AUTHOR:
Dr Angela Stott[1]

AFFILIATION:
[1]University of the Free State, South Africa

DOI: http://dx.doi.org/10.18820/2519593X/pie.v40.i1.16

e-ISSN 2519-593X

Perspectives in Education

2022 40(1): 268-287

PUBLISHED:
04 March 2022

RECEIVED:
06 August 2021

ACCEPTED:
05 October 2021

South African teachers' engagement in *Teach Online*: A case study about short course design

Abstract

In the developing world numerous barriers hinder teachers' uptake of the pedagogical and technological skills needed to teach online. This study sought to contribute to an understanding of effective programme design for developing such skills in such contexts by exploring the engagement of a cohort of South African teachers (n=97 initially, decreasing to n=25 across the programme) in a pedagogically and technologically moderately advanced 80-hour short learning programme (SLP). The research is guided by research questions regarding the retention and engagement across the SLP and design elements that affected these. A description of the SLP is given in terms of the teaching, social and cognitive presences included, as well as Chickering and Gamson's seven principles of good practice. Data were collected regarding the numbers of participants engaging in activities across the duration of the SLP. In addition, 20 of the participants who completed the SLP volunteered to answer a questionnaire with 31 Likert-scale items regarding engagement levels, and 3 open-ended items concerning their experiences with the SLP. Content analysis was performed, and findings were interpreted using collaborative cognitive load theory. The findings show high attrition levels, particularly during the registration and orientation processes. High engagement levels were found for those who managed to complete the SLP successfully, with approximately equal representation of these teachers from schools serving richer and poorer communities. The design description and derived recommendations are likely to be of value to designers of online SLPs, particularly within the developing world context, and particularly while the COVID-19 pandemic necessitates use of online teaching. Recommendations are inclusion of (1) participation marks to promote engagement in collaboration; (2) short videos to clarify (a) the nature of the SLP up-front and (b) engagement instructions.

Keywords: *Collaborative cognitive load theory; course design; in-service teacher development; online learning; online teaching; technological pedagogical and content knowledge.*

1. Introduction

Rapid deployment of emergency remote teaching in response to the COVID-19 pandemic, has fuelled the general perception – unsupported by research – that online courses are inferior to face-to-face courses (Hodges *et al.*,

2020). Research does, however, suggest a need to (a) adjust course design relative to face-to-face instruction, (b) develop online-appropriate Technological Pedagogical and Content Knowledge (TPACK) to ensure effective online teaching (Mishra & Koehler, 2006), and (c) address the higher attrition rates characteristic of online relative to face-to-face courses (Anyatasia, Santoso & Junus, 2020). Chickering and Gamson's (1987) seminal *seven principles of good practice* have been shown to be an effective tool for evaluating the quality of online courses (Hathaway, 2014), and one of these principles, the promotion of student engagement, has been shown to improve course retention rates to a moderate degree (Tirrell & Quick, 2012).

The feasibility of teachers being able to develop and apply the TPACK required to develop and implement quality online courses is highly dependent on context. Relevant contextual factors include teachers' initial TPACK, learners' access to technology and the extent to which teachers are supported by parents and guided by school leadership and other relevant role-players, including universities (Ehren *et al.*, 2021). Particularly for South African teachers teaching in contexts of poverty, contextual constraints to effective online teaching are considerable. Even before the pandemic struck, South African student engagement and course retention levels were known to be low in the basic (Sing & Maringe, 2020) and higher (Strydom, Kuh & Mentz, 2010) education sectors. The low quality of the basic education sector highlighted the need for teacher professional development (Van der Berg *et al.*, 2016), including in the area of integration of information and communication technologies (ICTs), where uptake levels were known to be low, particularly in schools serving poor communities (Padayachee, 2017).

To facilitate South African teachers' development of the TPACK needed for effective online teaching, despite these constraints, the University of the Free State (UFS) developed two university-accredited short learning programmes (SLPs) in the months immediately following the outbreak of the COVID-19 pandemic: *Teach Online* and *Harnessing Social Media for Distance Teaching*. The aim of these SLPs is to guide teachers of any grade and subject to design and deliver quality online or distance lessons. The SLPs differ in the level of TPACK targeted, in order to cater for the broad spectrum of needs and initial competencies present in the South African teaching force. This arrangement allowed for participants in the more advanced *Teach Online* course, to change to the more basic *Harnessing Social Media for Distance Teaching* course, rather than dropping out. UFS secured funding for 120 teachers to engage in these two SLPs during the second semester of 2020. In this research the focus is placed on the participants' engagement in the more advanced SLP, namely *Teach Online,* which may therefore be referred to as *the SLP,* in this article.

2. Purpose and research questions

Research regarding the effective design of online courses, and of the engagement of participants in such courses, has largely been confined to the global north (Bond *et al.*, 2020). Those studies situated in Africa have generally focused on undergraduate university education, rather than in-service teacher education (Bond *et al.*, 2020). The purpose of this research is to attempt to understand design and implementation features of online SLPs for in-service teacher professional development that are appropriate for the South African, and, possibly, the broader developing-world, context. To this end, I provide a rich description of the UFS *Teach Online* short learning programme and investigate how the participants engaged in this SLP and the issues and suggestions that arose. From this it is hoped that the reader

will be able to extract principles relevant to guiding the effective design of online courses in their context. Therefore, in reference to the first implementation of the SLP described in this article, the research is guided by the following research questions: (1) What were the levels of retention across the duration of the programme? (2) What were the completing participants' levels of skill-, emotional-, participation- and performance-engagement in the programme? (3) How should the design of the programme be changed for future implementations?

3. Conceptual framework

Collaborative cognitive load theory (Kirschner *et al.*, 2018) is used as a framework for making sense of the data and is built on the premise that the small size of working memory is the greatest limitation to learning (Sweller, 2011). This small space can be occupied by three types of cognitive load: harmful extraneous, necessary intrinsic and productive germane. Extraneous cognitive load results from paying attention to details that are not directly relevant to the learning at hand (Sweller, 2011). This may be particularly problematic in online learning due to the multiple opportunities for exploration that the internet affords, as well as the teacher's inability to control the learners' environments, relative to face-to-face instruction (Kirschner *et al.*, 2018). Intrinsic cognitive load is associated with the difficulty a person experiences with selecting key items in the learning material to aid its comprehension. This is partly inherent to the degree of complexity of the subject matter but is also influenced by the clarity with which the learning material is presented and the prior knowledge of the learner (Sweller, 2011). Germane cognitive load is experienced during sense-making and arises as the learner forms links between knowledge elements, including between new and prior knowledge, as they make sense of the learning material (Sweller, 2011).

According to cognitive load theory there are two main types of knowledge, which offer different degrees of cognitive load (Sweller, 2011): biologically primary knowledge is learnt intuitively through social interaction and offers little cognitive load, whereas acquisition of the more cognitively taxing secondary knowledge requires more formal and explicit learning experiences. Primary knowledge includes non-verbal communication, such as the meanings of facial expressions and body language, as well as everyday verbal communication, particularly in one's home language. During teaching and learning, primary knowledge is used to facilitate the acquisition of secondary knowledge, such as subject matter knowledge and knowledge of how to use technology (Kirschner *et al.*, 2018).

Collaborative cognitive load theory extends this theory to collaborative settings where collaborators can potentially benefit from the added cognitive space afforded by thinking together with collaborators. This potential benefit is, however, traded against the added cognitive load associated with the collaboration process, called transactional cost (Kirschner *et al.*, 2018). During face-to-face interactions, people can leverage primary knowledge to reduce transactional costs to a greater extent than during online interactions (Costley *et al.*, 2021). This is because online interactions often happen asynchronously or with technology-induced delays, and body language and facial expressions are often not observable, even during synchronous interactions, due to the need to switch video cameras off to conserve bandwidth. These features disrupt the communication rhythms and cues by which primary knowledge is used to leverage learning of secondary knowledge in face-to-face learning by reducing intrinsic, and promoting generative, cognitive load (Jiang, Kalyuga & Sweller, 2021). Furthermore, online collaborative interaction and individual engagement with material may suffer from the addition of extraneous cognitive load due to the split attention effect

(Schmidt-weigand, Kohnert & Glowalla, 2010); for example, as learners need to move their eyes between posts on a discussion board, or try to figure out ways to navigate between parts of a website.

4. Method

This is a pragmatically conducted (Plowright, 2011) instrumental case study (Stake, 1994) that was conducted during the first cycle within a larger action research project (McNiff, 2013). An instrumental case study facilitates the understanding of an issue; in this case the effectiveness of a programme designed to develop the ability of South African in-service teachers to effectively teach online. As explained below, the three items of the 3P (Presage-Process-Product) model of student learning (Han & Ellis, 2020) are used to structure the analysis of the components of the course that should be presented so that a reader can form a reasonable understanding of aspects relevant to its success. The presage to student learning consists of two aspects, namely attributes of: (1) the programme, discussed in the section about the intervention, and (2) the students, discussed in the section about the sample. Data were collected from the process and product aspects of the *Teach Online* SLP to understand the appropriateness of the course attributes for the participants and their contexts. This is explained in the data collection section. The process of a programme refers to the students': (1) perceptions of the learning environment, which was measured by means of closed- and open- questionnaire items; and (2) their approach to learning, which was operationalised as the students' engagement in the formative activities of the *Teach Online* SLP and their responses to self-report engagement questionnaire items. The product refers to the students' learning outcomes, which was operationalised as the students' engagement in the summative assessments of the SLP. There are multiple definitions, methods of operationalisation, and questionnaires for evaluating student engagement (Bond *et al.*, 2020). In this study, Kuh's (2003:25) definition of student engagement is used: "the time and energy students devote to educationally sound activities" and Handelsman *et al.*'s (2005) four categories of engagement, namely skill, emotional, participation and performance engagement, were used as a framework to guide data collection and analysis.

4.1 Intervention

This research investigated a group of South African teachers' experiences in a pedagogically and technologically moderately advanced 80-hour online SLP, *Teach Online*, which was conducted over a 6-month period. It aimed at developing the TPACK needed to teach the participants' chosen content online. The SLP was created according to research-based literature, consistent with the requirement for the first cycle of an action research approach (McNiff, 2013). Table 1 describes the characteristics of this SLP based on Means, Bakia and Murphy's (2014) nine dimensions of online learning.

Table 1: Characteristics of the Teach Online short learning programme

Dimension	Description of the Teach Online SLP
Modality	Fully online
Pacing	Deadlines, at 2-week intervals, provided for each of the 8 modules
Student-instructor ratio	<35 to 1
Pedagogy	Participants explore online resources that they are provided links to
Role of assessments	Provide student with information about learning state

Dimension	Description of the Teach Online SLP
Instructor role online	Support and feedback, not active instruction
Student role online	Explore and make sense of resources
Synchrony	Asynchronous, with a few voluntary synchronous sessions
Source of feedback	Instructors

The *Teach Online* SLP comprises eight modules, with two weeks assigned for each module. The learning material is presented on a website (www.ufs.ac.za/TeachOnline). Participants are expected to engage with this material individually, as well as to participate in formative collaborative discussion forums and to submit individual summative activities. The two facilitators for the SLP engaged in group and individual discussions with the participants and provided written individual feedback in response to participants' activities. In addition, a few voluntary synchronous virtual meetings were held. Table 2 indicates features of the SLP that are considered relevant to each of Chickering and Gamson's (1987) seven principles of good practice. These are organised according to the three elements of the Community of Inquiry (CoI) framework. According to this framework, three interrelated types of presence are needed for learning to be successful: social, cognitive and teaching presence (Dixson, 2015). For simplicity, interactions between these elements are excluded from Table 2 below.

Table 2: Description of features of the Teach Online short learning programme relative to principles of good design

Component	Chickering and Gamson's (1987) principle	Example(s) of how this was done in Teach Online
Social presence	Encourage contacts between student and faculty	The instructors sent at least one message to the group per week, and at least one individual message to each participant per month. During the first month, participants who did not respond were contacted telephonically. Participants were invited to contact the instructors at any time via email, WhatsApp or Google Classroom.
	Develop reciprocity and cooperation among students	The course material on the website directed participants to 7 Padlets, 1 collaborative Google Doc, 1 YouTube video and its comments space and 1 FlipGrid. Participants were required to respond to specific questions in these discussion spaces and were encouraged to share anything relevant to online teaching on any of the platforms used, and to respond to their peers' posts.
Cognitive presence	Use active learning techniques	Participants were guided to apply what they learnt in each module to incrementally compile an online lesson that they implemented and reflected on in the final module.

Component	Chickering and Gamson's (1987) principle	Example(s) of how this was done in Teach Online
Teaching presence	Give prompt feedback	The instructors gave individualised feedback, generally within 72 hours, to each participant as they submitted assignments, as well as in response to their discussion and messaging posts.
	Emphasise time on task	The course content was divided into eight modules, each having formative, and six having summative, assessments. Fortnightly deadlines were provided for successive modules.
	Communicate high expectations	Each of the summative assessment tasks was accompanied by a rubric that described the characteristics of quality work. In addition, the facilitators gave detailed individualised written feedback for each task.
Cognitive presence	Respect diverse talents and ways of learning	Participants were given considerable freedom in how they applied the principles taught in the programme to create a lesson using their choice of topic, target learners, and applications.

4.2 Sample

Working within a pragmatic paradigm, it is not necessary for the various sources of data to be collected from the same sample (Plowright, 2011). To answer the first research question, regarding the levels of retention across the programme's duration, the sample comprised the 140 participants who voluntarily began the registration and orientation processes for either of the short learning programmes (*Teach Online* and *Harnessing Social Media for Distance Teaching*). They did this in response to an invitation that was spread through teachers' WhatsApp groups and addressed to teachers of all grades and subjects throughout the Free State province of South Africa. However, very little data was collected from these initial participants, and therefore the term *sample* is reserved rather for the subgroup used to answer the second and third research questions. This sample comprised only the 20 participants, all who indicated having completed the SLP, who participated in a questionnaire that was sent at the end of the programme, to all participants who had completed the registration process for this SLP (n=48). The response rate was therefore 42% relative to the number of people the questionnaire was sent to, or 80% relative to the number of people who completed the SLP. The lack of questionnaire data from participants who dropped out of the SLP limits claims made from this data. Furthermore, the low absolute numbers and non-representability of the sample of those who answered the questionnaire relative to the population of South African teachers, limits generalisation from this case. Care is therefore taken not to overreach the claims that might validly be made from the data available. To help the reader judge the extent to which the findings presented here might be applicable to their own context, some of the biographical characteristics of the sample are given in Table 3 below, and information regarding their access to Information and Communication Technologies (ICTs) is presented in Table 4. The questionnaires were answered anonymously for enhanced validity. Participants gave informed consent for the inclusion of this data in this research, and ethical clearance was obtained from the university's General Human Research Ethics Committee (UFS-HSD2020/1790/163).

Table 3: Biographical characteristics of the sample

School type*	Gender	Average age	N
Quintile 1-3	Male	41	4
	Female	45	2
Quintile 4	Female	36.5	4
Quintile 5	Female	37.3	6
Independent	Male	43	1
	Female	26.5	2
District official	Male	49	1
Total	*Male n=6* *Female n=14*	*38.5*	*20*

***The quintile rating of South African schools refers to the socio-economic status of the community served, with 1 being the poorest**

Table 4: Characteristics of the sample's access to Information and Communication Technologies

Level of access	Number of teachers who answered this (/20) for				
	Smart phone	Tablet	Computer	Internet (at home)	Internet (at school)
I don't have access		5	1		
I have access, but I don't use it	1	2	18		
I own this and use it	19	9	1		
My school gives me access at school		3	1		
I have access to someone else's and use it		1			
Excellent: data and speed enough				11	5
Data is enough, but speed is limited				3	8
Speed is enough, but data is limited				5	4
Very little to none due to poor coverage in area				1	3

Figure 1 below shows the teachers' estimates of the access their learners have to various ICTs. The responses are consistent with what is known about South African learners' access to ICTs (Oyedemi & Mogano, 2018), i.e. (1) greater access to smartphones than computers, particularly in poorer communities; (2) little access to the internet for learners from poorer communities. Additional observations of interest are that: (1) responses are varied within a type of school; (2) few learners have access to tablets; (3) access to ICTs may be low even at some high quintile schools and, particularly, independent schools, despite the general understanding that such schools serve richer communities. The validity of these observations should, however, be considered in the light of their emanating from the estimates made by a small number of teachers. This information is particularly relevant to this study in that teachers' perceptions of the access that their learners have to appropriate technology affect their perceptions of the agency they can exert regarding online teaching (Ehren *et al.*, 2021).

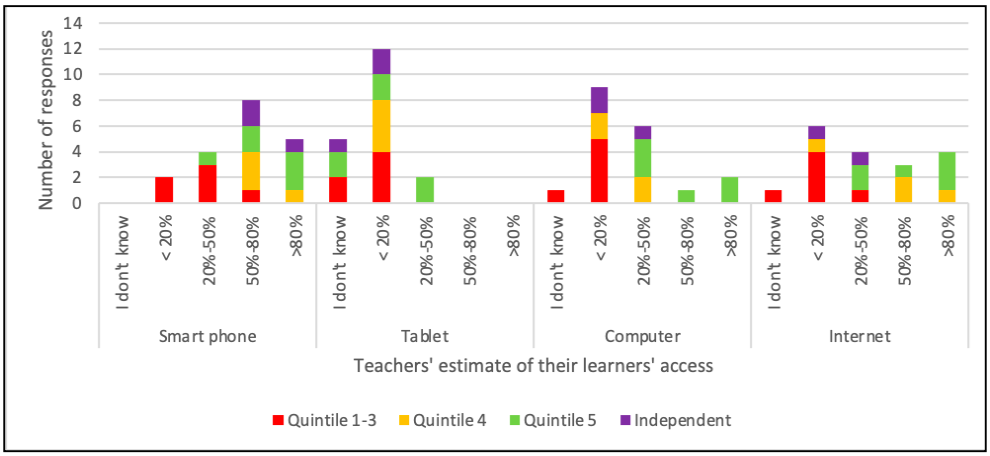

Figure 1: The sample teachers' estimation of their learners' access to Information and Communication Technologies

4.3 Data collection and analysis

To answer the first research question regarding course retention, the changes in the numbers of participants enrolled in, and engaging in, the *Teach Online* SLP across its duration, are presented. This includes the number of participants who submitted assignments for each of the 6 modules for which summative assessment was provided, observations made by the facilitators regarding participation in the various discussion forums and data regarding participation in, and use of recordings from Zoom sessions across the duration of the SLP. These data were collected from the administrative records for the SLP, such as registration forms, records in Google Classroom, pre-Zoom questionnaires and the analytics from the YouTube platform where the Zoom sessions were uploaded with the unlisted permission setting. These data were analysed through descriptive statistics. Relevant to answering the second and third research questions, data were collected from the 20 participants, referred to as the sample, who completed the final questionnaire, composed of 31 Likert-scale items regarding engagement levels and 3 open-ended items of their positive and negative experiences with the *Teach Online* SLP, and their suggestions for improvement. This questionnaire was taken, with minor adjustment for the context, from Handelsman *et al.* (2005). Content analysis was performed, with descriptive statistics provided where appropriate.

5. Results

The following assertions, in reference to the *Teach Online* SLP, answer the research questions. Each assertion is then argued for, after which explanations will be suggested in terms of the conceptual framework.

(1) There was a low retention rate (41%) between the start of the registration process and submission of the first assignment, and moderate retention (62%) from then to successful completion. There was approximately equal representation of teachers who completed the course from schools serving richer and poorer communities.

(2) The completing participants showed high levels of skill-, emotional- and performance-engagement levels, and moderate participation engagement levels. The lower participation

engagement levels resulted from lower motivation to engage in formative, rather than summative, tasks.

(3) Future implementations should include marks for participation in discussion forums and short videos to present the purpose and demands of the programme up-front, and to clarify the instructions for each module.

5.1 Retention across the duration of the course

As can be seen in Figure 2, the greatest attrition (49/97 = 48%) occurred between the start and completion of the registration and orientation processes. These processes occurred during the month prior to the official commencement of the SLPs and required *Teach Online* participants to complete two registration forms, submit certified documents, send the facilitators a screenshot of the *Teach Online* website and enter the *Teach Online* Google Classroom. It should be noted that only 25 (51%) of the teachers who exited *Teach Online* across this period were lost to the jointly funded pair of SLPs, since the other 24 moved to the more basic SLP, which itself lost 11 participants across this period. It is relevant to report the attrition (36/140=26%) across this registration and orientation period for both the SLPs because funding was dependent on the joint number of participants who completed the registration process for the two SLPs. The next greatest attrition (n=8) occurred between completion of registration and the submission of the first assignment. This means that attrition from start of registration to submission of the first task for *Teach Online* was 57/97 = 59%, i.e. 41% retention.

These observations might suggest the need to allow approximately a third more participants to enter the registration and orientation processes for such SLPs, than what the funders have indicated they will pay for, to compensate for the attrition that will occur during this phase. Such a guideline would be invalid, however, if attrition across this stage was unique to this case or could be manipulated in future implementations. The likelihood of these possibilities is now discussed. The high initial attrition seems likely to have arisen from poor initial understanding of the course requirements relative to the participants' abilities to meet these. If these arose from poor initial communication of these requirements and/or from the unpredictable environment which COVID-19 created for teachers during this time, then lower initial attrition rates could be expected in cases where such communication were clarified and/or the environment were more predictable. Further research would be needed to evaluate this prediction, but its likelihood is enhanced by the fact that this was the first iteration of this SLP and so communication was likely to be suboptimal, and participation was done in the teachers' free time between September 2020 and February 2021, overlapping the period when they had to cope with preparing their learners for the final examinations, despite the school year having been greatly disrupted by COVID-19 lockdowns.

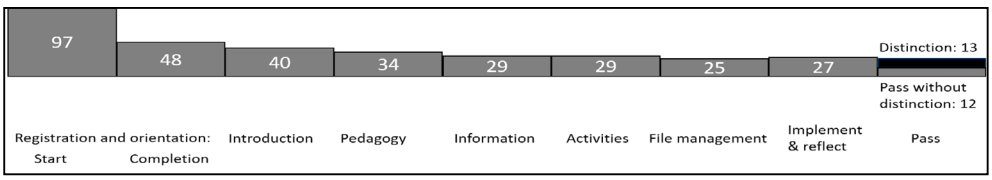

Figure 2: Retention across the Teach Online short learning programme

5.2 Completing participants' engagement levels

As shown in Figure 3, the sample of completing participants self-reported high engagement levels for the skill-, emotional- and engagement- (for summative tasks) dimensions. However, the participants' engagement was considerably lower for the formatively assessed tasks.

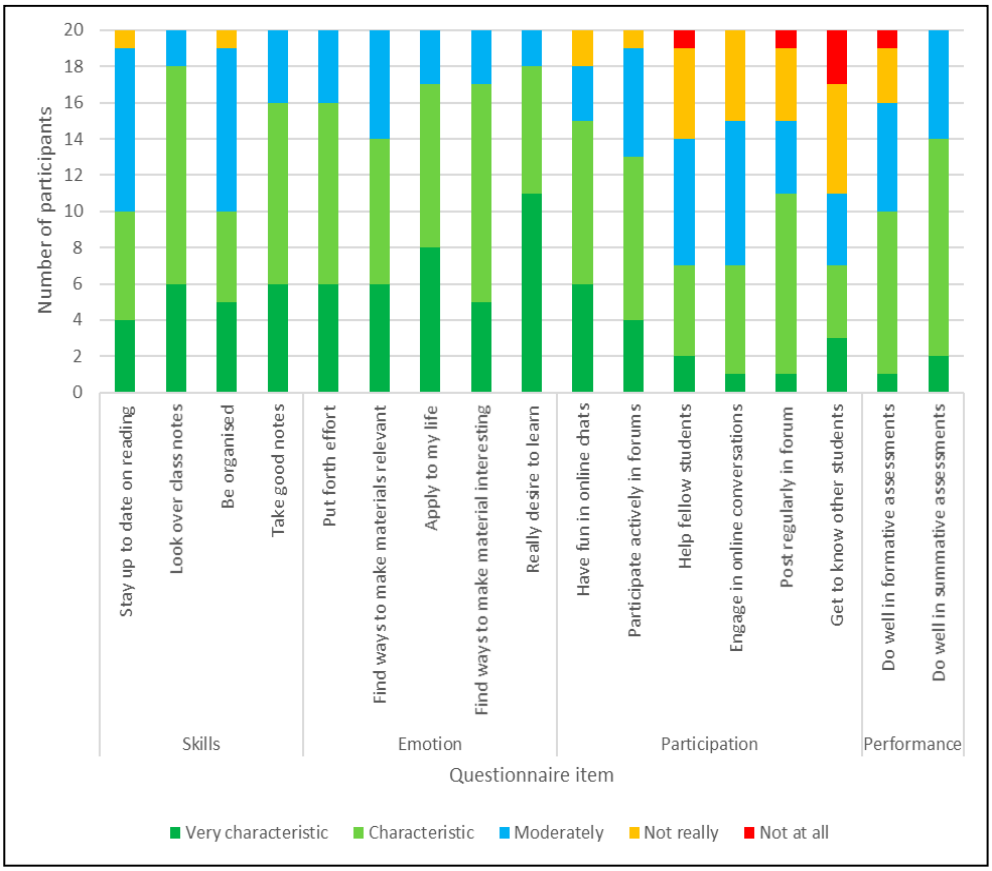

Figure 3: The sample's self-reported engagement in the Teach Online short learning programme

During the first two modules, the instructors noticed low participation levels in the formative discussion forums, coupled with poor performance in the summative assessment tasks. For the first modules, the instructors addressed this by appealing to the participants to engage thoroughly with all the formative tasks before attempting the summative task for each module. From the fourth module, participation marks were awarded for engagement in the formative discussion forums, incentivising participation with some success. From the third module, the instructors introduced voluntary Zoom sessions. These were intended to allow for interactive question-and-answer sessions; however, as indicated in Table 5, few specific questions were asked, with several participants indicating, in the pre-Zoom questionnaire, that they did not know what they were meant to do in the module. Consequently, the instructor spoke for most of the time, largely repeating information given in written format on the programme's website, rather than the session being as interactive as initially hoped.

Table 5: Engagement data for the voluntary Zoom session of the Teach Online short learning programme

Date, time and duration of session	Pre-session questionnaire			Synchronous session attendees	Asynchronous video views	
	Responses	Indication of not knowing what to do in module	Specific questions asked		Number of views	Average view duration (% of total time)
06/10, 10am, 50'	14	3	1	3	27	12
06/10, 7pm, 40'				3	17	7
24/10, 7pm, 40'	14	3	3	5	14	22
31/10, 7pm, 40'	8	3	2	2	15	34

5.3 Improvement for future implementations

The sample's answers to Likert-scale items about the strengths and weaknesses of the programme were analysed to inform an understanding of which features should, or should not, be changed in future implementations of this programme. This was further informed by the sample's answers to open-ended questions about these features and suggestions for improvement.

As can be seen from Figures 4 and 5, there were high satisfaction levels regarding the helpfulness of the various features of the programme. This satisfaction is echoed in the numerous positive statements recorded in the open-ended section of the questionnaire (see Table 6). The least utilised features were the voluntary Zoom sessions and the WhatsApp group. Since it was impossible to complete the course without using the website and Google Classroom, and only online material was provided, the fact that one participant indicated no use of these features and two indicated that "No offline material" was not characteristic of this course, undermines the reliability of these participants' data. Perhaps instead of responding to the wording of these options, these participants had intended to indicate the lowest possible degree of helpfulness of these features. Besides this possibility, the feedback was very positive with the only option chosen besides "very helpful", "helpful" and "not applicable" being "slightly helpful". This option was chosen most (n=5) for the discussion forums. This finding seems consistent with the observation that fewer open-ended comments were made regarding the role of social presence, such as afforded by the discussion forums, than regarding teacher and cognitive presences in the course (see Table 6, which summarises the themes that emerged from the qualitative analysis).

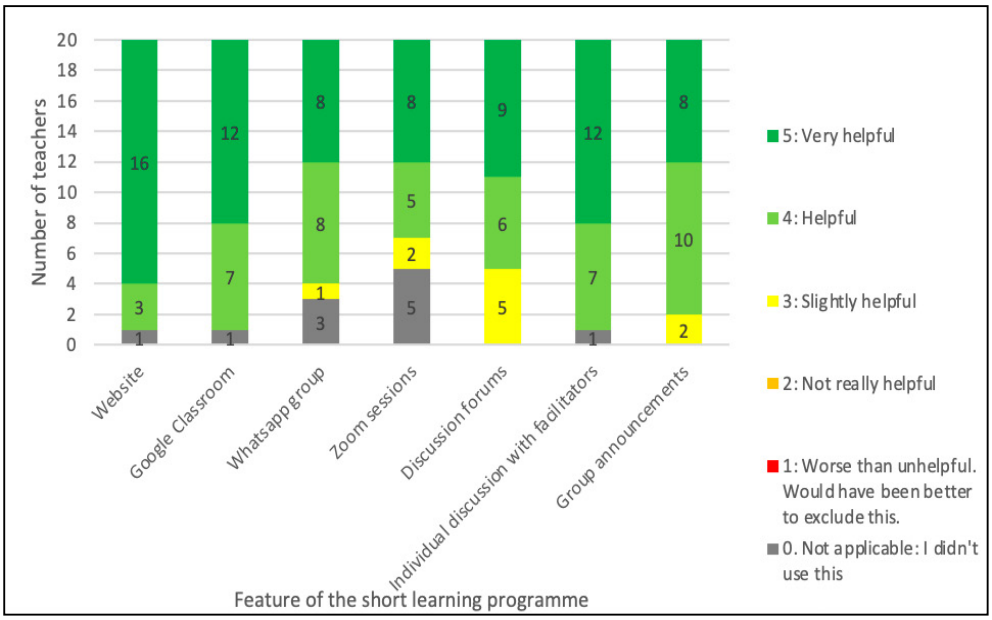

Figure 4: Perceptions of the helpfulness of various features of the Teach Online short learning programme

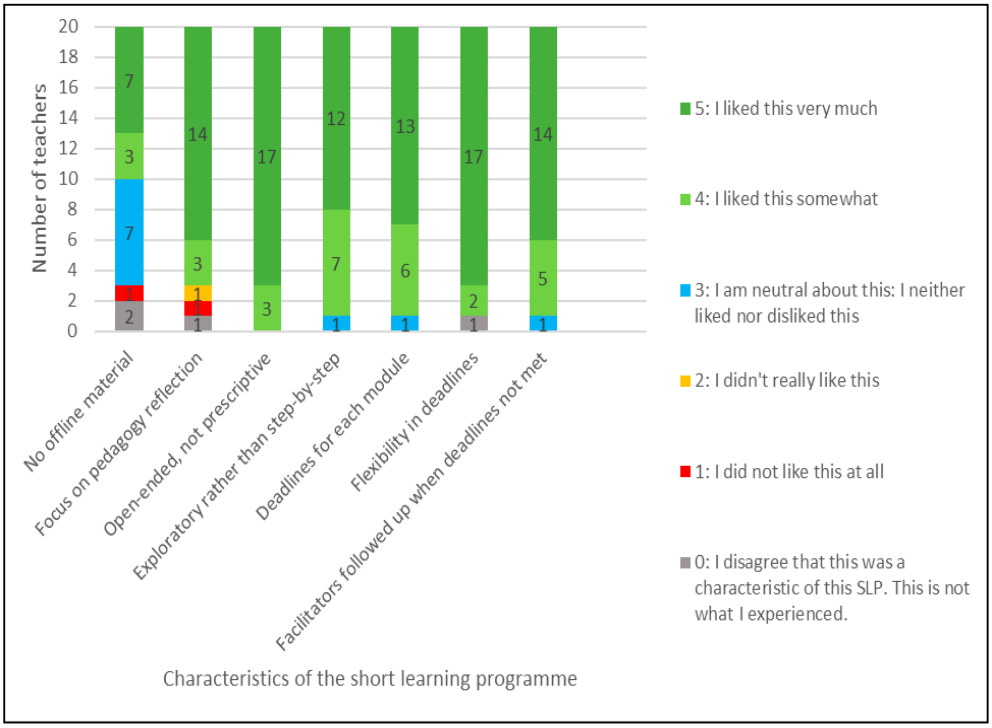

Figure 5: Opinions regarding various characteristics of the Teach Online short learning programme

Table 6: Summary of the open-ended responses regarding the strengths, weaknesses and suggestions for improvement, of the Teach Online short learning programme

Component	Theme	Number of comments	Examples
Teaching presence	Need to clarify instructions, e.g. through inclusion of instruction videos	11	"Have a short video clip of how to access everything on the link so we don't miss any information."
	Instructor feedback and support was helpful	9	"I had no previous experience in most of the features and through regular contacts and communication from the presenters and colleagues, I was able to acquire a lot of information which helped me a lot."
	Changes to pacing and structure suggested	6	"Give more time for assessments."
	Flexibility in deadlines was appreciated	3	"I am very thankful for the leniency on the submission dates - all of us are teachers and you do get some days (or weeks) where you really plan on doing the assignment and then school (and life) happens. I was scared that I would get penalised, but the administrators understood and gave the extension."
	Spaced deadlines were helpful	1	"The deadlines for tasks was [sic] also spaced in such a way that it gave you enough time to complete it, even when you are working until 4 at school."
Social presence	Discussions with colleagues were helpful	3	"The amount of help received from other people taking the SLP course was positive."
	Course climate was conducive to learning	3	"The general atmosphere of the course that inspired learning."
	Need for more interaction	2	"I think I had to ask questions when I wasn't sure what I need to do. But that was a problem on my side. Trying to do all on my own."

Component	Theme	Number of comments	Examples
Cognitive presence	Difficulty was experienced with acquiring particular knowledge and skills	7	"Conversion of files and compressing them was sometimes challenging." "Classroom can be confusing if you aren't computer literate. It is not chronologic." "It was challenging to learn how to record lessons."
	Exposure to a wide variety of applications was beneficial	5	"I learned about many different websites and apps to aid and further my online teachings."
	Motivation to learn and enjoyment of learning	5	"I think it helped me to extend my knowledge. When you use a new app it create questions and then you seek for answers."
	A more prescriptive, step-by-step approach would have been appreciated	3	"I would have liked to have selected apps go in detail about how to use them step for step, where a focus on how to use all the functions could be done and not just a self-study on them."
	Course resources were useful	2	"I still use some of the material."
	Need for change in mindset from face-to-face pedagogy	1	"I had to make a mind shift to look away from the traditional way of teaching when doing these tasks. I had to be open minded to new things to learn and to have learned to implement these new ways of teaching."
	Course was challenging and time-consuming	1	"Usage of a high volume of internet data. If you want to benefit in full with this course you need lots of time to watch all the video's and sometimes even more video's and lots of data. You could not really work for short periods on the SLP especially when creating activities etc. in the different apps. Then you need to sit and finish what you were busy with and sometimes there were some problems that you had to fix first because you did not know how to use the app."

6. Discussion

It appears that the *Teach Online* short-course's design was generally effective. This is suggested by the high self-reported engagement levels (Figure 3), the high satisfaction levels regarding the components of the SLP (Figure 5) and the positive open-ended responses (Table 6). This finding lends support to the view that course designers should pay explicit attention to the three elements of the Community of Inquiry (CoI) framework (Dixson, 2015)

as well as to Chickering and Gamson's (1987) principles of good design, as was the case for this SLP (Table 2). The description of this SLP could serve as an example of how this theory can be enacted in an online short course within the South African context. These claims are, however, limited by the high attrition rate observed and by the fact that the data referred to was collected only from participants who had managed to complete the programme.

For these participants, the fully online nature of the programme appeared not to be problematic (see Figure 5). They displayed high levels of access to the internet as well as to Information and Communication Technology (ICT) devices (see Table 4). This is inconsistent with Jacobs's (2018) finding that South African teachers tend to have fairly high access to ICT devices at school, but show limited usage, due to low confidence levels, and tend to have limited access to the internet. This inconsistency is unsurprising since the teachers who managed to complete this course are not representative of the population of South African teachers (see Table 3), since teachers from quintile 5 (6/20) and independent (3/20) schools, which likely serve richer communities, were overrepresented compared to the general South African population. Since the opportunity to participate in this SLP was publicly open to all teachers in the Free State province, it is probable that the characteristics of the teachers who originally signed up for this SLP were closer to the population of South African teachers. This suggests that teachers from higher quintile schools were more likely to complete this SLP than their counterparts in lower quintile schools. This is unsurprising, given the greater level of challenges teachers from lower quintile schools tend to experience in their teaching practice and in their everyday lives, which tends to limit the time and energy they can devote to professional development (Johnson, Monk & Hodges, 2000). Moreover, teachers teaching poorer learners would likely be less motivated to engage in a course about teaching online, given the low internet access of their learners (see Figure 1).

Considering this, the course completion by teachers from Quintile 1–4 schools, who made up 50% of the sample, can be seen as exemplary and suggestive of an anticipation of the possibility that learner internet access is a potential for which they should prepare themselves. In fact, the low access that learners, even from richer communities, seem, from Figure 1, to have to the internet, may be expected to have undermined the motivation of any of the teachers to engage in this course. Although the COVID-19 pandemic had necessitated some form of distance teaching, which likely provided motivation for learning to teach online, it was clear from the participants' introductory remarks in the course, that they had mainly been doing this via WhatsApp. Use of WhatsApp was discouraged in the *Teach Online* course, since it formed the focus of the more basic alternative course, *Harnessing Social Media for Distance Teaching*. These issues may partially explain the finding that many participants chose to move to the more basic course, or to drop out completely. However, high dropout rates are unfortunately characteristic of South African education trends, even in face-to-face programmes. As Strydom, Kuh and Mentz (2010) point out, it is necessary to find ways to enhance the engagement of South Africans, particularly from disadvantaged communities, in educational opportunities. To this end, the discussion below attempts to explain the findings, in terms of collaborative cognitive load theory, in a manner that may help inform changes that could be made to improve engagement levels, particularly of teachers from disadvantaged communities, in the future.

This SLP was designed such that the formative tasks were somewhat collaborative, in that participants were meant to engage in discussion forums with their peers, whereas the summatively assessed tasks were all individual tasks. This design favoured individual work

over collaboration, since there is obviously greater motivation to engage in summatively, rather than formatively, assessed tasks, particularly in cultures characteristic of developing world contexts, which strongly emphasise high-stakes examinations (Okitowamba, Julie & Mbekwa, 2018), downplaying knowledge and activities that are not summatively assessed (Brodie & Sanni, 2014). The poor performance of those participants who skipped the formative tasks completely in the early modules suggests that the formative assessment was needed to succeed in the summative assessment. This might be understood in terms of the greater collective working memory space that collaboration can afford if engaged in effectively (Kirschner *et al.*, 2018). This said, it is not possible to establish to what extent this explanation is relevant, since those who skipped the formative tasks might not have engaged with any of the learning material, even individually.

Indications, in the pre-Zoom questionnaires, that participants did not know what they were meant to do, despite the presence of written instructions on the website and in Google Classroom, as well as suggestions by more than half (11 out of 20) of the sample for short instructional videos to clarify the written instructions, may be understood as follows. Written instructions in online courses are known to provide more cognitive load than verbal instructions would, particularly if given face-to-face where non-verbal cues can harness biologically primary knowledge to leverage learning of biologically secondary knowledge (Jiang, Kalyuga & Sweller, 2021). This occurs particularly in cases where the language of learning and teaching is not the home language (Kirschner *et al.*, 2018), and for which even teachers' language proficiency is low, as tends to be the case in developing world contexts (Krugel & Fourie, 2014). The 40-minute Zoom sessions were intended to provide the missing verbal instructions and simulate a degree of face-to-face interaction. The low synchronous attendance and percentages of asynchronous watch times for these sessions support findings that the imposition of face-to-face pedagogy, such as long synchronous lectures, onto online learning, has limited effectiveness (Hodges *et al.*, 2020).

7. Significance and limitations of the study

Table 7 summarises the challenges experienced in this study and suggested mitigating measures. Except for the call to improve internet access, particularly to poor learners, which is beyond a programme designer's sphere of influence, the suggested mitigation measures are being implemented in an improved version of this SLP, and the value of these measures is being investigated, forming the second action-research cycle within the broader project. It is hoped that these suggestions, as well as the description of how design principles from the literature were applied in this case, may be relevant to helping others in their design and implementation of similar programmes. Since this is a case study, its purpose was not to produce grand generalisations, but rather what Stake (1994) calls naturalistic generalisations, which a reader can abstract and apply to their own context. As the reader does this, they should take into consideration the fact that the sample was not representative of South African teachers, was small (n=20), included only participants who completed the course, and that most of the data displayed here was self-reported, with associated limitations, such as limited knowledge of self and the possibility of misunderstanding questions.

Table 7: Identified difficulties and suggested mitigation measures

Issue	Explanation	Suggested mitigation
High attrition, particularly during the registration and orientation phase before the course began	Some potential participants had a poor understanding of the demands of the programme	Creation of orientation and overview videos to communicate course demands more clearly
		Couple programmes of different levels of difficulty to allow participants to move between programmes rather than drop out
	High attrition is a norm within this context	Admit significantly more participants into the registration process than stipulated by the funding agreement. This inflation should be about 30% if funding is determined by the number of registrations.
Those participants who managed to complete the course over-represented schools serving richer learners	Teachers who teach richer learners are more likely to consider online teaching a feasible option, and may be more likely to meet the prior requirements for success in such a course	Improvement of internet access to poor learners, e.g. at governmental level; Provision of incentives for teachers to equip themselves to prepare to capitalise on such access
Lower participation than skill, emotion and performance, engagement levels	Higher motivation to engage in summatively assessed rather than formatively assessed tasks, and poor understanding of the value of the formatively assessed tasks	Inclusion of marks for participation in the formative discussion forums, and clearer communication of the value of engagement in these forums
Some difficulty in knowing what to do, suggested by questionnaire comments and requests in pre-Zoom-session questionnaires	Written instructions offered high cognitive load due to text being unable to harness primary knowledge to leverage the learning of secondary knowledge	Creation of short instruction videos for each module in a manner that allows for use of facial expressions and body language to clarify the communication

8. Conclusion

In developing-world contexts there are considerable hindrances that prevent teachers from developing the Technological Pedagogical and Content Knowledge needed to effectively teach online. These include low proficiencies with ICTs (Padayachee, 2017), low motivation levels to learn these skills due to their learners' limited access to the relevant technologies (Oyedemi & Mogano, 2018) and challenges that plague all levels of education, including teacher professional development programmes. These challenges include low proficiency levels in the language of learning and teaching (Krugel & Fourie, 2014), a culture of examination preparation (Okitowamba, Julie & Mbekwa, 2018), often at the expense of engagement in deep learning (Brodie & Sanni, 2014), and high dropout rates (Strydom, Kuh & Mentz, 2010). However, unless teachers overcome these hindrances and develop skills that enable them to harness the educational benefits of ICTs, there will be little incentive for funders to provide

ICTs for education (Gyamfi, 2017). Breaking this vicious cycle is difficult, but imperative, as has been demonstrated by the differential ability of different socio-economic groups to use ICTs to mitigate the educational impact of the COVID-19 pandemic (Ehren *et al.*, 2021). This article has described the design of a programme that showed some operational success within the developing-world context. Alterations to programme design have also been suggested for enhanced retention and engagement across the programme. This information should assist and guide designers and implementers of similar programmes to make successful inroads into addressing low ICT-integration into education, including low usage of online learning opportunities, in developing-world contexts.

References

Anyatasia, F.N., Santoso, H.B. & Junus, K. 2020. An evaluation of the udacity MOOC based on instructional and interface design principles. *Journal of Physics: Conference Series*: 1-13. https://doi.org/10.1088/1742-6596/1566/1/012053.

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richger, O. & Kerres M. 2020. Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education*, 17(2): 1-30. https://doi.org/10.1186/s41239-019-0176-8.

Brodie, K. & Sanni, R. 2014. "We won't know it since we don't teach it": Interactions between teachers' knowledge and practice. *African Journal of Research in Mathematics, Science and Technology Education*, 18(2): 188-197. https://doi.org/10.1080/10288457.2014.930980

Chickering, A.W. & Gamson, Z.F. 1987. Seven principles for good practice in undergraduate education. *AAHE Bulletin*: 3-7.

Costley, J., Fanguy, M., Lange, C. & Baldwin, M. 2021. The effects of video lecture viewing strategies on cognitive load. *Journal of Computing in Higher Education*, 33(1): 19-38. https://doi.org/10.1007/s12528-020-09254-y

Dixson, M.D. 2015. Measuring student engagement in the online course: The Online Student Engagement scale (OSE). *Online Learning*, 19(4): 1-15. http://dx.doi.org/10.24059/olj.v19i4.561

Ehren, R., Madrid, R., Romiti, S., Armstrong, P.W., Fisher, P. & McWhorter, D.L. 2021. Teaching in the COVID-19 era: Understanding the opportunities and barriers for teacher agency. *Perspectives in Education*, 39(1): 61-76. https://doi.org/10.18820/2519593X/pie.v39.i1.5.

Gyamfi, S.A. 2017. Pre-service teachersâ attitude towards information and communication technology usage: A Ghanaian survey. *International Journal of Education and Development using ICT*, 13(1): 52-69.

Han, F. & Ellis, R.A. 2020. Initial development and validation of the perceptions of the blended learning environment questionnaire. *Journal of Psychoeducational Assessment*, 38(2): 168-181. https://doi.org/10.1177/0734282919834091.

Handelsman, M., Briggs, W., Sullivan, N. & Towler, A. 2005. A measure of college student course engagement. *The Journal of Educational Research*, 98(3): 184-192. https://doi.org/10.3200/JOER.98.3.184-192

Hathaway, K.L. 2014. An application of the seven principles of good practice to online courses, *Research in Higher Education Journal*, 22: 1-12.

Hodges, C., Moore, S., Lockee, B., Trust, T. & Bond, A. 2020. The difference between emergency remote teaching and online learning. *Educause Review*, 27: 1-12.

Jacobs, L. 2018. *Current status with regards to ICT integration in teaching and learning in Free State schools*. Bloemfontein: University of the Free State.

Jiang, D., Kalyuga, S. & Sweller, J. 2021. Comparing face-to-face and computer-mediated collaboration when teaching EFL writing skills, *Educational Psychology*, 41(1): 5-24. https://doi.org/10.1080/01443410.2020.1785399.

Johnson, S., Monk, M. & Hodges, M. 2000. Teacher development and change in South Africa: a critique of the appropriateness of transfer of northern/western practice. *Compare*, 30(2): 179-192. https://doi.org/10.1080/713657456

Kirschner, P., Sweller, J., Kirschner, F. & Zambrao, J. 2018. From cognitive load theory to collaborative cognitive load theory. *International Journal of Computer-Supported Collaborative Learning*, 13(2): 213-233. https://doi.org/10.1007/s11412-018-9277-y

Krugel, R. & Fourie, E. 2014. Concerns for the language skills of South African learners and their teachers. *International Journal of Educational Sciences*, 7(1): 219-228. https://doi.org/10.1080/09751122.2014.11890184

Kuh, G.D. 2003. What we're learning about student engagement from NSSE: Benchmarks for effective educational practices. *Change: The Magazine of Higher Learning*, 35(2): 24-32. https://doi.org/10.1080/00091380309604090.

Kuh, G.D. & Gonyea, R.M. 2003. The role of the academic library in promoting student engagement in learning. *College & Research Libraries*, 64(4): 256-282. https://doi.org/10.5860/crl.64.4.256

McNiff, J. 2013. *Action research: Principles and practice*, third edition. London: Routledge. https://doi.org/10.4324/9780203112755.

Means, B., Bakia, M. & Murphy, R. 2014. *Learning online: What research tells us about whether, when and how*. New York & London: Routledge. https://doi.org/10.4324/9780203095959

Mishra, P. & Koehler, M.J. 2006. Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6): 1017-1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Okitowamba, O., Julie, C. & Mbekwa, M. 2018. The effects of examination-driven teaching on mathematics achievement in Grade 10 school-based high-stakes examinations. *Pythagoras*, 39(1): 1-10. https://doi.org/10.4102/pythagoras.v39i1.377

Oyedemi, T. & Mogano, S. 2018. The digitally disadvantaged: Access to digital communication technologies among first year students at a rural South African university. *Africa Education Review*, 15(1): 175-191. https://doi.org/10.1080/18146627.2016.1264866

Padayachee, K. 2017. The myths and realities of generational cohort theory on ICT integration in education: A South African perspective. *The African Journal of Information Systems*, 10(1): 54-94.

Plowright, D. 2011. *Using mixed methods: Frameworks for an integrated methodology*. London: SAGE Publications. https://doi.org/10.4135/9781526485090

Schmidt-weigand, F., Kohnert, A. & Glowalla, U. 2010. A closer look at split visual attention in system- and self-paced instruction in multimedia learning. *Learning and Instruction*, 20(2): 100-110. https://doi.org/10.1016/j.learninstruc.2009.02.011.

Sing, N. & Maringe, F. 2020. Learner dropout in South African schools: Epistemological and management challenges, in K. Adeyemo (Ed.) *The education systems of Africa* (pp. 1-15). Springer, Cham. https://doi.org/10.1007/978-3-030-43042-9_22-1

Stake, R.E. 1994. Case studies. In N.K. Denzin & Y.S. Lincoln (Eds.). *Handbook of qualitative research* (pp 236–247). Thousand Oaks: SAGE.

Strydom, F., Kuh, G. & Mentz, M. 2010. Enhancing success in South Africa's higher education: Measuring student engagement, *Acta Academica*, 42(1): 259-278.

Sweller, J. 2011. Cognitive load theory. In J.P. Mestre & B.H. Ross (Eds.). *Psychology of learning and motivation* (pp.37-76). Amsterdam: Elsevier. https://doi.org/10.1016/B978-0-12-387691-1.00002-8

Tirrell, T. & Quick, D. 2012. Chickering's seven principles of good practice: Student attrition in community college online courses, *Community College Journal of Research and Practice*, 36(8): 580-590. https://doi.org/10.1080/10668920903054907.

Van der Berg, S., Spaull, N., Wills, G., Gustafsson, M. & Kotzé, J. 2016. *Identifying binding constraints in education*, *research on socio-economic policy*. Stellenbosch: University of Stellenbosch. https://doi.org/10.2139/ssrn.2906945