into the use of devices. An additional assumption, that effective device use is required in sustainable blended approaches is needed.

The explanation inference is based on the warrant that the findings align with the program and are consistent with an understanding of sustainability within the context of the evaluation. The key assumption for this inference is that blended approaches are sustainable with the available resources.

As shown in the findings of this case study, the assumptions were not backed by the evidence: that is, ideas to foster sustainability were tentative despite years of tablet computers being used at the institution.

The utilization inference rests on the warrant that stakeholders such as the administration, academic staff, and curriculum design team members make use of the evaluation to enhance sustainability. This warrant is based on two assumptions: (1) Outcomes resonate and stimulate action from stakeholders and (2) Outcomes identify areas for improved sustainability. Potentially, recommendations that may lead to enhanced sustainability, and an expected improvement, could include:

1. A clear institutional stance on blended learning and pedagogical technology use through the establishment of policies surrounding tablet computers use and corresponding applications in teaching and learning.
2. Greater recognition in policies and initiatives on the need to foster pedagogical patterns.
3. Spread of sustainable practices, such as repurposing and reuse of lesson materials.

To justify such recommendations, evidence can be drawn from document analysis and member checks. At this point, this case study is primarily for research (that is, as a pilot study to check the utility of an argument based approach) and not for evaluation. Without deeper consultations and actual use, however, the utilization inference cannot be supported through our work for this case study.

Not all program evaluations, particularly those designed for an internal audience only, can meet the ramification inference that attention to concerns of sustainability can inform the promotion and evaluation of blended learning; thereby attempting to connect the project to broader practical implications. To transfer this argument to another educational context, the college could be seen as a case study representative of higher education institutions that are well resourced with contemporary educational technologies. Two assumptions are required: (1) Outcomes are disseminated in professional forums and (2) The evaluation project interests the broader community. Due to the scope of this case study the ramification inference cannot be supported at this time.

Appraising the argument

The claim that the use of tablet devices is sustainable in the EAP program is weak; that is, an idea that the devices enhance sustainable practices could be rebutted as it has not been fully met at this time. In line with the effort by Golonka et al. (2014) to set out a rubric to evaluate the strength of claims, any suggestion that key stakeholders, primarily teachers, make use of devices in ways that enhance sustainability in blended learning would be 'moderate'. That is, although the first two inferences of observation and analysis were met, neither explanation nor utilization inferences could be fully supported. Regarding the inference of explanation, for example, matters of sustainable practices at the case study institution appeared to be at aspirational stages and are yet to be fully developed. For utilization, this limited case study cannot assert that institutional stakeholders will incorporate any of the findings in their future work.

As with other institutions offering pathways programs in Australia, the college has seen tremendous growth (Lisciandro & Gibbs, 2016) which has put pressure on available facilities and human resources, particularly academic staff, who have had to cope with changes in rising student numbers and changing teaching approaches. In this climate, and in line with studies of educational technology policy, academic staff saw little connection between their own efforts and college initiatives (Zhao & Lei, 2009). Most perceive blended learning more as a means to facilitate class management, and cut down on the use of paper, rather than enhancing pedagogy. Teachers agreed that it would take time to properly integrate new initiatives in their own approaches to blended learning and teaching.

Discussion

Years ago, work by Zhao and Lei (2009) pointed out that the "public, policy makers, and educators are in desperate need of rigorous research to guide their technology decisions and technology project implementations" (p. 688). One outcome of this case study evaluation is that such a need still exists, but there appears to be an

increasing alignment of institutional strategies and resources allocated to support blended approaches. More research is needed, however, to bring together the many strands of evidence that could be the basis of a strong argument. Learning analytics can shed some light on program evaluation (Bollenback, 2015) but it is advisable to take into account a wider range of contextual issues beyond the immediate design and teaching environment (Huber & Harvey, 2016).

Perhaps not surprisingly, our evaluation demonstrated that the use of tablet computers in this blended learning program is not sustainable; that is, the claims made by the key stakeholders were not supported: the tablets did not meet the pillars of sustainability for environments and tools for learning, community and knowledge building, pedagogical and professional development or organisational structures (Blin et al, 2016). Our work in evaluating the sustainability of blended programs will now focus on technology as a *system* rather than a device. From a system point of view, technology is seen as a complex network of inter-related components that form a unified whole (Banathy & Jenlink, 2004; Ison, 2008); a clear example of which is an LMS. Therefore, the focal technology to be investigated will shift to the LMS utilised in the college, where a similar approach will be undertaken through a qualitative case study. The focus will be centered at the meso, or departmental, level and then continue to investigate classrooms at the micro level. A multi-level approach, combined with differing considerations and methodologies, allows us to undertake a longitudinal investigation of the blended learning initiative that will no doubt continue to change in the coming years.

During our discussions, we have begun to think that there is a need to take into account design practices that could be seen as making up a much more local, or nano, level. Tentatively, we defined the nano level as one that would focus on design practice themselves in line, perhaps, with the work of Phillips, McNaught, & Kennedy (2012). At this level of argumentation, pre-implementation designs as well as inevitable ongoing changes in blended materials could be taken into account within an evaluation. By doing so, the project could seek to show how well the use of learning objects, for example, was done in light of sustainability. Other considerations such as purpose, appropriateness, and multimodality as well as others could be brought to greater scrutiny. One value of the argument is that it creates a narrative that can be understood by all those involved along the continuum of developing and enacting a blended approach to learning throughout an entire university course.

Another consideration, alignment, also is on our agenda: Across an entire blended learning program, how much do policy and institutional initiatives align with other levels? How is policy put into practice, for example, in the

creation of a lesson plan? By bringing in alignment as a key consideration, an evaluation team can have a stronger warrant for work across programs and the disciplines; on a related note, curriculum design teams could better defend their pedagogical patterns with a footing both in policy and educational theory. Further evidence, too, could be brought to issues surrounding the value of learning outcomes (Havnes & Prøitz, (2016) in the appraisal stages of the evaluation. Combined in a single pattern, work on alignment may enhance the work in the eyes of the institution as well as throughout the wider fields of practice in educational technologies.

To conclude, an argument-based approach to the evaluation of programs rich in educational technology appears to be feasible. Importantly, because they use the same structure and reasoning, an argument-based approach may allow for the comparison of one classroom to another, one discipline to another, and one institution to another and so on until a comprehensive picture emerges regarding the efficacy of blended learning approaches. Across Australia, for example, such an evaluation would help to improve the use of limited educational resources.

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