Effective Blended Learning – A Taxonomy of Key Factors Impacting Design Decisions

Hanlie Smuts[1] [0000-0001-7120-7787], Corlia Smuts[2]

[1]Department of Informatics, [2]Department of Humanities Education,
University of Pretoria, Pretoria, South Africa
hanlie.smuts@up.ac.za, U19264217@tuks.co.za

Abstract.

One of the keys to effective 21st century teaching is to integrate traditional pedagogical methods with the effective use of technology to foster student-centred learning. These increasingly sophisticated technologies are deployed in learning solutions, blending teaching techniques, learning styles, and delivery methods while creating a need for educators to gain new skills to meaningfully engage with these tools. The requirement is to scale blended learning and to design learning experiences that take full advantage of the digital platforms. This study presents a taxonomy with its dimensions and characteristics of the key factors impacting blended learning design. Such a taxonomy is useful not only for describing key factors impacting blended learning design, but also as a professional development tool for educators to increase efficacy of teaching and learning design. We constructed the taxonomy through a classification process following the taxonomy development approach of Nickerson et. al.

Keywords: educational technology, blended learning, e-learning, taxonomy.

1. Introduction

The world is experiencing revolutionary advances in technology labelled the 4th Industrial Revolution (4IR) [1, 2] and with the evolution of digital technologies, many opportunities realise through its application [3]. Both from a commercial perspective, as well as a knowledge and skill outlook perspective, digital technologies creates two possibilities: firstly, they provide multiple options for an organisation to embrace digital transformation [4] and secondly, they enable a world of visual and experiential learning in order to enhance skills and knowledge [5, 6].

The role of teaching and learning includes the development of cross-boundary knowledge and requires new approaches to knowledge generation and transmission as students are required to apply knowledge in- and outside of work structures [7]. The Educause 2019 Horizon Report Preview, highlighted 6 key trends accelerating technology adoption in a higher education institution [8]. The two short term trends presented, focused on the redesign of learning spaces and blended learning designs. A focus on virtual learning spaces is required as many online platforms have bundled solutions to facilitate team-based learning and synchronous meeting spaces, yet emerging learning spaces programmed in extended reality (XR) have the potential to create more engaging and personal experiences for students than any current developments in online course design [8]. Blended learning designs to date are defined by the proportions of face-to-face versus online coursework, including media-rich elements [9]. The requirement is to scale blended learning and to design learning experiences that take full advantage of these digital platforms [8].

However, there is evidence in the literature that there is a lack of research investigating the effectiveness of computer-based instruction [10]. Some issues highlighted include lack of knowledge of the environment of computer-based instruction and virtual learning, and lack of knowledge and understanding regarding pedagogical issues and challenges in the context of computer-based instruction [11]. Furthermore, some educators are unable to use technology tools effectively to create a blended teaching- and learning environment without a clear understanding of the relationship between pedagogical knowledge and the role e-learning tools play as a medium for teaching and learning [12]. Therefore, if educators are expected to prepare students for a technological saturated working environment, they too need to be well versed and able to use the appropriate technology tools [13]. However, educators may find it difficult to use technology tools if they are unable to envision said tools as being part of their pedagogical frame of reference [12, 14].

Therefore, this study aims to consider the key factors impacting blended learning design. The primary research question that this study aims to address is: "*What are the key factors impacting effective blended learning design for education?*". This was achieved through a review of the literature focusing on educational technology (Ed-Tech) and blended learning, and we used Nickerson et al.'s classification method for developing a taxonomy [15]. By applying the taxonomy of the key factors impacting blended learning design, educators will be able to increase efficacy of teaching- and learning design, as well as understand where they nee to focus their own skills improvement.

Section 2 of this paper provides the background to the study and presents an overview of blended learning, e-learning and the impact of Ed-Tech on educator design choices. The approach to this study is discussed in Section 3, while Section 4 provides an overview of the taxonomy development process, as well as the taxonomy of the key factors impacting blended learning design. Section 5 illustrates application of the taxonomy and Section 6 concludes the paper.

2. Background

Teaching practices are evolving, as student-centred approaches to instruction guides course design, accelerating the need for strategically planned teaching and instruction [8]. Consequently, the role of the educator has shifted – from a presenter of knowledge to a facilitator and curator [16]. This shift in role, further enabled by Ed-Tech, has completely reshaped the education landscape and required educators to implement more technology based teaching tools within and without the classroom [16].

In the following sections, we consider this shift in teaching practice and blended learning, as well as the impact of Ed-Tech.

2.1 Teaching practice and blended learning

As technology has developed and now proliferates all areas of society, it is also impacting education and learning – specifically blended learning [13, 16]. Blended learning refers to innovative- and adaptable methods of education, teaching and learning through the usage of technological tools which allows learning to be student-centred and improve a students' interaction with the material [17]. These methods are informed by the type of technology, the system of delivery, and educational- and communication paradigms [16]. Research has shown that a blended-learning approach can greatly benefit students seeing as it combines online teaching and learning with in-class teaching and classroom time [18], allowing students to interact with the material comfortably at home, while more conventional content can be focused on in the classroom [16, 19].

One of the keys to effective 21st century teaching is to balance traditional pedagogical methods with the effective use of technology to foster learning [20]. Learning solutions are designed and deployed using increasingly sophisticated technology, creating a need for educators to gain new skills to meaningfully engage with those tools [20]. Therefore, professional development supporting the use of digital tools has evolved into collaborations with instructional design teams and other professionals in the learning science field, accelerating the application of new teaching practices [8]. The teaching practice impact on students entails increased collaboration, 24/7 access to learning, "flipping" the classroom (move direct instruction from the group learning space to the individual learning space), personalized educational experiences, attention-grabbing lessons, etc. [21]. For educators, impact lies in automated grading, classroom management tools, and paperless classrooms [22].

2.2 Impact of Ed-Tech

Seeing as technology is developing continuously, the concept of blended learning is also ever changing and dynamic [11]. It is therefore required that educators develop and acquire the skills necessary to navigate among the multiple options of interactive content technology, technologies that provide instant feedback [23], technologies with diagnostics capability for identifying student needs [24], technologies enabling learning assessment and storing of student work (student management systems), etc. [9]. However, successful blended learning, is more than a simple integration of information and communication technologies with face-to-face approaches [25]. With a student-centred construction of blended learning, the choices of what and when to blend are key [25]. Therefore, processes are required where educators are engages and supported to select fit-for-purpose Ed-Tech with the aim to facilitate and support teaching and learning [26].

Without sufficient access to sustained support and the tools and resources essential in the design of a student-centred environment, instructors are challenged to create these experiences on their own [14]. Furthermore, the myriad of Ed-Tech tools to consider such as software applications, web tools, data platforms and mobile applications, further amplifies the educator challenge and requires support to navigate and chose the best options [27].

2.3 Existing technological pedagogical frameworks

Developing theory for educational technology is a complex endevour, because it requires a detailed understanding of complex relationships that are contextually bound. Moreover, it is difficult to study the cause and effect when educators, classrooms, politics, and curriculum goals vary from case to case [28]. Considering Ed-Tech, several theoretical frameworks are suitable for the evaluation of technology adoption such as the Technology Acceptance Model (TAM) [29], the extended Technology Acceptance Model (TAM2) [30] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [31]. Although these frameworks deal with a number of variables like perceived usefulness, perceived ease of use, performance expectancy, facilitating conditions, social influence, etc., they do not consider pedagogical attributes. The SAMR model uses 4 classifications: substitution (technology provides a substitute for other learning activities without functional change), augmentation (technology provides a substitute for other learning activities but with functional improvements), modification (technology allows the learning activity to be redesigned) and redefinition (allows for the creation of tasks that could not have been done without the use of the technology). Learning activities that fall within the substitution and augmentation classifications are said to enhance learning, while learning activities that fall within the modification and redefinition classifications are said to transform learning [32].

Mishra and Koehler [28] conducted a design experiment aimed at understanding educators' development toward enhanced uses of technology, while developing teaching with technology. The Technological Pedagogical Content Knowledge model (TPACK), is a concept created to assist in explaining sets of knowledge that educators need in order to teach to their students and effectively use technology in their teaching [28]. TPACK is a technology integration framework that identifies three types of knowledge which educators need to combine for successful Ed-Tech integration, namely; technological, pedagogical, and content knowledge. *Technology knowledge* refers to knowledge regarding the working of Ed-Tech tools, ways of technology application and how the understanding of technology needs to be sufficient in order to be applied in a variety of contexts (including, work, school, personal life etc.). *Content knowledge* refers to the knowledge of the teacher about the subject that is being taught/needs to be taught and not only includes facts or data, but also concepts, theories, ideas, evidence and a variety of practices and approaches. *Pedagogical knowledge* refers to the educators' knowledge regarding the procedure, practices, methods and means in which teaching and learning take place [28].

Before the taxonomy of the key factors impacting blended learning design is presented, the research approach is discussed.

3. Reseach approach

The objective of this paper was to design a taxonomy of the key factors impacting blended learning design. Firstly, we present an overview of the taxonomy development approach where after we share the taxonomy development process.

3.1 Taxonomy development approach

Nickerson et al. studied classification in IS [15] and as main contribution of their work, they defined a taxonomy, as well as proposed a classification method for a taxonomy that is depicted in Figure 1 [15].

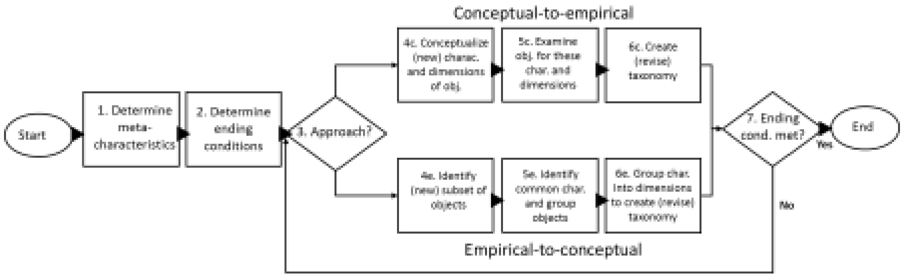

Figure 1: The classification approach for Taxonomy development reproduced from Nickerson et al. [15]

As depicted in Figure 1, the classification approach of Nickerson et al. [15] is an iterative method that commences with determining the meta-characteristics and determining the ending conditions. The meta-characteristics should be determined by the overall purpose of the taxonomy and Nickerson et. al defined the ending conditions as being objective or subjective. *Objective* ending conditions included confirmation that a representative sample of objects has been examined, and no object was merged or split in the last iteration of the taxonomy development approach; no new dimensions or characteristics were added in the last iteration of the taxonomy development approach, and no dimensions or characteristics were merged or split and at least one object is classified under every characteristic of every dimension (no 'null' characteristics). *Subjective* ending conditions relate to conciseness, robustness, comprehensiveness, extendibility and explanatory of the dimensions and characteristics classified [15].

In an *empirical-to-conceptual* iteration, the researcher identifies a subset of objects that have to be classified, and from an investigation of the objects, characteristics are identified. These characteristics are then refined into dimensions. In a *conceptual-to-empirical* iteration, the dimensions of the taxonomy are conceptualized in a deductive-, and often intuitive, way that is based on the researcher's knowledge. These dimensions are then refined by adding characteristics that allow for the classification of objects. It is necessary to note that for the development of a taxonomy, both types of iterations may be adopted, for instance, the first iteration might be conceptual-to-empirical, and a next iteration that refines the taxonomy could be empirical-to-conceptual. The iterations are performed until the ending conditions are met.

3.2 Taxonomy development process

In order to develop the taxonomy, we followed a number of steps. Firstly, we identified potentially relevant articles using a keyword search with the terms "characteristic" and "technology tool" and "higher education" and "student" and ("efficiency" or "effectiveness"). The keyword search was executed in common academic databases such as SpringerLink, ACM, AIS, EBSCO Host and Google Scholar. We considered peer-reviewed journals and conference papers and identified 311 papers. Secondly, we screened the identified set of papers and extracted 105 papers as we excluded non-English papers, duplicates, and papers that did not contribute any considered key factors impacting educational technology decisions related to designing blended learning. We concluded a detailed screening of abstracts and analysis of the full text of the prospective papers and created a dataset (Appendix 1) that we utilized for the systematic development of the taxonomy dimensions and characteristics based on Nickerson et al.'s [15] taxonomy development method. This taxonomy development process [33, 34] was executed through a number of steps: firstly, we defined the meta-characteristics as the dimensions of blended learning design choices. We adopted Mishra and Koehler's [28] TPACK classification i.e. technology knowledge, content knowledge and pedagogical knowledge (section 2.3), and framed our meta-characteristic therein. We proceeded through 4 iterations (refer Figure 2) until all the extracted papers in our dataset were classified and the ending conditions were fulfilled as specified by Nickerson et. al. [15].

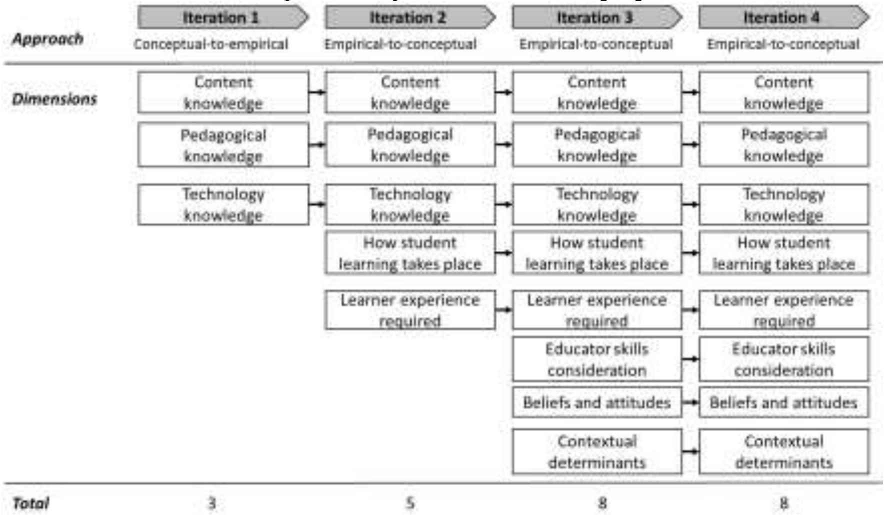

Figure 2: Development of the dimensions of the taxonomy of the key factors impacting Ed-Tech decisions related to blended learning design

In terms of the iterations, we initially adopted a conceptual-to-empirical iteration and integrated taxonomy dimensions identified in the literature review. The second, third and fourth iterations were empirical-to-conceptual and led to the classification of all the extracted papers in our dataset guided by the key factors impacting Ed-Tech decisions related to blended learning design. In these iterations, additional dimensions were identified namely how student learning takes place, student experience required, educator skills required, educator and students beliefs and attitudes and contextual determinants. Figure 2 depicts the iterations and dimensions identified during the taxonomy development. We describe each dimension in the taxonomy in detail in the results section of the paper.

Lastly, we performed a thematic analysis for each dimension of the taxonomy to identify, analyse and report patterns or characteristics within the data [35]. The purpose of a thematic analysis is to interpret and organise the data in order to identify patterns or themes, emphasizing both organization and rich description of the data set and theoretically inform interpretation of meaning [36, 37]. We followed an iterative approach identifying patterns of themes until all characteristics in a particular taxonomy dimension were classified (Appendix 2).

In the next section, the design of the taxonomy of the key factors impacting educational technology decisions related to designing blended learning, is discussed.

4. Results: Taxonomy for key factors impacting Ed-Tech decisions related to blended learning design

The purpose of this study is to present a taxonomy of the key factors impacting blended learning design. In Figure 3 the taxonomy of key factors impacting blended learning design is depicted consisting of eight dimensions, and each dimension with two to six distinct characteristics.

Dimensions	Characteristics					
Content knowledge	Cater to students needs	Availability	Variety			
Pedagogical knowledge	Assessment	Enrichment	Interaction	Learning approach	Learning objectives	
Technology knowledge	Access	Knowledge and skill	Usage			
How student learning takes place	Meaningfulness	Efficacy				
Learner experience required	Problem solving	Student interaction	Motivation	Performance		
Educator skills consideration	Communication	Creativity	Efficiency	Understanding	Management	Development
Beliefs and attitudes	Educator judgment regarding their own use of technology	Educator judgment regarding the use of technology by students				
Contextual determinants	Accessibility	Culture	Affordability	Environment	Policy	Skill determinants

Figure 3: Taxonomy of key factors impacting blended learning design

In blended learning design, content knowledge refers to the core requirement of an educator in terms of teaching a particular topic. The content knowledge dimension refers to a complete understanding of the subject knowledge and considers the question: *what content knowledge must the educator have to adequately meet the needs of students while making a variety of knowledge available to them?* The application of content knowledge in blended learning design should promote the *adaptation of teaching and learning content* to meet the needs and curiosities of a diverse population of students. *Variety* guides an approach to instruction that involves actively engaging students with the course material through multiple methods e.g. role plays, discussion boards, etc. Certain concepts may not readily be *available* for reflection, learning and critique and these concepts must be considered when content knowledge is applied for blended learning design.

For an educator to effectively convey their content knowledge, they also need to be in the possession of the appropriate pedagogical knowledge. Pedagogical knowledge points to the *how* of teaching, in other words what, the best methods of teaching content knowledge are that ensures that learning takes place and answers the question: *what are the best methods for enriching he learning experience and assessing whether the content knowledge had been effectively taught? Learning objectives* focus attention on, and awareness of the importance of what is to be learned. *Learning approach* entails the combination of different kinds of teaching materials (auditory, visual and kinaesthetic materials) enabling the improvement and enhancement of the learning process. To be remembered, new information must be *enriched* and meaningfully connected to prior knowledge, and it must first be remembered in order to be learned. *Assessment* comprises of the ways in which students are assessed and evaluated, aligned to the learning outcomes. This is a powerful characteristic as it affects the ways students study and learn. *Interaction* promotes learning as it encourages communication and engagement among faculty, educators and students and is a means to provide feedback to students on their learning.

Seeing as blended-learning constitutes the effective incorporation of Ed-Tech tools into the teaching- and learning process, the educator needs to be familiar with- and be well acquainted with technical knowledge regarding the usage of Ed-Tech tools. Technology knowledge denotes the knowledge and ability to use Ed-Tech in combination with the relevant content- and pedagogical knowledge to create a blended-learning environment and answers the question: *how to access and use these Ed-Tech tools and which skills or knowledge are needed to do so?* The *knowledge and skill* characteristic refers to the skills and technology resources required to effectively integrate Ed-Tech into blended learning design. Mobile technologies enable mobility and has reduced the dependence on fixed locations for work and study, as well as accommodated synchronous and / or asynchronous communication. The proliferation of digital technologies enable multiple *usage* options such as immersive experiences, virtual reality, natural language processing, automatic speech recognition, etc. Irrespective of the usage options chosen, the ability to save and recycle materials previously created or annotated reinforces and extends the learning over a sequence of lessons. Having access to prior lessons may help students build on prior knowledge and educators locate and diagnose misconceptions. The *access* characteristic considers *accessibility* to material that students may require e.g. internet, web, internet sources etc. Additionally, the educator must also have sufficient knowledge on how certain tools operate and how to gain access thereto in order to guide students to be able to do the same. Furthermore, learning should not be impaired by malfunction of learning tools or information sources.

In order for learning objectives to be met, educators need to be familiar with how students learn. The how student learning takes place dimension focuses on creating meaningful learning experiences for students, and addresses the question: *how to teach for effective learning to take place?* The *meaningfulness* characteristic refers to the notion that learning is more effective and efficient when students have explicit, reasonable, positive goals, and when their goals fit well with the educator's goals. Apart from including collaborative, interactive, media-rich and personalised learning in blended learning design, an adequate pace – that may be managed with technology - in a lesson is important to the overall lesson success. *Efficacy* points to the meaningful organisation of information to ensure that it is more likely to be retained, learned, and used.

The importance of how students experience learning cannot be overlooked and a rapport between the educator and the students must be established so that the students' experiences can inform the teaching process. Student experience required refers to solving the problem surrounding how students experience learning and considers the question: *how can interaction between students be fostered while improving their performance and sustaining their motivation to learn?* The *problem solving* characteristic guides educators to design blended learning that is compatible with student determined objectives while identifying and addressing the challenges students are facing when attempting to learn with Ed-Tech tools. Furthermore, blended learning design needs to avoid over-reliance on technology and avoid the "lone student" syndrome where all possible interpersonal interactions are eliminated during the learning process. *Student interaction* highlights more opportunities for feedback, reflection and general support throughout the learning cycle between educators and students enabled through Ed-Tech. In addition, it enables interaction opportunities among students and learning communities, students and materials, and students and technology. *Motivation* focuses on the potential Ed-Tech offers students to own their own learning by embracing the opportunities available for transparent, collective-oriented learning processes. Blended learning design in the context of motivation must therefore aim to increase autonomy in learning, provide easy access to learning materials and act as a guide for both the educator and the student. Student *performance* may be impacted by Ed-Tech supporting the provision of information and resources to students. This characteristic focuses create better understanding by clarifying basic concepts in order to increase student success.

For educators to be able to achieve a sustainable and enriched blended-learning environment, they need to be in the possession of a certain skill set to be able to make the correct decision and execute the most effective teaching- and learning processes. Educator skills consideration denotes the ability that an educator has or needs to develop and considers the question: *what are the skills needed to make the best, informed choices regarding the institution of a blended-learning environment? Communication* from and educator perspective refers to the prompt and effective giving of feedback and the development of reciprocity and cooperation among students. *Creativity*, knowledge, and skills allow educators to utilize Ed-Tech's ability to address multiple acumens in order to differentiate instruction and to create a new learning environment that enables better personalization of the learning process. *Efficacy* refers to the more efficient use of the time by balancing levels of intellectual challenge and instructional support, while keeping track of deliverables. The *understanding* characteristic highlights that a student is not merely a consumer of content and materials, but an active participant in the learning process engaged and motivated through interactivity and collaboration. Learning tool specificity is fostered through an understanding that an information source provides results of direct relevance to a learning task accompanied by little irrelevant information. Educators need to *manage* their own capability to utilize Ed-Tech features to completely transform student achievement by implementing Ed-Tech purposefully. Furthermore, educator *development* need to take full advantage of the pedagogical affordances of technology, and develop a dynamic understanding of the features of Ed-tech, as well as learn how to interact fluidly with it during instruction.

Educators have certain preconceptions about how all educators and their students experience a blended-learning environment and these beliefs and judgements inform the choices that they make whether these attitudes reflect reality or not. Beliefs and attitudes points to an educators' judgement regarding the thoughts and beliefs of others when it comes to using Ed-Tech tools for teaching and learning, and answers the question: *what are the beliefs of educators when it comes to their own and their students' experiences when it comes to technology?* The fact that students utilise significant screen time does not imply that the use of a learning tool or information source is intrinsically pleasurable, that intellectual stimulation results from using a learning tool or information source or that the information about a learning domain captured by a learning tool or information source is complete.

The application of Ed-Tech tools are dependent on a wide range of variables originating from the environment surrounding an educational institution. Contextual determinants therefore refers to the physical factors that need to be taken into account when decisions are made regarding the institution of a blended-learning environment and considers the question: *what are the contextual determinants that will influence the Ed-Tech choices that need to be made?* It must be acknowledged that the characteristics related to the contextual determinants dimension are based on the papers that were extracted and classified. Characteristics identified through our classification process included *accessibility* (internet, web, internet sources, information source access anywhere, anytime), affordability (cost of Ed-tech ownership, total cost of education), environment (computing facilities, relationship between class size and efficacy of instruction, etc.) and policy (balance between promoting experimentation, working with student consent, and achieving transparency). *Culture* norms play an important role in how Ed-Tech is incorporated in education and is impacted by the homogeneity and diversity in computer usage, as well as students' background. *Skill determinants* focus on different capabilities of electronic learning and the adjustment to a digital environment, bringing in new curricula based on real world problems.

In the next section we share the application of the taxonomy with two exemplary studies.

5. Using the proposed taxonomy of key factors impacting blended learning design

The aim of this study was to present a taxonomy of the key factors impacting blended learning design. The taxonomy presented in the previous section could be applied as a professional development tool to guide new blended learning design, or to evaluate an existing design and close potential gaps. Figures 4 and 5 show how an exemplary module design was mapped as application of the proposed taxonomy. A practicing Further Education and Training (FET) teacher was supplied with the taxonomy and asked to map out her blended learning application. She utilised a typical red-amber-green (RAG) notation and assessed her module pre-COVID lockdown (Figure 4) and the same module during COVID lockdown (Figure 5) as adjustments were required as no face-to-face contact was possible. The characteristics that were able to be executed effectively and occurred often, were indicated alongside those who were less effective followed by identifying problem areas or characteristics which are lacking. Those aspects that were executed well and which the teacher managed were indicated as green whereas those that needed improvement and/or refinement were indicated amber. Aspects that were absent, or severely lacking were labelled red seeing as they were identified as being areas not supported in her blended learning design.

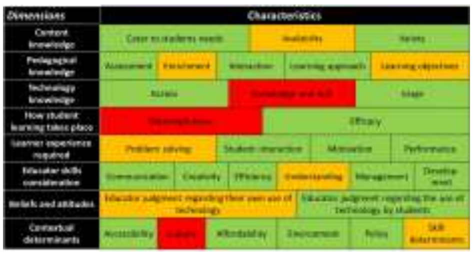

Figure 4: Exemplary study mapped with the proposed taxonomy using heat map notation – before COVID pandemic lockdown

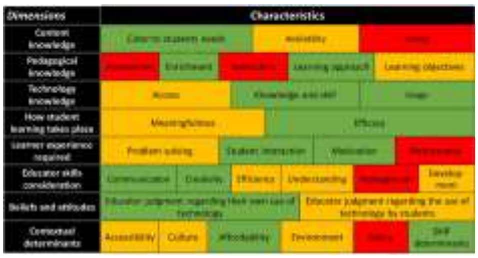

Figure 5: Exemplary study mapped with the proposed taxonomy using heat map notation – during COVID pandemic lockdown

Seeing as the learners were unable to attend school, their most immediate need was to continue to receive schooling without physically attending classes. The impact on blended learning design is illustrated above where that which was effective versus areas that are problematic could be identified such as in the case of *variety* (changed from green to red*)*. Due to the COVID lockdown circumstance, certain choices had to be made regarding the curriculum and what is teachable. Some topic areas needed to be removed to accommodate the new learning circumstances. This also impacted *assessment* seeing as all examinations were cancelled and assessment needed to be completed in a simpler manner by using a single summative tool.

When schooling returns to normal, this assessment against the taxonomy may be revisited and adapted to another change in circumstance.

6. Conclusion

In this study we presented a taxonomy of the key factors impacting blended learning design. The taxonomy was developed by applying Nickerson et. al's [15] taxonomy development process.

A taxonomy of key factors impacting blended learning design, consisting of 8 dimensions, were defined. Each taxonomy dimension consists of two to six characteristics. Such a taxonomy is useful not only for describing key factors impacting blended learning design, but also as a professional development tool for educators to increase efficacy of teaching and learning design. In order to illustrate the application of the taxonomy, an example assessment against the taxonomy using the heat map notation, was shared. The FET teacher reflected that it was a useful tool to identify what worked out well and what still needed further attention. She also mentioned that the fact that adjustments had to be made due to COVID-19 lockdown (red characteristics), the taxonomy highlighted potential risk areas that need to be attended to until such time as proper blended learning design may be applied again.

The characteristics of the first version taxonomy is quite coarse and further refinement of the classification may be implemented in future research. A study that specifically evaluates the applicability of the taxonomy across different teaching and learning initiatives may also be considered.

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Appendix 1 - Dataset created from papers identified (extract)

Paper title	Key factors	Refer-ence
Podcasting: A new	• encourages contact between students and faculty,	[38]

technological tool to facilitate good practice in higher education	• develops reciprocity and cooperation among students, • encourages active learning, • gives prompt feedback, • emphasizes time on task, • communicates high expectations, • respects diverse talents and ways of learning • active learning, • prompt feedback • more efficient use of the time	
Comparing a large- and small-scale online language course: An examination of teacher and learner perceptions	• (N) preventing the lone–learner syndrome • interaction during the learning process • collaborative, interactive, media-rich and personalized learning • learners and instructors interact, share ideas and generally try to support one another throughout the learning cycle • student to student interaction, student to community, student to materials, and student to technology • broaden the space and opportunities available for learning; • support course management activities (e.g., communication, assessment submission, marking and feedback); • support the provision of information and resources to students; • engage and motivate students through interactivity and collaboration • relevance of ease of use of web and internet sources environment	[39]

Note: where negatively formulated key factors were extracted, it was denoted with an "(N)"

Appendix 2 - Classification during taxonomy development process (extract)

Reference	Key factors	Dimension	Characteristic
[40]	(N) incompatible with learner determined objectives	Learner experience required	Learner challenges/ areas for improvement/ problem solving
[40]	(N) lack of opportunity to discover what standard was required	Learner experience required	Learner challenges/ areas for improvement/ problem solving
[40]	Learner-centered	Learner experience required	Learner performance
[41]	(N) preventing the lone–learner syndrome interaction during the learning process	Learner experience required	Learner challenges/ areas for improvement/ problem solving
[11]	access to material	Learner experience required	Learner motivation
[42]	better grades	Learner experience required	Learner motivation
[42]	increased autonomy in learning	Learner experience required	Learner motivation
[42]	better understandability,	Learner experience required	Learner performance
[42]	increase student success.	Learner experience required	Learner performance

Note: where negatively formulated key factors were extracted, it was denoted with an "(N)"