Blending Behaviourism and Constructivism: A Case Study in Support of a New Definition of Blended Learning

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Abstract

Definitions of blended learning that refer to a combination of face-to-face and computer-mediated instruction focus on the transmission of information rather than learning. It has been argued that a definition of blended learning should provide for a blend of learning theories methods and technologies. When blending learning theories, behaviourism and constructivism should not be viewed as mutually exclusive opposites. This article presents a case of a distance learning workshop with asynchronous and synchronous learning and technologies ranging from WhatsApp to YouTube. The workshop contained a blend of direct instruction (behaviourism), construction (constructivism), an integration of the two, and an immersive experience of serendipitous learning. Various modalities of learning occurred during the same learning event. Sometimes the two modalities occurred simultaneously, suggesting that behaviourist and constructivist learning can be blended.

Keywords: blended learning; behaviourism; constructivism; ODEL; WhatsApp; YouTube

Introduction

The aim of this article is to build on a proposition by Cronjé (2020) that the definition of blended learning should be extended to focus on learning by blending behaviourist and constructivist learning theories. Cronjé argues that the two theories are not directly opposing, but rather orthogonal and can be blended. The case study reported here was designed to test the extent to which the two opposing theories of behaviourism and

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constructivism can indeed be blended. The article concludes by proposing a framework for blending the type of knowledge to be learnt with appropriate learning theories methods, tools and technologies.

The case involves an instructor and students at a university with a predominantly under-resourced student population, the majority of whom live in rural areas with poor internet connectivity. The problem that drove the learning design in this research was to test the feasibility of a range of methods and tools which support learning through a blend of distance technologies that are freely available to students. The article will describe the extent to which theories, methods, and technologies were mixed to create a blended learning experience.

Two questions drove the study:

- What blend of theories, methods, tools, and technologies were used to create the learning experience?
- To what extent did this constitute a blend of direct instruction and constructivist learning?

Background and Theoretical Underpinning – A New Definition of Blended Learning

The most common definition of blended learning refers to the use of some combination of technology with distance and face-to-face instruction (Graham 2006). The problem with this definition is that it refers to instruction and technology, but not to learning. Driscoll (2002) proposes a definition of blended learning that includes a combination of modes of web-based technology, various pedagogical approaches, any form of instructional technology, and even job tasks to create a harmonious effect of learning and working. Furthermore, there is a call for definitions of blended learning to pay attention also to learning theory. Lesson plans should be based on theory (Iqbal, Akhter, and Mazid 2021) and there is an ongoing movement towards the use of multiple learning theories in developing blended learning (Campbell, Craig, and Collier-Reed 2020; Chou 2020). The development of new technologies such as Zoom and Skype has meant that face-to-face learning can easily take place at a distance. It is against this background that Cronjé proposes a new definition of blended learning as: "The appropriate use of a mix of theories, methods and technologies to optimise learning in a given context" (Cronjé 2020, 120).

When extending the definition of blended learning to include a blend of learning theories, it is necessary to overcome the tendency to classify behaviourism and constructivism as opposing or competing theories (Ahmad, Sultana, and Jamil 2020; Maharg 2020). Table 1 presents a comparison in which characteristics of behaviourism and constructivism are placed in direct opposition, with the implication that they are mutually exclusive.

Table 1: Comparison of behaviourism and constructivism (tabulated from Muhajira 2020)

Behaviourism	**Constructivism**
Concerned with environmental influences	Increase what is in a person
Concern over parts of the whole	Increase overall than parts
Concerned with psychomotor reactions	Increase the cognitive role
Concerning the causes of the past	Improve current time conditions
Concerned about forming habits	Increase the formation of cognitive structures
Prioritising the mechanism of learning outcomes	Prioritise balance in humans
Prioritising "trial and error"	Prioritise "insight" (understanding)

Despite these theories being seen in opposition, one must consider the advantages and disadvantages of both. It is not one or the other that should be considered, but a blend of both, depending on the desired outcome and the context.

Behavioural learning is based on the stimulus and response behaviour of classic conditioning (Chou 2020). It places emphasis on rote learning of lower-level skills (Ahmad, Sultana, and Jamil 2020). Its strength lies in rapid acquisition of lower-level knowledge whereas its chief weakness lies in an uncritical stance towards knowledge acquired (Oommen 2020).

Constructivism regards the learner as the constructor of meaning as they solve "messy, problematic situations" (Pande and Bharathi 2020), whereas knowledge is constructed through social negotiation of individually understood concepts.

Whereas for behaviourists there is one true meaning to achieve, the constructivist sees numerous realities where knowledge is not necessarily stable. These numerous realities could be problematic in learning areas where one solution is ideal.

Behavioural learning leans towards efficiency, whereas constructivism leans towards effectiveness. To achieve both aims one should use both approaches. Some authors regard cognitivism as the middle ground between the two opposing theories (Chou 2020; Parson and Major 2020; Reyes and McGuigan n.d.). Cognitivism places emphasis on the processing that occurs between the stimulus and the response (Chou 2020). It emphasises active processing and the developing of a learning map.

In proposing a new definition of blended learning emphasising learning theory, Cronjé (2020) argues that the two main learning theories, behaviourism and constructivism, should not be regarded as binary opposites, but as complementing axes on a two-by-two matrix shown in Figure 1.

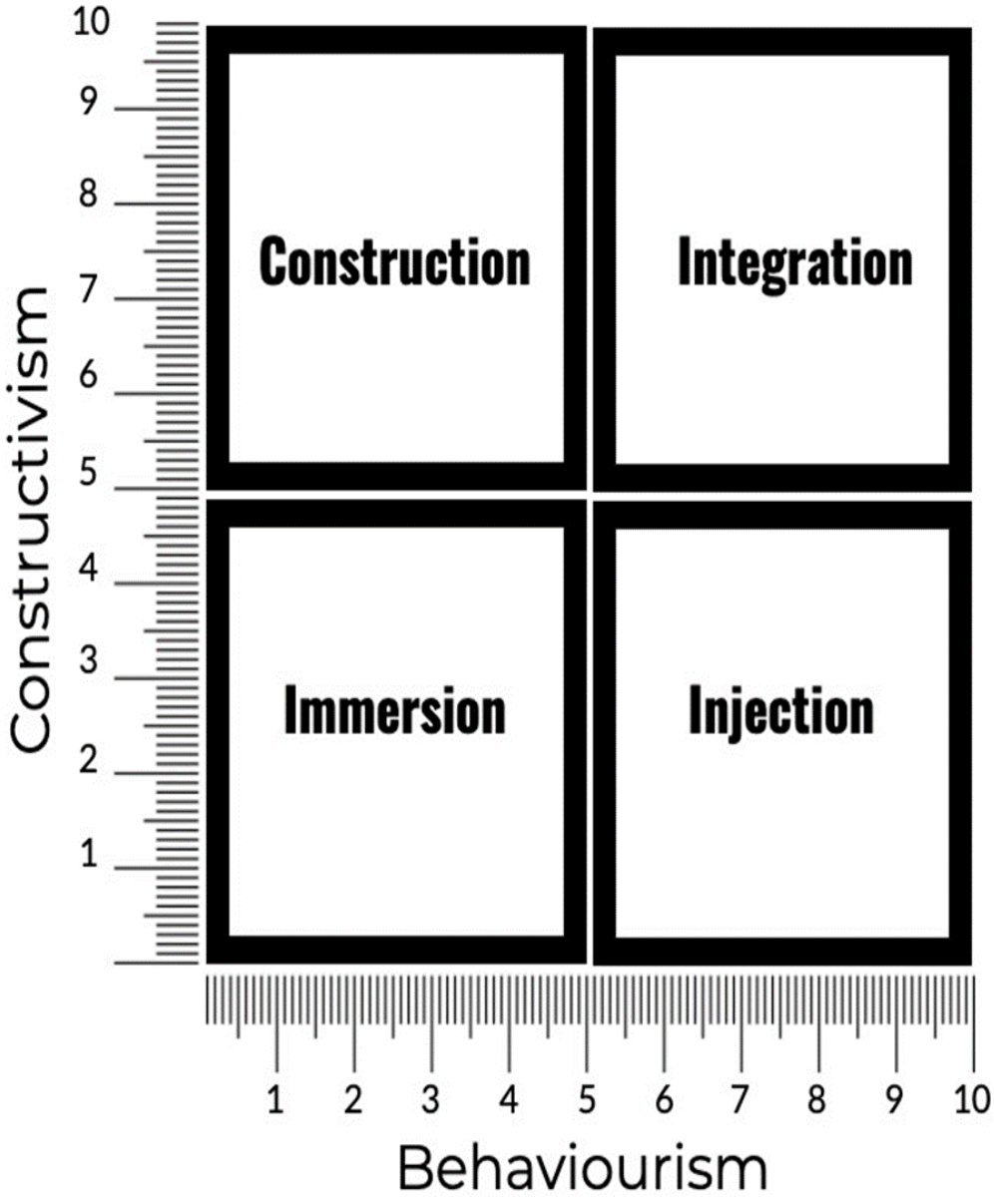

Figure 1: Four quadrants of learning (Cronjé 2020)

The matrix has four quadrants, one low in overtly designed direct instruction and low in constructive scaffolding. It is the quadrant where one learns by being thrown into the deep end, and hence immersion. The quadrant that is high in constructivist elements and low in behaviourist elements is construction – the one in which one learns by doing. It is the typical space of project or problem-based learning. The injection quadrant is the area of direct instruction where the idea is to achieve efficiency and to develop "automaticity" (Bloom 1986) by drill and practice. In the integration quadrant, learning designers develop a blend of techniques both of direct instruction and guided construction to achieve an outcome. The integration quadrant could be equated to a cognitivist approach.

This model is directly mapped onto the Kurtz and Snowden (2003) Cynefin framework of knowledge management (Figure 2). It therefore indicates that immersion in chaotic information is the best design choice, whereas complex information can best be facilitated through construction, known information by "injection" and knowable information by an integrated approach.

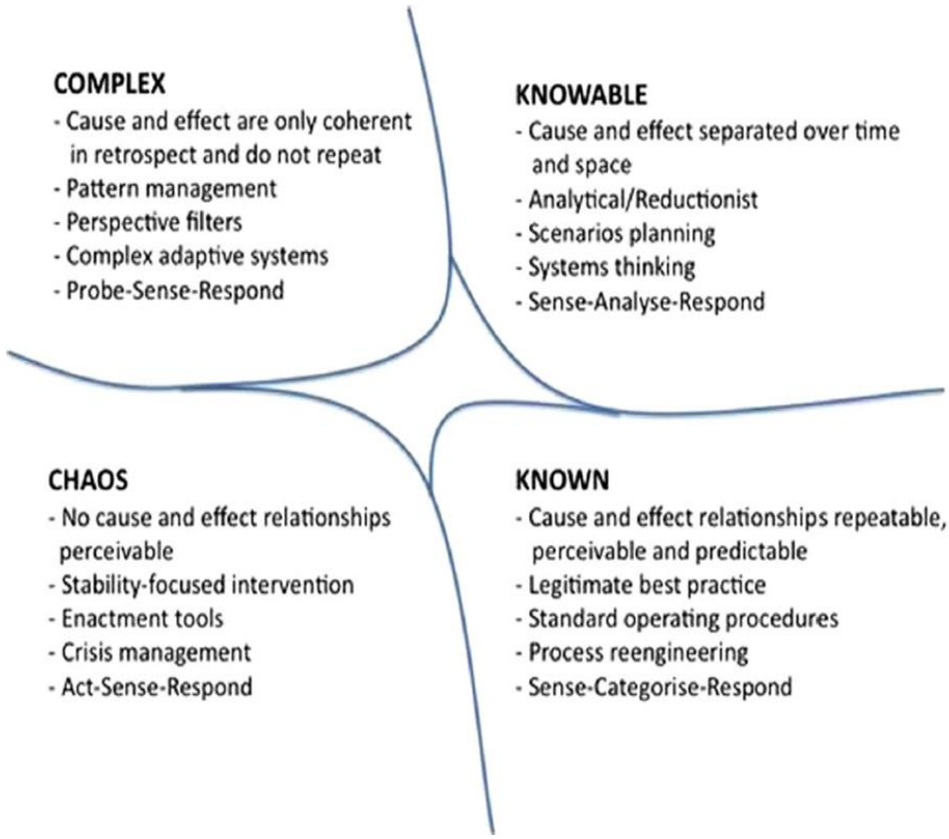

Figure 2: The Cynefin framework (Kurtz and Snowden 2003)

In assisting designers to decide how to develop blended learning in an open and distance learning environment, Cronjé proposes a decision matrix (Table 2) that matches the knowledge domain, theoretical stance, method, and technology.

Table 2: Blended learning decision matrix (Cronjé 2020)

Context (Kurtz and Snowden)	**Theory (Cronjé)**	**Methods**	**Technologies**
Known	Injection	Tutorial Drill	Lecture Book Video
Complex	Construction	Construction Exploration	Open-ended learning environments Construction kits and tools Spreadsheets
Knowable	Integration	Puzzle Discussion Debate	Games Discussion tools
Chaos	Immersion	Experience Field trip Apprenticeship	Blogs Logbooks Assessment tools

Method

The illustrative case study presented here formed part of a series of online workshops presented to facilitate proposal writing for novice master's and doctoral students at a university of technology. The university has a significant number of students from previously disadvantaged communities. Most of them are the first members of their immediate families to graduate from university. Most of them are in full-time employment and have family responsibilities. For this reason, although it is a contact university, the proposal-writing workshop was done via a synchronous or asynchronous distance delivery mode. The students could watch preparatory videos in their own time and attend online after hours from their homes.

The research was designed as a "social construction of reality" (Stake 1995, 99). It represents a "typical case sample" (Etikan, Musa, and Alkassim 2016), which was purposively sampled from a range of workshops that were presented, because it contained both behaviourist and constructivist elements. It applied a diverse range of presentation styles, activities methods, and technologies, and it was presented both synchronously and asynchronously.

The Case

The case is an online workshop on proposal writing to a group of new masters' and doctoral students from all the faculties in the university. It was early in the year and many were not yet registered on, or not familiar with, the university virtual campus. To ensure the broadest possible reach, as little data and other resources as possible would be used, WhatsApp was selected as the main vehicle, and supported YouTube videos when needed. High-bandwidth tasks occurred outside class time, so students could use cheaper after-hours data. The workshop followed a large-group or small-team approach. Students from various disciplines were randomly assigned to WhatsApp teams of six and were also in the main WhatsApp group that formed the whole class. The students presented individual tasks to the team of six before posting them to the main group.

Learning design was a blend of behaviourist and constructivist learning. Asynchronous pre-workshop work was behaviourist, pre-recorded YouTube lectures. Synchronous work consisted of short learning tasks in teams of six or individually. The tasks were brief enough that some could be completed in one teaching period. Bigger assignments formed overnight homework. There were no long-term projects. Most assignments were personalised: students received frameworks to apply to their own research. Finishing a task meant that the learning outcome had been achieved.

Four themes were covered during the workshop: (1) a video on the design of research questions that formed homework and which was discussed in class; (2) a team exercise in which students had to evaluate a precis that was done for homework, followed by a clarification video on YouTube; (3) a team exercise in which students had to draw a mind map about smoking; and (4) an individual exercise in which students had to draw their own mind maps about their studies.

Data Sources and Analysis

Data sources include the lived experience of the lecturer, student work, YouTube videos, downloaded WhatsApp messages and images. The first step in the analysis of the data involved a close reading of the WhatsApp transcript to produce the course "story" that appears below. The WhatsApp messages were then copied into a spreadsheet and coded for pedagogic acts. Seven of these were identified, namely discussion, feedback, briefing, presenting, thanks, humour, and praise. These will be clarified below. The pedagogic acts were then classified per theme and their percentages compared to see if different pedagogical approaches were followed in different themes. The timeline was also analysed to determine the time spent on each theme.

Findings

This section will begin with a description of the workshop as derived from reading the messages that were sent in the main WhatsApp group. Then follows an analysis of the messages sent per theme of the workshop (the homework video, the homework precis,

the in-class team exercise of developing a mind map on smoking, and the individual development of mind maps of students' own research). Upon that follows an analysis of seven pedagogical acts identified during the analysis: discussion, feedback, briefing, presenting, thanks, humour, and praise. These are then categorised by theme to see the extent to which each exercise had a different style. Finally, the time spent on each topic is considered.

The Story

This story is about the second workshop in a series of five. The specific theme for the evening was academic writing. Preparation homework was to precis a given passage from 94 words to 30, and to watch a 105-minute YouTube lecture on finding a research problem from the literature.

The first synchronous activity was a discussion of the 105-minute video with the lecturer clarifying certain aspects and responding to student questions. The second activity was for teams to review the individual homework task. They circulated their precis among themselves and arranged them from best to worst, using criteria: How close to 30 words? How close to the original? Questions in the large group showed that some students had not done the homework. The 94-word original was re-posted with an explanation that "If someone did not do the homework, they move down to position six on the team's ranking with one being best and six being worst". Then followed a big-group discussion of the best precis from each team. When the discussion dried up, the model answer was posted as well as a link to a YouTube explanation for students to watch asynchronously later.

For the third activity, the teams of six had to arrange 20 random sentences about smoking logically into a branching-tree diagram and post a picture of it to the main group. The first team responded nine minutes later, and the main group discussed it. The next one was so close to the model answer that it was discussed with a voice note explaining why it looked the way it did. Then followed a discussion that compared all the other responses as they were received.

The last task was presented in the form of a voice note. Students had to make their own individual branching-tree maps of their own research and discuss these in small teams before posting to the main group, where the diagrams were discussed as they were posted. The lecturer wanted students to look at the diagrams during the discussion, and therefore commented using voice notes. The students responded in text. Class ended with a briefing of the homework that would be discussed at the beginning of the next workshop.

Themes

The first theme was a discussion of the 105-minute homework video about a literature survey and a problem statement. A total of 34 minutes were spent on this section. Since there were no activities for students to carry out except to respond to and ask questions about the video, it is clear why this part of the workshop accounted for the majority (55) of the messages (Figure 3).

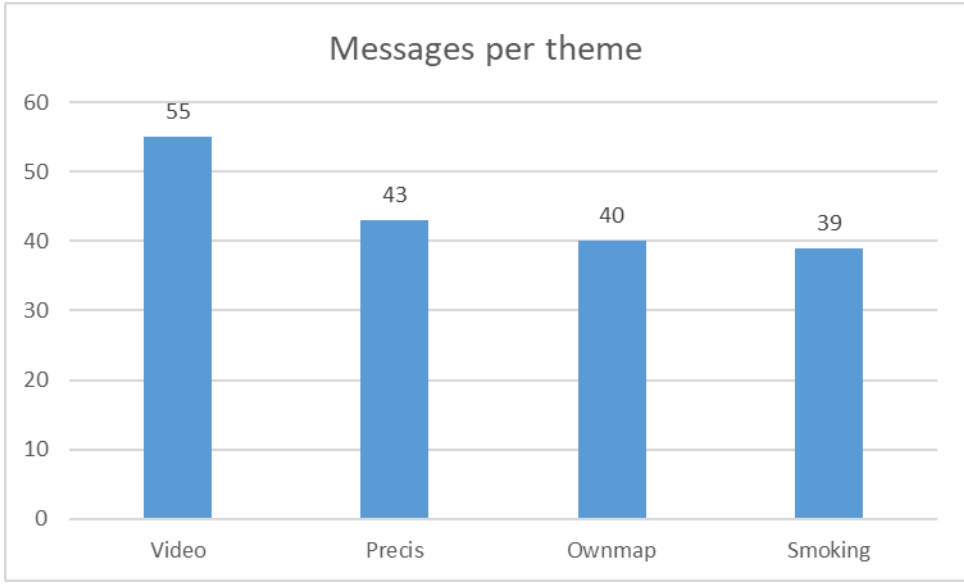

Figure 3: Messages per theme

The precis exercise was also a homework exercise, but in class the students had a further instruction to work in teams of six and rank their responses from best to worst. The high degree of investment in the exercise led to 43 messages, with students suggesting several improvements to their attempts. Finally, they expressed fascination at the number of precis techniques that were used in the YouTube solution.

The mind map on smoking was a team exercise and for many students this was the first time they had heard of a mind map. Many of the 39 messages therefore went into briefing the students and answering clarification questions. The individual mind map required much less briefing, but there was a considerable amount of presentation, leading to 40 messages.

The messages exchanged during the workshop were classified according to their pedagogical format, as discussion, feedback, briefing, presenting, thanks, humour, and praise. These are described more clearly in Table 3.

Table 3: Classification of messages into pedagogic acts (n = number of messages in that category)

Pedagogy	**n**	**Description**
Discussion	112	Longer sections of Socratic questioning rather than quick question-and-answer sessions
Feedback	37	Feedback from students and lecturers about the quality of work or the course and requests for students to complete the feedback form
Briefing	34	Learning tasks set for students, both in class and homework, and follow-up messages to clarify instructions or questions
Presenting	17	Longer one-way communications or the presentation of a document, picture, or audio clip
Thanks	13	General expressions of thanks, including emojis
Humour	9	Light-hearted comments and “lol” and smiling emojis
Praise	7	Presenters praising students for quality of work, students praising presenters for the course quality, congratulations to the co-presenter

Table 3 shows that most of the messages took the form of discussion. In the first session the discussion was about the video that was watched for homework. In the second session the students and the lecturer discussed their own precis and the model answer. The small tasks that students were given required a briefing first and then feedback once the tasks had been completed. The students would then present their results or the lecturer would present explanations. Affective aspects during the workshop included mutual expressions of thanks, humour, and praise.

Discussions per Theme

Figure 4 shows that discussion made up most messages. In fact, so much so that it would be wise to consider the distribution of discussion message per theme separately from the other pedagogical acts.

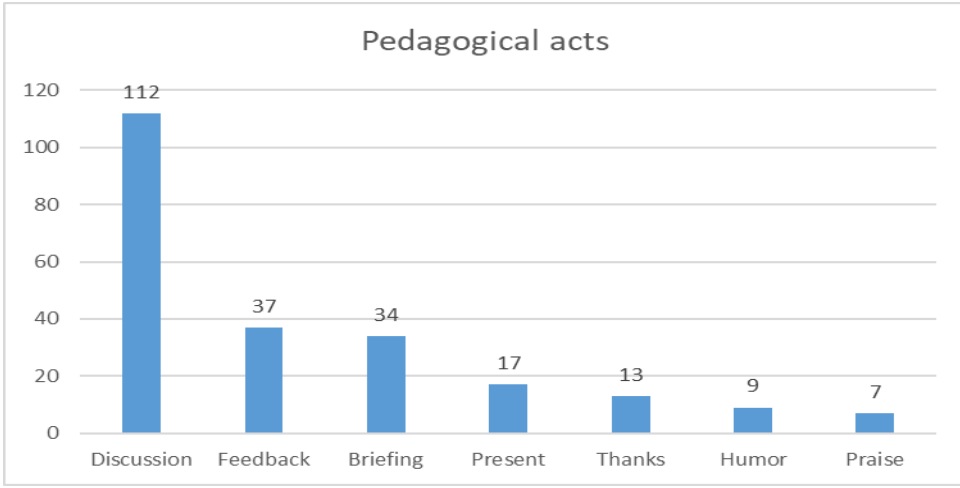

Figure 4: Pedagogical acts

Figure 5 shows that the video and the mind map on smoking generated the highest level of discussion. Since the video was a homework exercise, there was little else to do than discuss, hence the high volume of discussion messages. The team exercise of the mind map on smoking generated much discussion as students had never done mind maps before, and because there could be any number of different ways in which such a map could be made. The students completed the maps in teams and then presented and discussed their results. By contrast, the students' own mind maps presented generated the least discussion. This was mainly because each student would present their map, and the lecturer would comment with a voice note and the student would indicate agreement, or clarification.

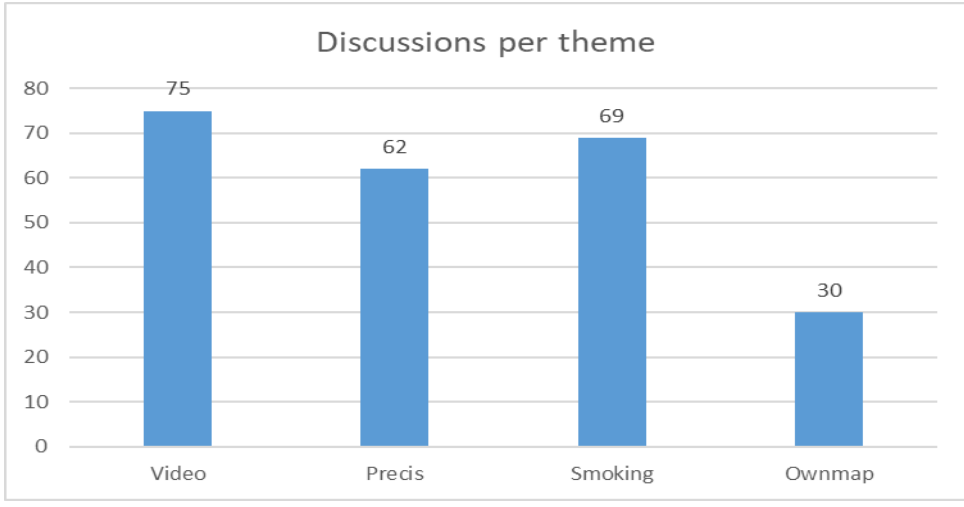

Figure 5: Discussions per theme as a percentage of the total messages in the theme

Other pedagogical acts per theme

Figure 6 shows the percentage of the remaining pedagogical acts per theme, once the discussions had been cut out.

Although 75 per cent of the messages in the video theme were spent on discussion, the remaining 25 per cent show much thanks, praise, and general feedback for the instructor about the usefulness of the video.

In the precis exercise, 62 per cent went to discussion, and the remainder of the pedagogical acts went to the briefing of the students, humour, feedback, praise, and thanks. The praise related to the elegance of the solution shown in the YouTube video, and the lecturer humorously admitting that the solution had been the result of refining that specific precis with students continuously through a 30-year long career.

The 31 per cent of the remaining pedagogical acts on the smoking mind map were dominated by the briefing. This was a constructivist, collaborative exercise and required briefing the students of both what a mind map was and how to work collaboratively to make one.

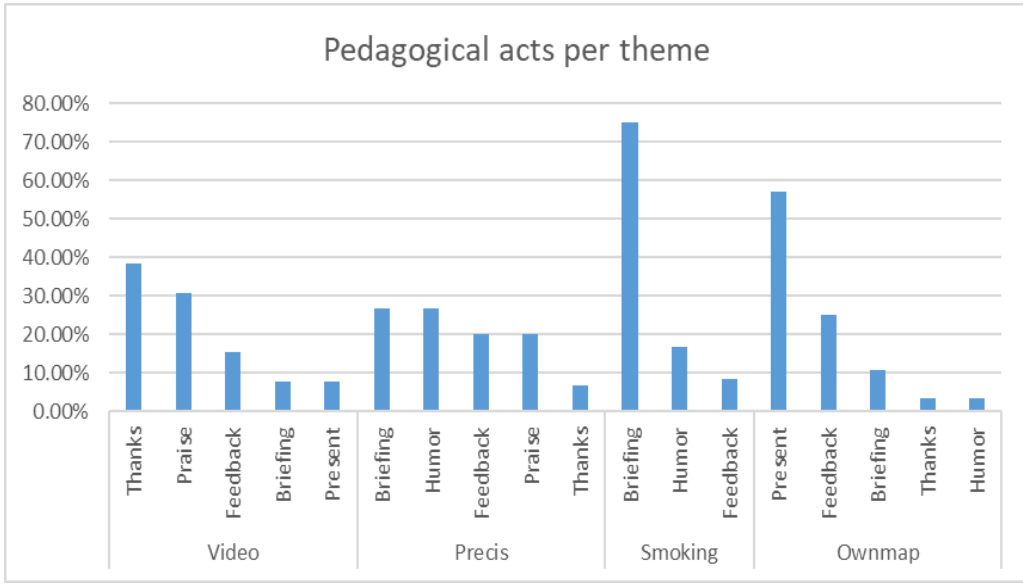

Figure 6: Other pedagogical acts per theme

The only activity in which the other pedagogical acts outnumbered the discussion, was the individual exercise where students had to make their own mind maps. The briefing was very short, as they just had an extensive briefing about what mind maps were and could ask support from their team members. Most of the time was spent in the students presenting their mind maps and receiving feedback from both the lecturer and the other students.

Discussion

The activities described above were classified according to the four quadrants identified by Cronjé (2020): injection, integration, construction, and immersion. These activities determined the extent to which the theoretical perspectives of behaviourism and constructivism were blended during the workshop. Each theme was based on a specific knowledge domain: known, knowable, complex, and chaotic (Kurtz and Snowden 2003). Each activity used a different blend of methods, tools, and technologies.

Injection

The injection quadrant involves direct instruction of known information. In the case above, this occurred via the 105-minute video that students watched for homework and the subsequent discussion. The video was a "talking head" presenting on the (known) standard ways of searching and analysing the literature to come up with a research problem. The method was a lecture, the tool was a video and the technology was provided by YouTube. This information could also have been presented as an audio recording or as text. It was a classical, linear, behaviourist learning event following Gagne et al.'s (2004) nine events of instruction with the provision of feedback, performance evaluation, and retention and transfer enhancement occurring during the live WhatsApp session. A total of 75 per cent of the messages sent were devoted to discussion led by the lecturer. When it was necessary to explain some of the issues in the video, the lecturer went into the mode of a presenter. The briefing was to tell students who had missed the video the previous night where to find it. No new knowledge was created and the video and subsequent discussion were aimed at giving the students information efficiently so that they could come to class prepared. The technology involved was a YouTube video and a WhatsApp discussion.

Integration

The integration quadrant involves arriving at knowable information through integrating direct instruction and construction. The knowable information was the systematic process of developing a precis. Students received guidelines for conducting a precis (direct instruction or behaviourism) and had to construct a precis (constructivism), compare it with that of their colleagues (socio-constructivism) and watch a video (direct instruction or behaviourism) of a model answer. At the heart was the collaborative nature of negotiating meaning to determine who had the best solution. Tools and technology were a blend of a construction tool in the form of a word processor, YouTube video instruction tool and WhatsApp as a communication tool. A total of 62 per cent of the messages were devoted to discussion, with the other pedagogical acts reasonably evenly distributed.

Construction

In the construction quadrant, learners construct some structure to make sense of complex knowledge. Here students were given building blocks of an essay in the form

of 20 statements about smoking, and asked to arrange these by constructing a branching-tree diagram. If necessary they could add their own "knots" in the diagram. There was no correct answer, although in this instance one group came close to the "model answer".

The socio-constructivist (Vygotsky 1978) nature of this exercise required a detailed briefing (eight messages) to prevent uncertainty. To scaffold students' learning, they were put into smaller WhatsApp teams where they completed this as a team task. The discussion consisted of teams posting their maps to the WhatsApp group and critiquing one another's work. The lecturer facilitated and provided feedback. The method was construction, and the tools and technologies used ranged from mind mapping software to pencil and paper, and sending a photo of it to the WhatsApp team.

Immersion

In the immersion quadrant, students make sense of chaotic information. This quadrant shows little evidence of either planned constructivism or programmed behaviourism. They were immersed, thrown into the deep end. The students created their own branching-tree diagrams of their own research. They created their own order out of chaos and developed their own research experience. This activity was the only one where discussion made up less than 60 per cent of the messages. This is because students had to present their work to the class by sending a picture to the whole WhatsApp group. The lecturer provided feedback and facilitated discussion. Technology included pen and paper to draw the map, a cell phone camera, and WhatsApp.

Timelines

An analysis of the timestamps on the messages (Figure 7) showed that 34 minutes were spent in the injection quadrant discussing the video, 20 in the integration quadrant discussing the precis homework, 23 in constructing the smoking mind map, and 36 immersed in own mind-map making. The time spent on each form of learning in the mix was therefore roughly the same.

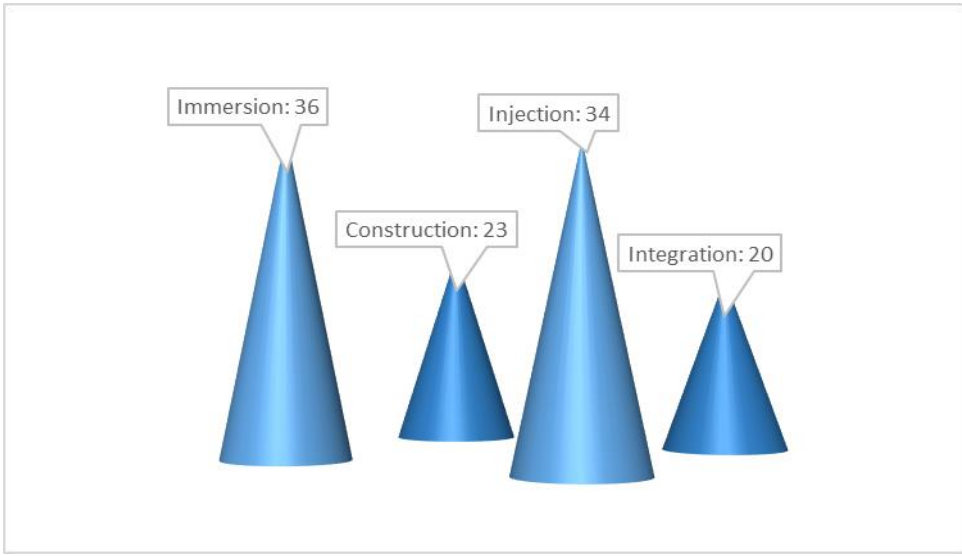

Figure 7: Time spent in each quadrant

Conclusions

Two questions drove this study: what blend of theories, methods, tools, and technologies were used to create the learning experience, and to what extent did this constitute a blend of direct instruction and constructivist learning?

To answer the first question, elements of the story above were classified according to Kurtz and Snowden's (2003) contexts, Cronjé's (2020) matrix, and the methods, tools and technologies used. The result is presented in Table 4.

Table 4: The learning exercises classified according to Cronjé's (2020) matrix

Context (Kurtz and Snowden)	**Paradigm (Cronjé)**	**Methods**	**Tools**	**Technologies**
Known	Injection: High in behaviourism	Students watched a YouTube lecture and discussed it in class	Presentation (Video) Discussion	YouTube WhatsApp
Knowable	Integration: High in both behaviourism and constructivism	Puzzle: Develop a precis (puzzle it out) Discuss with team members Debate the ranking of the precis Watch model answer (Direct instruction)	Writing Discussion Presentation (Video)	Word processor WhatsApp YouTube

Context (Kurtz and Snowden)	Paradigm (Cronjé)	Methods	Tools	Technologies
Complex	Construction: High in constructivism	In a team, construct a branching tree that shows the relationships between 20 given statements	Drawing Communication	Branching tree generator in MSWord, or other mind mapping software Pen, paper and phone camera WhatsApp
Chaos	Immersion: Low in both constructivism and behaviourism	Experience: Students use own research problem to develop own branching-tree diagram	Research journaling Drawing Communication	Word processor notebook Pen, paper and phone camera WhatsApp

The analysis and the synthesis presented show that one evening's workshop, which was presented entirely online, contained a blend of knowledge types, learning theories, technologies, tools and methods. The homework from the previous night added a blend between synchronous and asynchronous learning. Tools used included video presentation tools, discussion tools, communication tools, and research and drawing tools. Technologies included YouTube videos, word processors, mind-mapping software, WhatsApp, pen and paper, and cell phone cameras. It is clear that in a blended learning environment the blend does not have to consist of a blend between contact and distance.

In answer to the second question: The methods ranged from direct instruction, construction, and immersion to a full-on blend of both theories. The sequencing of the learning event moved from simple, known knowledge, through knowable, and complex, to chaotic. The students were asked to view a presentation of known information in their own time. They were then allowed, in teams, to debate knowable information, then asked to make a complex construct supported by their peers, before finally being immersed in an exercise to make sense of chaotic information. The timeline showed that 23 and 34 minutes were spent on the extremes of instruction and construction respectively, whereas integration consumed the least in-class time (since it was based on homework) and immersion took the most class time.

The findings support the critique of placing behaviourism and constructivism at opposite ends of a continuum. They support the proposition that the two paradigms are orthogonal.

Recommendations

Based on the findings and conclusions of this article, a blank version of Table 4 is proposed as a framework for designing blended learning experiences. Learning designers could analyse the learning material with regard to Kurtz and Snowden's (2003) knowledge types, and use an appropriate learning paradigm. From there they can select appropriate methods, tools and technologies to complete the blend.

Context (Kurtz and Snowden)	**Paradigm (Cronjé)**	**Methods**	**Tools**	**Technologies**
Known	Injection: High in behaviourism			
Knowable	Integration: High in both behaviourism and constructivism			
Complex	Construction: High in constructivism			
Chaos	Immersion: Low in both constructivism and behaviourism			

Although the pedagogical acts differed between the various paradigms, it was not possible to determine if a clear pattern exists. Further quantitative research should be conducted to determine if certain pedagogical acts are more prevalent in some paradigms than in others.

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