All Things Merge into One, and a River Runs Through It: Exploring the Dimensions of Blended Learning by Developing a Case Study Template for Blended Activities

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Abstract

The BLITT (Blended Learning International Train the Trainer) Project is focused on developing a training programme to equip teachers to become proficient in championing the use of Blended Learning in the classroom. The training programme will be developed in two phases, in the first phase involves the development of a series of case studies relevant to Blended Learning, followed by a second phase where the BLITT training programme will be designed and developed, using input from these cases. In developing the blended learning case studies, two key documents were identified as being essential, first, a case study template to describe the main headings for the case studies (including looking at Blended Learning from the points-of-view of Security, Accessibility, and Costs), and second, a case study checksheet tool with a number of questions to help undertake reflection on the case studies to assist in completing the template. These two documents provide a coherent and organized way to structure the case studies, and their development is described in this work.

1. Introduction

The goal of this paper is to outline the process undertaken in creating a template for tracking and capturing key aspects of a series of case studies focused on introducing Blended Learning innovations into the classroom, to be used as part of the development of a train-the-trainer course on Blended Learning.

The approach undertaken used research literature in this area as a starting point, and from there a MindMapping approach to brainstorm features of the template. To compliment and support the case study template, a checksheet was created with a series of questions that would prompt someone reviewing the case studies to reflect deeply on them [1].

2. Blended Learning

"Blended learning" typically refers to educational experiences that combine both online teaching with traditional classroom-based teaching [2]. The two most commonly used definitions for it are as follows: Graham [3] define "blended learning" in education as a process that "combines face-to-face instruction with computer-mediated instruction" (p.5), and Garrison and Kanuka [4] define it as "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences". Allen, Seaman, and Garrett [5] suggest that for an educational experience to qualify as blended, the mixture should have a substantial quantity of both modalities of teaching (i.e. traditional classroom and online). In fact, they suggest that a minimum of 70% traditional classroom and 30% online, to a maximum of 20% traditional classroom to 80% online (see Table 1 below). However, Hrastinski [6] argues that it is better not to be too specific on what the term means, but rather instead it should be seen as an umbrella term, and it should be accepted to mean different things to different people in different contexts.

Table 1. Blended Learning Mixes

Content Delivered Online	Content Delivered in classroom	Type of Course
0%	100%	Traditional Classroom
1-29%	71-99%	Web Facilitated Classroom
30-79%	***21-70%***	***BLENDED LEARNING***
80-100%	0-20%	Online Teaching

Hubackova and Semradova [7] undertook a survey of 98 language students who participated in two semesters of blended learning, and their findings indicate that the students not only found it to be an acceptable alternative to face-to-face teaching, but many found it to be a preferable form of teaching. Similarly, Gecer and Dag [8] surveyed 67 students from the departments of Mathematics and Education to assess their experience of a blended learning module, and they found that the online activities had positive effects on students from a learning and

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evaluation perspective, and the students stated that the blended learning environment supported their active participation to the course activities. Interestingly, Akkoyunlu and Soylu [9] undertook a survey of 64 Education students who undertook a blended module, and although they found the use of a forum extremely helpful and positive, they nonetheless reported that the face-to-face interaction (either in person or online) aspects of in blended learning application as being most important. Finally, Eryilmaz [10] surveyed 110 students undertaking a blended learning module in a Computer Science programme, and she observed that students found their blended experience to be extremely effective, and that they rated it as being preferable to face-to-face teaching, and that their educational attainment was higher in blended modules.

Oliver and Trigwell [11] suggest that there are issues with the term "blended learning", most particularly questioning if it is a useful term at all. They contend that the majority of learning is already "blended" to a certain extent (for example, learning typically combines verbal and visual aspects), and that the term "learning" would tend to suggest that the focus is student-centred, whereas, in practice, the majority of research on "blended learning" treats it as a model of instructional design, and therefore a teacher-centred phenomena. Moskal, *et al*. [12] note that Blended Learning is not the exclusive concern of students and teachers but is also something that needs be considered by the whole educational organization. They state that a successful blended innovation must be supported by a reliable and robust set of processes and procedures where a range of staff, including management staff, support the blending process. In Jared Carman's 2005 seminal report [13], they outline five key ingredients that should be present for successful Blended Learning:

1. *Live Events*: These are events where all students are together in a teacher-led learning session, that can be either virtual or real.
2. *Online Content*: This is learning content that the students can explore at their own pace, in whatever location they prefer.
3. *Collaboration*: This is creating communication opportunities between the students, and includes emails, forums, and chat tools.
4. *Assessment*: This is any form of assessment, including pre-assessment to determine prior knowledge, and post-assessment to measure learning transfer.
5. *Reference Materials*: This is additional online and off-line content that enhances student comprehension and retention.

Some key issues that are important to consider when discussing blending learning include topics such as Security, Accessibility, and Costs, so as to provide a grounded understanding of the potential challenges associated with the blending process.

In the context of Computer Security, Qwaider [14] outlined some of the challenges associated with ensuring secure blended environments, such as providing robust authentication processes to safeguard the confidentiality of personal data, academic results, and medical information. These environments must also prevent unauthorized modification of data to counteract the principle of non-repudiation of transmitted information. Although different researchers suggest different approaches to achieve these aims in a blended context, including Biometrics [15], Cloud-based Solutions [16], and Service-oriented Architecture [17], they all agree that what is essential is a single, coherent security policy that deals with both the online and offline storage of data in a unified and consistent manner, and that the lecturer operates as a Data Controller for their institute ([18], [19]).

In the context of Accessibility, blended learning can provide a range of students with new ways of accessing, and engaging with, learning materials, including students with disabilities, students for whom English is not their first language, and students with different learning styles [20]. Mayisela [21] focused on mobile technology in blended learning and found that it increased opportunities for accessing learning materials significantly, and it also enhanced both student-to-student and student-to-lecturer communication by means of social networks. The study concludes that mobile technology has the potential to increase accessibility and communication in a blended learning course. Razaliz *et al*. [22] undertook a study to explore the relationship between blended learning and accessibility using a total of 208 students who were randomly chosen as respondents. They found a statistically significant positive relationship between these two factors and concluded that blended learning environment have potential to address a range of accessibility issues.

In the context of Costs, it is important to recognize that many blended learning initiatives have both set-up costs and on-going costs. The set-up costs may include things like training, staff time, software and hardware; and the on-going costs may include things such as upgrading, patch management, back-up, and security maintenance [23]. However, Taplin, *et al*. [24] note that in general even if these expenses are taken into account, a blended approach will be profitable for an educational organization after five years.

3. Case Studies

A Case Study is an investigation into an individual, a group, an event, or some other occurrence. They describe their target phenomena in

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a holistic way, taking into account a wide range of information, to help understand and help to explain some research questions related to the phenomena. Yin [25] defines a case study as " an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". To better understand the phenomena under investigation, sometimes several case studies are used together, so that they can be compared and contrasted. If several case studies are treated as a single entity to explore research questions, they are called either a "quintain" [26], or, commonly, a "collective case study" [27].

Rowley [28] highlights four key considerations that should be taken into account to ensure that quality of a case study:

i. Construct Validity: This refers to the need to reduce subjective in case studies, and to ensure data is collected in a manner that doesn't introduce bias into the case.

ii. Internal Validity: This refers to the degree to which we can establish a clear relationship between the evidence presented in the case and the conclusion or results we can draw.

iii. External Validity: This refers to the generalisation of the case study, or in other words, does this case study agree with existing cases in terms of the general explanation or theory as to which it is proposing?

iv. Reliability: This refers to the repeatability of the case study, or in other words, if the data collection were repeated exactly, would the same case emerge?

Shakir [29] looks at case studies specifically related to the introduction of technologies into organizations, and identifies three continuums or *dimensions* that these cases can be categorized into:

i. Typical-Significant Cluster: This scale is used to categorize a case as either being one that is typical or one that is extreme in some way.

ii. Similar-Different Cluster: This scale is used to categorize a case as either being one that a lot of variation in a range of features (such as using random purposeful or the stratified purposeful sampling strategies), or one that does not.

iii. Convenience-Determined Cluster: This scale is used to categorize a case as either one that is selected using a pre-determined selection criteria or one that did not use a specific criterion.

4. Developing the Template

The methodology employed in this research was a two-stage approach, where six researchers familiar with case study research came together and initially began with a general discussion of the types of headings that should be in a case study in general, as well as focusing an on what a blended learning case study should be. Following this, an iterative MindMap session [30] was undertaken, where the participants undertook an iterative brainstorming approach to develop the key headings of the case study template, using the MindMap to structure the discussion. One important key to the discussion was that whatever heading were eventually agreed upon had to allow for a wide range of types of case studies, including ones that lead to contradictory conclusions (Creswell and Poth [27] refers to this as "Purposeful Maximal Sampling").

The basic assumption inherent in the design process for this research is that each case study is describing a transformation of some kind, potentially from a non-blended scenario to a blended scenario, or from a blended scenario to a different blended scenario. Based on this assumption, the main body of the case study has three parts:

i. Pre-transformation,

ii. Post-transformation, and

iii. Intervention Analysis

The above three parts also contain documentation of the sources of evidence of the case. Following the main body of the case study, another essential section in the case study is the Issues Section. This section allows the reader to explore the "meaning" of the case study, and it provides a summary of the key issues of the case, as well as exploring some of the challenges or complexities of the case, and finally critically examining the case for confirming and/or disconfirming evidence to ensure the elimination of potential sources of bias.

The cases must have Introduction and Conclusion sections. The Introduction section helps "sets the scene" by providing some background information about the case, including time and date information, geographical information, ecological information (people), and any ethical information relevant to the case. The Conclusions section restates the key information of the case, as well as describing the key themes, the key questions raised, and some reflections on alternative approaches. Finally, the Title Section focuses on the title of the case study, which may have a main title and a sub-title; and should provide a detailed overview of the nature of the case study.

The headings from the MindMap (see Figure 1) were put in a Table, and a further review was undertaken, and any missing concepts were discussed, and four, in particular, were noted:

- In the Case section, although the notion of evidence is implicit, it was decided to make the concept explicit, and refer to the "Sources of Information", to ensure supporting documents

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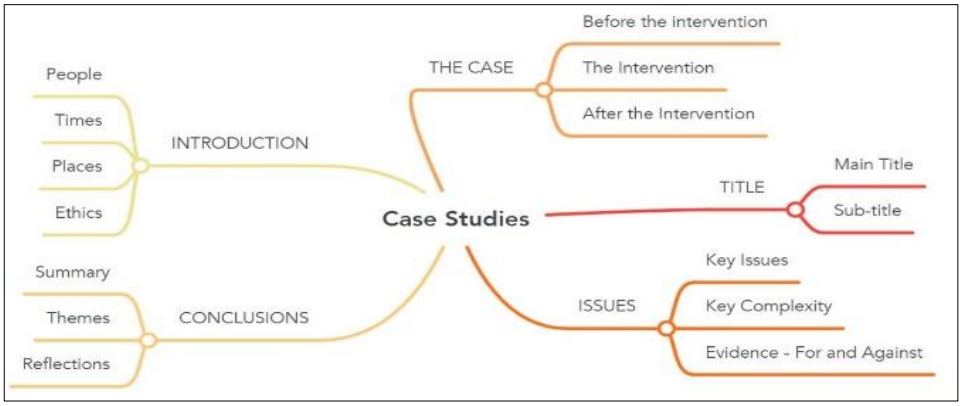

Figure 1. MindMap of the Structure of a Case Study

(both online and offline) are clearly identified.

- In the Issues section, a discussion focused on whether or not to explicitly suggest some themes to aid the Case Study creators, ultimately it was decided to include some themes in parenthesis, as follows: "Key issues of the case study (such as Security, Accessibility, and Costs)".
- Also in the Issues section, the importance of providing an interpretation of the case study was discussed in terms of what lessons can be learned from a case, and what evidence is there to support that particular interpretation of the case. Evidence can be derived from both internally within the case, and from external sources.
- In the Conclusions section, it was felt another useful prompt would be to include "Questions Raised", to ensure that the readers were reminded that a case can raise more questions than answer them.

After some final discussions, the key sections of case study were agreed upon, as follows:

- Title Section
- Introduction Section
- The Case Section
- Issues Section
- Conclusions Section

The complete details of each section are presented as a template with a sample case study are presented in Appendix A.

5. Developing the Checksheet

To compliment the development of the Case Study template, the experts felt it was important to develop a checksheet that could be used as a generic tool to review case studies in a consistent manner.

And, therefore, to ensure that the checklist was not merely a duplicate of the case study template, an almost completely separate group of four researchers (with one person in common) were involved in the development of the checksheet, and a different diagraming technique was used to develop it, in conjunction with a reviewing process of several other checksheets developed by members of this group in the past concerning the evaluation of different aspects of computer science teaching and training (e.g., [31] and [32]).

The diagraming technique chosen was Ishikawa diagrams (also called Fishbone or Herringbone Diagrams), which were developed by Kaoru Ishikawa in the 1960s to explore the potential causes of a specific event [33]. The diagram places the issue or challenge at the "head" of the fish, and the causes extending to the left as fishbones; the ribs branch off the backbone for major causes, with sub-branches for root-causes, to as many levels as required.

In different scenarios the "ribs" are labelled with different terms, so, for example, if the issue of concern is focused on production line processes, the ribs are typically labelled as: "Materials", "Measures", "Machines", "Methods", "Manpower", and "Milieu".

However, in this activity, given that it is focused on a more conceptual issue, the ribs were labelled with the questions: "Why", "How", "Where", "When", "Who", and "What" (See Figure 2 below), and the issue/challenge in this case was stated as follows: "*What are the important things to consider when reviewing a blended learning case study?*".

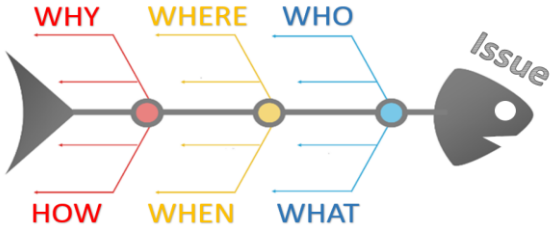

Figure 2. Ishikawa Diagram with the 5 Ws and a H

The group developed a number of key questions that were drafted and redrafted, and they were finally categorized into seven main themes:

- *Introduction*: The initial questions are about understanding the context of the specific case.
- *Main Features*: These questions deal with the main features of the case, including the intervention.
- *Organisation*: These questions relate to the organisation, or organisations, that are involved in the case.
- *People (Ecology)*: These questions concern the people involved in case, and the people impacted by the case.
- *Pedagogy*: These questions look at the teaching philosophy and techniques employed in the case.
- *Technology*: These questions focus on the software and hardware involved in the case.
- *Evaluation*: These questions reflect on the outcomes of the case, the positives, the negatives, and the alternatives.

The complete checksheet is presented as a template with a sample case study is presented in Appendix B.

6. Discussion

This research presents the development of a case study template for blended learning activities, as well as an associated checksheet for reviewing the case study. The case studies are designed to be used as part of a training course, and thus have to serve several purposes, in the sense that they can be used in their complete format to discuss an intervention that has occurred concerning a blended activity, or a section of the case study can be extricated and used to highlight a specific point in the training course. Additionally, the case studies need to be structured in such a way that multiple cases can be used in concert to highlight a specific point, or to contrast different outcomes of different cases.

The cases must also consider some of key issues associated with blended learning, including Security, Accessibility and Costs, to provide a realistic description of some of the challenges of blending.

A set of PowerPoint slides were developed based on the case study template, and some cases were input into it, and based on that activity, it is essential to point out that a case study when used in a training situation should not necessarily limited to content that can be incorporated into PowerPoint, the trainer should also do other things such as demonstrate software, visit websites, display physical artefacts, invite guests to discuss their experience of the case, and initiate a debate on some of the key the issues raised in the case.

To compliment the case study template, the experts who participated in this process also recommended the development of a checksheet to help review the case studies, and this resulted in the creation of a separate expert group, who used a different diagramming technique to brainstorm the checksheet, that focused on the themes of the Organisation, the People (Ecology), the Pedagogy, and the Technology.

A comparison of the template to the checksheet reveals considerable overlap between the two outputs, including looking at the people involved, the technologies, the teaching, and many aspects of the evaluation process. However, there were some differences, where one output produced content that was not present in the other, and these differences are presented below in Table 2.

Table 2. Comparison of Outputs

Template Only
• Title of Case Study • Time (When the Case took place) • Organisational Policies • Key Reflections on the Case • Explicit mention of key issues such as Security Accessibility, and Costs.
Checksheet Only
• Data Collection process • Legal and Social considerations • History of Organisation • Structure of Organisation

It is noteworthy that the majority of the content that was developed from both outputs was highly similar, with only a few elements of difference in each. This points to a shared understanding of what represents the key aspects of a blended learning case study, and it also highlights that different brainstorming techniques may give slightly different answers. In practice, once the blended champions begin to create case studies using this template, they will be able to identify any lacuna that remains.

7. Conclusions

This paper explores the dimensions of blended learning by getting two groups of experts to develop two artifacts associated with categories of interest in a case study concerning a blended learning initiative. One group focused on the development of a template for Case Studies, and they used a MindMap as their approach to both reflecting and brainstorming. The second group focused on developing a questionnaire for blended learning case studies, and they used an Ishikawa diagram as their approach to both reflecting

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and brainstorming. The majority of the content developed from both activities was identical, with other a few differences, while the template included the theme on reflections, the checksheet asked for more details on the organization.

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Appendix A: Blended Learning Case Studies Template

Title Section	*Title of Case*
	Teaching Ethics to Programming Students
	Sub-Title of Case
	Using Four Key Case Studies to teach First-Year students about Digital Ethics
Introduction Section	*Time (chronological information)*
	Every second Friday from Feb 1st to the End of March, 2pm-4pm.
	Place (geographical location)
	Room CQ-007, Central Quad, Technological University Dublin, Ireland
	People (individuals involved)
	Damian Gordon, Michael Collins
	Ethics of Case, if applicable
	Ensured that all content that we previously being taught on this module was still covered. Also ensured new ethics content was presented in an unbiased way.
Case Section	*Evidence/Sources of Information (if applicable)*
	Teaching Content Available here: http://ethics4eu.eu/ Organizational Website: https://www.tudublin.ie/
	Before intervention (such as Challenges, Issues)
	Lack of content about ethics in classes
	The Intervention (such as Technology, Organisations, Education, Processes)
	A series of on-line lecturers and tutorials were held both online and in class, using the VLE for the lectures, a forum for student group discussions, and Padlet for students to anonymously share their ideas and views with everyone else. The lectures were designed to highly relevant to the student experience.
	After the intervention (such as Outcomes, Challenges)
	Students are focused, excited, and engaged about digital ethics Lecturers are excited about digital ethics
Issues Section	*Key issues of the case (such as Security, Accessibility, and Costs)*
	Ethics, Pedagogy, some accessibility considerations, and time management
	Complexity of the case
	The success might be due to the novelty of both the content and teaching approach
	Confirming and Disconfirming evidence
	Content reviewed by both ethics and computer science lecturers using LORI
Conclusions Section	*Summary of Case*
	Introducing digital ethics into a first-year programming course
	Themes that Emerged
	Teaching content needs currency, relevance, and enjoyability
	Questions Raised
	What is digital ethics? How is it related to general ethics? Where does it apply in programming? Where does it apply in other Computer Science disciplines?
	Reflections (what should have been done)
	Three of the four cases were highly relevant to the students, but one case was slightly more abstract, and less appealing to the students

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Appendix B: Reviewing and evaluating Blended Learning Case Studies

Evaluation criteria	**Notes**
What is the case study about?	*Introduction: Teaching Ethics in programming*
What is the organisation?	*Introduction: Technology University Dublin, Ireland*
What are the technology issues?	*Introduction: None, but added Forum and Padlet*
Who are the principal actors?	*Introduction: Students and two lecturers*
What was the situation previously?	*Main Features: Ethics not taught to 1st year students*
What innovations have been introduced?	*Main Features: Ethical case studies, discussion*
What were the general outcomes of this innovation?	*Main Features: Students enthused and excited about ethical issues in computer science*
Are there any legal, social or ethical issues associated with this innovation?	*Main Features: Ethics was the core of the case, with some legal and social issues also discussed.*
Is there are chronological or other logical sequence for analysis?	*Main Features: Gradual confidence in lecturers teaching in a new way, and students in ethics.*
What is the nature of the organisation?	*Organisation: Educational Institute*
What is its history?	*Organisation: Originating org founded in 1880s*
How is it structured?	*Organisation: Hierarchal*
How has it changed as a result of the innovation?	*Organisation: More focus on ethics in teaching classes*
Who are the principal actors in detail?	*People (Ecology):175 students, 2 lecturers*
What are their positions within the organisation?	*People (Ecology): Students and lecturers*
What are their technical skills?	*People (Ecology):Numerous*
Does the target population for this innovation include more people?	*People (Ecology): No*
What teaching approach was being used?	*Pedagogy: Behaviourist*
What teaching skills needed to be learned?	*Pedagogy: Constructivist*
What were the challenges because of students with differences in time or geography or culture?	*Pedagogy: None*
Was there a new model of Instructional Design used for the change?	*Pedagogy: A move towards constructivist teaching using TPACK as a model*
How was the division between content taught online and f2f decided on?	*Pedagogy: 100% online*
What technology was present? What software? What hardware?	*Technology: VLE, forum, Padlet*
What technical level of expertise exists within the organization?	*Technology: Extensive*
What new technology has been introduced for this innovation?	*Technology: Forums and Padlet*
How successful has the innovation been?	*Evaluation: Students learned about ethics*
What new outcomes have been identified?	*Evaluation: More ethics teaching needed*
What went well in this innovation?	*Evaluation: Interaction, and discussion*
What did not go well in the innovation?	*Evaluation: One of the case studies was boring*
What alternative approaches could have been taken?	*Evaluation: More cases studies relevant to these students, more technology-supported discussion.*

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