Self-Regulated e-Learning in Pre-Service Teacher Training for Realities of 21st Century Classrooms

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Abstract: Educators and students were unprepared for the suspension of face-to-face (f2f) educational activities due to Covid-19, specifically those less experienced in online teaching and learning. Students and educators were traumatised by the sudden switch to online teaching and learning. As such the transition from f2f to exclusive online learning prompted adjusted pedagogical methods and assumed measures of self-regulated e-learning (SRL). During this period researchers embarked on a longitudinal project in Information and Communication Technologies (ICT) called the 21st Century Project (21CP). The purpose of the study was to explore the SRL behaviours of pre-service teachers in online learning and to understand the extent to which a curriculum for technology integration alongside contextual factors influences SRL. As such our conceptualisation of the SRL framework adds two moderating constructs, these are, context and intervention to the core constructs of SRL. The sample of sixty six (66) students were drawn from a volunteer cohort of 166, 4th year pre-service students. Data were collected through interviews, surveys and online journal entries. The data was analysed qualitatively using narrative methods in which themes were identified and reported. The findings revealed that: the ICT integration curriculum represented a cornerstone for SRL development and shaped students' SRL behaviours; there were differences in the SRL practices that could be attributed to students' learning habits and attitudes to the ICT-based interventions. The findings of this study provide an understanding of interrelationships among SRL, context, and the design of an online curriculum. The study made three contributions to policy and practice. Firstly, SRL can be improved by providing activities that include clear guidelines for engagement through guided instructional methodologies. Secondly, the faculty curriculum developers should formulate guidelines to ensure that curricular iterations are developed as blended f2f/online modes to enable a quick and seamless transition for exclusive online use. Finally, course creators can improve student engagement by aligning learning outcomes and related activities with learning events.

Keywords: Self-Regulated e-Learning, Learning styles, Motivation, Online, Self-Efficacy, Qualitative-Data

1. Introduction

To alleviate the spread of COVID-19, the South African government instituted a national lockdown in March 2020. This resulted in the suspension of face-to-face (f2f) educational activities prompting institutions of higher education to resort to online education to save the academic year. Studies report students' and teachers' scepticism about online learning, citing challenges of online learning methods whose effectiveness they doubted ; anxiety about study success; difficulties owing to varying learning attitudes; technological challenges with online-blended engagements (Azis and Fatimah, 2020; Bao, 2020; Baloran, 2020). Similarly, Makhmudov, Shorakhmetov and Murodkosimov (2020) have shown that many educators are still not ready for true online teaching, and learning. This could be due to the belief among teachers that online learning may be less rigorous and effective than f2f learning in which teachers can present challenging ideas that engage students (Abe, 2020).

This paper reports on how a university, training pre-service teachers, responded to online learning through the design and delivery of an ICT integration curriculum, designed and developed for a blended f2f/online mode of delivery through the university learning management systems (LMS). Our paper is aligned with the study of Kim, So and Joo (2021). E-learning refers to online learning incorporating learning with and through digital technologies. Usually, e-learning occurs over the internet using several digital platforms which include LMS, cloud services and social networking services (SNS). This form of learning can be asynchronous (learner-paced) and synchronous (teacher-paced) engagements. The 21CP is viewed through a professional development lens and focused on the development of knowledge and skills through active learning.

Self-regulated online learning is an area which has received research attention as reported in a few studies. For example, Zhao and Song (2021) believe that the implementation of blended learning is closely related to the development or import of online courses and this can trigger self-regulated learning if managed properly. Another study which attempted to ascertain the effects of online learning on self-regulated learning was by Carter et al. (2020), which was conducted with K12 learners. Both studies provide the basic requirements for the

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transition from f2f to the online learner which are planning, performing, and evaluating (Carter et al., 2020; Zhao and Song, 2021). There are technological and technical limitations in transitioning from f2f to online education and these include the lack of access to well-functioning devices, poor connectivity, and ICT resources to support e-learning. The practical and pedagogical challenges are rooted in knowledge, skills and competencies in technology use, self-efficacy beliefs, self-regulatory attitudes and, learning styles (Abdous, 2019; Aziz and Fatimah, 2020; Bao, 2020). Various practical and pedagogical challenges may be attributed to tendencies to replicate f2f methodologies; replication of traditional classrooms in online environments; the indiscriminate use of technologies, systems and services, despite many technical issues, and lack of cognitive access and competencies.

Online learning is aligned with learning with and through technology, using blended methodologies. According to Zhao and Song (2021), blended learning methodologies are likely to become the most prevalent mode of education delivery in higher education. Studies suggest that the basic success of online e-Learning lies in SRL (Azis and Fatimah, 2020; Pham et al., 2019). It is assumed that online learning is more effective than f2f learning because it takes in environments which support SRL, where students are more likely to develop skills, and need to control their learning (Azis and Fatimah, 2020). Some researchers challenge the assumption by arguing that students have negative attitudes to online learning which can result from limited access to the internet as well as methods of online education which are viewed as inferior and unsuitable by students (Baloran, 2020; Bao, 2020; Azis and Fatimah, 2020).

The research gap addressed by this study is how SRL in South African pre-service teacher training is influenced by online learning during the COVID-19 pandemic. The study was guided by two research questions stated as:

- How does online learning influence self-regulated e-learning among pre-service teachers?
- To what extent do the 21CP contextual factors enable self-regulated learning?

Existing studies for online learning support the notion of support for students after f2f learning. The significance of this study stems from its contribution to the knowledge of how a curricular design for online learning contributes to SRL. This longitudinal study used real-time online learning in which the researchers did not interfere with students when learning online but provided support and guidance. The limitation of this study was its confinement to 4th-year pre-service students enrolled for the academic year 2020.

2. Literature Review

2.1 Theoretical Underpinning

The contextual circumstance of the impact of Covid-19 inadvertently suggested self-regulated e-learning. As such two actionable processes are highlighted: one, the need for students to take more responsibility for their learning and two, for teachers to provide appropriate support for student learning. Zimmerman (1990, pp. 3) maintains that SRL "has profound implications for the way teachers should interact with students…" This implies a shift from learning as fixed traditional processes to students' agency. Accordingly, the SRL framework was used as it comprises the [core] "cognitive, metacognitive, behavioural, motivational, and emotional/affective aspects of learning" (Panadero, 2017, pp. 1). A range of variables are understood to influence SRL: attitude, self-efficacy, volition, cognitive strategies, feedback loops, outcome expectation, contextual circumstances and intervention processes. In this study, the 21CP was the intervention.

According to Zimmerman, (1990, pp. 4) "Systematic use of metacognitive, motivational, and/or behavioural strategies is a key feature of most definitions of self-regulated learners." Cleary and Zimmerman (2004), further note that a "self-oriented feedback loop" and "an indication of how and why students choose to use a particular strategy or response…. unless the outcomes of these efforts are sufficiently attractive, students will not be motivated to self-regulate (Zimmerman, 1990, pp. 5). As active participants in their learning, Cleary and Zimmerman (2004) maintain that to domesticate SRL, "attention must be directed toward developing all three dimensions of self-regulated learning in students: metacognitive, motivational, and behavioural." Figure 1 presents our conceptual framework of SRL.

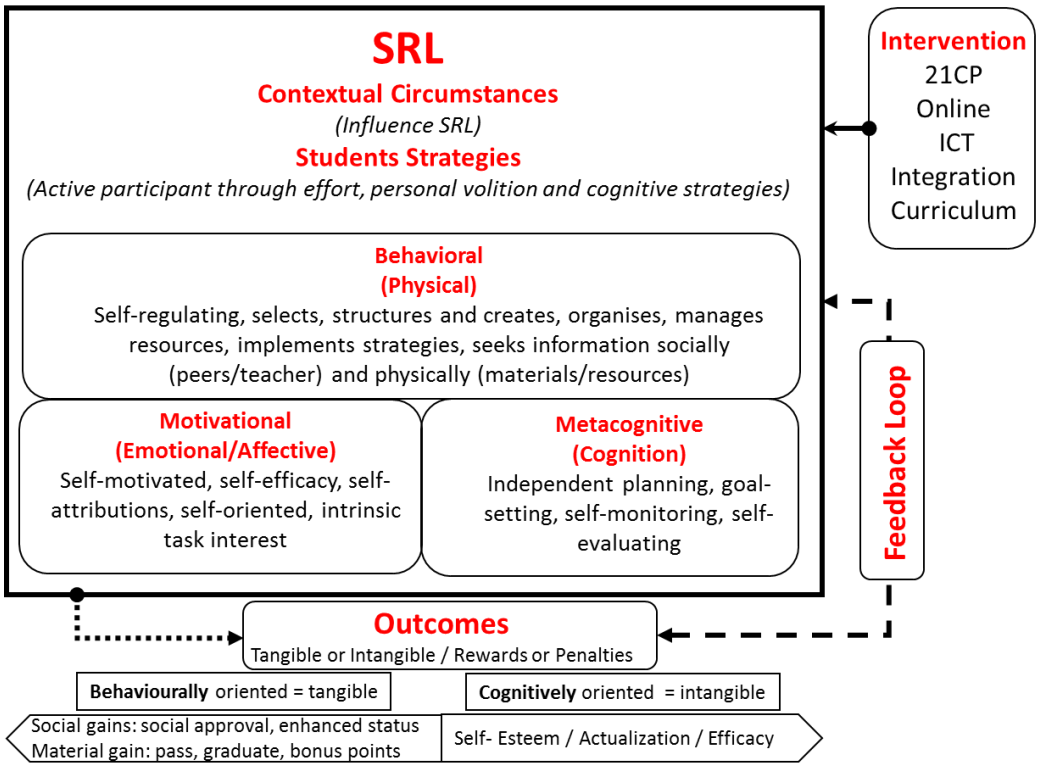

Figure 1: Authors' Conceptual SRL Framework

According to the conceptual SRL framework, the behavioural and physical elements indicate that preservice like any other student can actively seek important educational information, resources and strategies that are helpful to their success. Self-regulated learning requires such efforts where individuals become actively seek various ways of organising their learning using online technologies and resources. This is played out individually and socially and is representative of visible manifestations of actions. The motivational element is intertwined with learning processes. One specific aspect is perceptions of self-efficacy, which according to (Schunk, 1984 & 1989) provides both a motive to learn and iteratively successful learning contributes to self-efficacy beliefs. According to Zimmerman (1990), SRL tends to stimulate strong metacognitive elements among students which urge them to understand selves as agents for learning. Such metacognition makes students eager to realise their strengths, academic capabilities, and shortcomings and ultimately seek strategies to solve the potential challenges by themselves.

The proponents of self-regulated learning assert that self-regulated learners tend to accept greater accountability for their attainments because the achievement can bring about some tangible or intangible personal benefits (Zimmerman, 1990). Two approaches identified toward achieving desired outcomes are behavioural, targeting tangible material or social gains (Mace, Belfiore and Shea, 1989), and cognitive approaches targeting intangible concepts such as self-actualization, and self-efficacy (McCombs, 1989). Efforts ought to be sufficiently attractive for student pursuit. Efforts result in two opposing ends of a continuum – one conditional on external rewards (social approval, boosted status, material gain) (Mace, Belfiore and Shea, 1989), and the other inspired by personal gratification (self-esteem, self-actualization) (McCombs, 1989). In the cycle of behaviours based on expected outcomes, students respond to feedback. Cleary and Zimmerman (2004, pp. 8) regard the feedback loop as "the process in which students monitor the effectiveness of their learning methods or strategies and react to this feedback in a variety of ways, ranging from covert changes in self-perception to overt changes in behaviour".

Our conceptual SRL framework adds two moderating constructs: context and intervention. Students' SRL takes place in contextual circumstances that may be the source of enablement or disablement of SRL. The content and the interaction of teachers and students manifest as an enabling environment, which we refer to as the intervention.

According to Zimmerman (1990, pp. 6) self-regulated students need to proactively engage and extend efforts, be self-directed and self-motivated signalling that "skill and will are integrated components of self-regulation".

Weiser, Blaub and Eshet-Alkalaia (2018, pp. 50) maintain that the rate of voluntary participation is determined by learning style (personality traits). Outside of social and contextual circumstances, students' willing engagement can be understood through attitudes and self-awareness. Self-awareness as an agency contributes to self-efficacy and competency beliefs which iteratively include a sense of motivation. Approaches to SRL from the social cognitive school of thought focus "on perceptions of self-efficacy as the ultimate source of students' motivation" (Zimmerman, 1990, pp. 11). According to the theory of planned behaviour (TPB) by Ajzen (1991), attitudes, subjective norms and perceived behavioural control determine the intention to perform a behaviour. Intention and behaviour concerning SRL is a tension between inner forces and the environment in a network of reciprocally interacting influences (Bandura, 1989; Zimmerman and Schunk, 2011.).

Behaviour is tempered by personal motivational and feedback factors. The strength with which an attitude is held is often a good predictor of behaviour (McLeod, 2018; Nortvig, Petersen and Balle, 2018). If students are not motivated by outcomes and do not experience social inclusion and acceptance, they may be less motivated to engage in SRL. Weiser, Blaub and Eshet-Alkalaia (2018, pp.15) focusing on teachers, speak of the "importance of adapting the teaching methods to the learners' characteristics" and recommend using "types of teaching-learning interactions that have been found to increase participation, such as students' presentations and explicit encouragement of participation by instructor-student interactions."

2.2 Design: 21st Century Project

The 21CP was designed and developed for a blended f2f/online methodology. Inherent in the design was our attention to the flexibility of the learning environment to meaningfully engage students in the enterprise of learning. Aspects of our design find concurrence with the recommendations of Kim, So, and Joo (2021, pp. 13) – these included "time for students to reflect"; "elaborate on what they learned"; "interaction with other students" and "provide appropriate scaffolds to students". At the onset of the Covid-19 lockdown, the 21CP continued exclusively online via the LMS and SNS. The framework of the six modules in 21CP encompassed:

- Modules set out to scaffold learning with module outcomes, learning outcomes, assessment grids, and rubrics;
- Alignment among assessment-outcome-activity;
- Inclusion of modern teaching methodologies (instructivist, constructivist and connectivist) in activities and engagement alongside detailed engagement guidelines;
- Repository of multi-media resources;
- Tools for submitting tasks on LMS;
- communication/collaboration tools (discussion forums, email; WhatsApp); provision for reflective learning (journals/exit tickets)

The changed circumstances required us to rethink the 21CP and how to facilitate reciprocating engagement among students and lecturers. We were critically aware of Kim's (2020, pp. 156) assertion that various phases need to be accomplished whether online or f2f.

Students and teachers experience acute technological limitations and challenges, in the South African context. Sadeck et al. (2020, p. 595) reported that many students reiterated the heavy draw on data and high data cost with some noted difficulties with connectivity, and of devices not being well suited for the high-end requirements of digital learning environments. Our first consideration was technological challenges, focused on affordable, efficient and preferred means of communication and support. We settled on continuing with the LMS and increased our use of WhatsApp. We based this on a finding that students used and preferred WhatsApp and Blackboard (Sadeck, et al., 2020, pp. 594 & 597; Chaw, and Tang, 2023). Blackboard was zero-rated except for video streaming, and all students had access to WhatsApp at a low cost with proven efficiency for quick responses. We felt it necessary to reduce the task load; increase the engagement and submission times; permit alternative submission modes and increased WhatsApp usage.

3. Research Methods

A qualitative research method with purposive sampling was used in this study. Participation was voluntary and 166 out of the population 244 responded positively. Qualitative data were collected from 66 of the 166 respondents using journal entries, surveys and interviews. Information was gleaned from the combination of data sets.

The researchers informed students early in the study that they were not members of the staff of the University and only researchers in the project. The purpose of the data collection was explained, and student volunteers

were invited. Anonymity was assured and students were free to withdraw at any time. Permission to conduct the research was obtained from the relevant university authorities. All data was discussed with the co-researchers and member checks were done to ensure accuracy. Four data sets were triangulated - journals, surveys, interviews and classroom observations – classroom observations are not included in the analysis as they were too few to provide substantive findings.

We used an open-ended format for the journal as we believe that this would closely replicate the realistic conditions of the participants' SLR. Usable journal data was availed from 64 respondents. The surveys, at the end of each module, are largely open-ended with a few close-ended questions specifically as prompts to understand students' use of the learning outcomes and assessment guidelines, key learning takeaways and clarity of instructions and guidelines. Usable survey data was availed from 66 respondents. Thirteen (13) one-to-one virtual interviews and 1 virtual focus group (4 participants) interview were conducted.

Data from the three sources were gathered categorised and coded (Atlas ti). We deductively atomised data under themes of SRL, context and curriculum intervention. Inductive processes comprised alignment with SRL theory (metacognition, behaviour and motivation), contextual enablers and distractors, and curriculum design, layout and delivery. The key codification method was organised to provide us with findings related to the questions of inquiry, that is how students responded to online teaching and learning, and the extent to which the design and layout of the 21CP and contextual factors enabled SRL. All data was discussed with the co-researchers and member checks were done to ensure accuracy. The findings and analysis in this paper are confined to themes of SRL, context and intervention.

4. Findings and Discussion

4.1 Self-Regulated Learning

This theme centres on the use of behavioural and cognitive strategies in learning online. Feedback and outcomes are included as they influenced both behaviour and cognition. There appeared to be general satisfaction with the predominantly personal, immediate, and long-term gains in the journal entries data.

> *"It taught us to think more deeply" "I was 20% as far as ICT was concerned and then I got the 80%" "To see the benefits from actually using it… and I'm going to use it in the future"*

It is reasonable to assume that people engage in behaviours based on outcomes, e.g., expectancy (Vroom, 1964). The data showed alignment with Mace, Belfiore and Shea (1989) and McCombs (1989), who maintain that expectancy outcomes are cognitively/behaviourally oriented with tangible or intangible gains.

According to Zimmerman (1990, pp. 5) metacognitive "processes enable them [students] to be self-aware, knowledgeable, and decisive in their [students'] approach to learning". Student agency appeared to emerge in 4 of the interviews:

> *"I constantly bounced between self-esteem and self-actualisation…I'm constantly looking at something more that I can be than what I was yesterday" "project has allowed me to identify my strengths and weaknesses"*
>
> *"need to discipline yourself as to when to learn and how to learn…have to go an extra mile about your studies" "project taught me to be responsible…I've taken charge of my learning"*
>
> *"I have to plan to make things easier because I'm not a very structured person"*

Two intervention design elements (journals and surveys) were noted as contributing factors leaning towards the metacognition and motivational elements in responses.

> *"The survey at the end of each module provoked my thinking"*
>
> *"The journals help me reflect on everything that I've done and how I can better myself…to see my progress in learning…I have moved from point A to a certain point"*
>
> *"You see what you've gained"*

Paraphrasing Dewey's (1916) notion that 'we do not learn from experience, we learn from reflecting on experience', data from students evidenced instances of self-awareness and self-reflection aligned with Zimmerman's (1990) self-monitoring and self-evaluating. Pressley and Ghatala (1990 in Mansfield, 1990, pp. 9) concluded that student awareness of learning outcomes is critical to continued strategy use.

Students voiced positivity on what appears to indicate personal intrinsic motivation and self-efficacy factors, related specifically to self-attribution and how they managed challenges.

> *"We were forced to go out to explore…so figuring it out by myself has taught me a lot more, so that made us more independent"*
>
> *"We're working on our own, not dependent on anyone"*
>
> *"We had to teach ourselves…it was self-centred learning, and it helped us to get out of the comfort zone"*

Students' internal recognition and self-acknowledgements may have arisen from satisfaction with their own SRL efforts and our intervention processes. Such self-efficacy beliefs align with Bandura's (1982, pp. 22) articulation of, "judgments of how well one can execute courses of action required to deal with prospective situations"

> *"has prepared me…helping me learn… to be cognisant of how I structure my planning and studies...I'm very confident now" "when people ask me because they feel that I would give an appropriate answer…that motivates me to want to help"*
>
> *"made me more confident in using and applying technology in class"*

students' beliefs of self-efficacy appear to promote renewed confidence towards tangible outcomes.

> *"I'm more equipped with knowledge that will help me"*
>
> *"I'm able to use technology" "feel like my capabilities have increased…the technical skill that I feel I've developed enhance my efficiency and effectiveness in teaching…It's allowed me to be more effective in the class"*

Researchers have noted over time that self-regulating students display behaviours of structuring and building learning environments to optimize their learning (Wang and Peverly, 1986; Zimmerman and Martinez-Pons, 1986). The interview data returned students' behavioural processes aligning with SRL's self-regulation and management of time/resources.

> *"I developed a very unique way of study" "we were helping each other… I can ask one of my classmates"*

These findings are consistent with Rohrkemper (1989) who notes that self-regulatory behaviours are typified by students looking for help and information from people and spaces from who/where they are most likely to learn and follow through by self-teaching and self-monitoring their progress. One student who appeared to manage well noted in the survey that:

> *"I didn't experience any problems…hasn't been too challenging and the ones I had, I managed to resolve by communicating with friends or the lecturer"*

Coping in the current situation necessitated active student agency. In the context of this paper, the agency is confined to self-regulation and resilience which are not independent of one another. Emerging from the data was that some students possessed and some were starting to develop self-regulatory skills in varying degrees in different ways. The SRL processes in the data suggest alignment and confirmability with related theories such as cognitive (Piaget, Bruner), and, motivation and expectancy (Vroom, Bandura, Parijat and Bagga). Students' actualisation of SRL was evidenced through their experiences of the intervention through cognitive and affective articulations regarding their beliefs, attitudes and feelings.

4.2 Context

In this section of the moderating constructs, we turn our attention to broader contextual and situated learning (intervention). The context that frames this study typifies current South African educational realities and provides insight into why students pursue particular SRL strategies. These include very low-quality internet connectivity (where available); high data cost; non-access to personal computing devices and, rampant load shedding/power cuts. The social circumstances encompass the contexts of, policy imperatives, technological challenges/enablers and learning habits that provide the background to understand the SRL narrative.

4.2.1 Policy

The South African national education department and the decisions by the university to continue educational activities remotely necessitated a move from f2f to online education. This represented a policy imperative which elicited the following:

"was quite challenging" "was not fair…we were on our own…we had to do everything online…we had to now teach ourselves" "It was challenging at the beginning…hard for us…was so frustrating"

Some students were not averse to online education as noted:

"This is how it should be done" "it was online learning from the beginning" "you could do the work at your time" "The online elements of this curriculum provide an advantage to continue"

The policy imperative meant that students had no option but to regulate their learning instantaneously notwithstanding their comfort level, familiarity, and skills with online digital learning. Students who are not familiar with online learning or with reasonably developed SRL strategies, appear to experience negative feelings of frustration. The data highlighted that the opposing was also true; students who appeared to possess experience and SRL strategies did not seem to hold negative feelings about the imperative.

4.2.2 Technological challenges

Technological and technical challenges were the focus of responses to challenges in online learning. Access to data based on high cost and connectivity quality was highlighted as the most challenging. Some difficulties connecting and/or accessing learning online with personal devices were noted.

"Challenges…is the internet connection, the data, the affordability…and network specifically" "if you want to use applications, like Blackboard you couldn't"

Different social standing and circumstances suggest that not all experienced challenges the same way.

"It didn't affect my studies, because I had data"

Studies by Baloran (2020) noted similar issues of poor connectivity. Physical access to learning in an online environment is contingent on reasonably reliable connectivity. The exorbitant cost of data, access to the internet and poor-quality connectivity is highlighted as a problem in South Africa. The proliferation of different low-cost affordable technologies does not appear to be well-suited for the high-end requirements of current/evolving online environments. This could have accounted for device limitations or quality of connectivity for particular resources, and applications.

4.2.3 Enablers and learning habits

Engagement in learning is predicated on learning styles/learning-study habits. Ajzen (1991, pp. 181-182) notes that one's flexibility to perform behaviours is contingent on the level of volitional control over the behaviour. Students were in full control of their SRL, with opportunities to learn and develop strategies best suited for their desired outcomes.

"I'm not a fan of being taught by the PC or WhatsApp" "I prefer to have face-to-face lessons…that's just my learning style"

Students who preferred the online mode said:

"I could take charge of my learning…It's my personality to push myself" "I prefer online learning because it was less pressured…allowed for me to [engage] in my own time and reply"

The data also showed that some students were able to operate with some comfort in both modes based on their learning habits:

"I prefer face-to-face, but I also prefer to figure it out on my own" "I prefer a blend"

The data yielded unexpected though not unfamiliar factors related to learning, i.e., learning preferences and unfamiliarity with online learning. This challenged our assumptions of students' digital literacy.

"It is difficult not to sit in a classroom and be taught" "I am not used to reflecting on my learning after each session"

"Have not had opportunities to learn online" "not been exposed to seeing what is expected and going to happen"

Our findings align with Abdous (2019, pp. 34) who noted as the "transition from a face-to-face to an online learning environment unfolds, online students are likely to feel anxious about their ability to succeed in an unfamiliar learning environment". We inferred that students' experiences of online learning appear to be rooted in the use of digital tools/technologies through traditional/institutionalised methodologies.

The online expectations represented a uniquely unfamiliar learning environment and as Abdous (2019, pp. 39) contended "online students are often pressed to unlearn longstanding learning habits and to engage in new ways of learning". The notion that a 'net generation/digital native' student, in a fourth-year degree course, would be reasonably comfortable with learning digitally was challenged.

4.3 Intervention

4.3.1 Guidelines, instructions and engagements

The curriculum intervention theme focuses on the embodiment of online learning - representing a shift from traditional learning processes to student agency. It is through the effects of the 21CP that SRL was explored to understand how it enabled or challenged students. The intention was to assist students to take charge of their learning by deliberately developing, designing and presenting the 21CP modules for 'blended' digital engagement. This necessitated pedagogically sound levels of detail in guidelines, support, instructions and engagements significantly different from any curriculum that could have been presented f2f. The journal and survey data from students related to the course modules, layout and delivery, and access to learning drew mixed reactions.

> *"Module outline with the guidelines are useful…found it relatively easy, interesting, and very interactive…the information was very specific and detailed"*

Comments seem to indicate that some students were able to engage with what was presented and understand it from a learning perspective. They also seemed to find it useful for self-engagement with little or no lecturer mediation. However, not all students were satisfied/comfortable with the design and presentation of 21CP.

> *"Why are they making our lives difficult with all this work for the entire year" "feel the layout wasn't orderly, a bit confusing"*
>
> *"With the modules available at once…[was] an advantage to work at my pace" "useful to know and see the different modules' learning outcomes…help manage my learning by knowing" "was useful to be given the mark breakdown for all tasks upfront"*

4.3.2 Support, instructions and engagements

Key comments in this category are located in learning habits, preferences and experiences. The counter comments capture our design thinking, i.e. where we wanted to allow for faster and slower students. The sections and modules while atomised units of work, were all interrelated and scaffolded, providing for students to go back and forth to pick up on aspects as needed. Additional comments focused on support from lecturers, peers, and the modules themselves.

> *"had friends who were so supportive whenever I need help" "They [peers and lecturers] assist at any time…you just WhatsApp them"*

The support, availability of content, guidelines, and online engagements all appeared to have served the purpose to assist students with their learning. This aligns well with skills noted by researchers such as collaborative problem-solving (Castro, Kelly and Shih, 2010); help-seeking (Sharplin, O'Neill and Chapman, 2011) and personal traits such as perseverance, pragmatism and collaboration (Ebersöhn, 2012).

4.4 Summative Findings

Our summative findings align with many previous research and relevant literature. The findings of this study provided 3 insights:

- The pivotal role of sound design principles of intervention in facilitating movement along an SRL continuum.
- The influence of context on SRL variances.
- Uptake and resilience in involuntary situations.

4.4.1 The pivotal role of sound design principles of intervention in facilitating movement along an SRL continuum

The 21CP, not specifically developed for exclusive online engagement, does not claim SRL as its theoretical underpinning. It does however claim alignment with the notion of design as espoused by Byungura et al. (2018: pp 6) who noted that learning environments need to be designed to help learners intentionally and consciously

regulate their learning behaviours". As such we argue that the conceptual underpinning of the initial blended design was useful to progress SRL.

Some students struggled a bit with the changed design, and layout and suggested online engagement. While some appreciated the revamped look and approach, some appeared to merely tolerate it. The 'new' design completely flipped the 'drip feed and dump' of materials/content and instructions, and the 'notice and post-box use of the LMS for due dates/reminders, grading and submissions. Notwithstanding how theoretically sound the design of the online learning environment is, if it does not provide cognitive or physical access through a clear roadmap and induction/orientation, students less experienced in online learning are likely to feel and experience apprehensiveness. Bozkurt et al. (2020, pp. 10) noted that this represents a "real challenge which ended up with unsatisfactory learning experiences".

Transitioning from face-to-face to online, and gradations within online learning requires sustained efforts to challenge and break the fetters of traditionalism, typified by mere transferences to online learning environments. Azis and Fatimah (2020, pp. 24) contend that "good e-learning must be designed through regular online contact with tutors". In this study, given the blended design was to transform into an exclusive online, we deemed it essential to provide a 'clear roadmap and induction' with multiple opportunities to assist students to become self-regulated and self-directed. Our roadmap/induction in the intervention bears an extraordinarily strong similarity to Abdous' (2019, pp. 37) online learning orientation. The 21CP design elements included:

- Comprehensive guidelines, and reminders through text, forums and WhatsApp support to ensure and clarify the requirements and expectations of 21CP;
- Progressive use of Puentedura's (2012) Substitution, Augmentation, Modification and Redefinition (SAMR) model levels to introduce students to the exclusive online environment, its tools and technologies. The introduction of technologies such as discussion forums, and blogs could help students from progressing from asynchronous to synchronous or in moving from in-class f2f situations to online learning environments.
- Providing access to resources in multiple and different formats to assist students in taking charge and developing strategies to access resources, seek help and reflect on their learning and strategies.

From these insights, we recommend firstly that opportunities for engagement and support in an online environment be the default 'modus operandi' for all disciplines at tertiary and school levels. Secondly, we suggest that online engagements include those best suited to learning and developing discipline-specific concepts. Our third recommendation is there be a clear 'roadmap' and 'induction' to online learning for both teachers and students.

4.4.2 The influence of context on SRL variances

Evaluations of contexts in which online interventions play out are often reduced to technical deficit factors. The political, socio-economic, cultural, pragmatic realities, technical factors and personal factors all feature in contextual realities. In an unequal educational milieu, the majority of students in this study experience unprecedented socio-economic challenges. The effect of these manifests in a lack of access to funds and technological devices.

This study was undertaken in 2020 when Covid-19, a mere circumstantial 'event' hit the world. According to Alhawsawi and Jawhar (2021), such events affect the way people responded to changes through their thinking and behaviour. Alhawsawi, Alhawsawi and Sadeck (2021, pp. 11) furthermore contend that policy-like implications of going online are influential in altering behaviours. Such was the case in this study where we found students adjusting and altering (self-regulating) their learning behaviours. Skills to engage, varying learning styles, attitudes, motivation, learning habits and self-efficacy beliefs of students provide a personal level context. Personal level context intertwined with the lived context of the students thus functions as a moderator of enablement or disablement in shaping SRL.

Based on the findings, it is recommended that access to online learning should consider the participant's context. Institutions and individual teachers must use a variety of alternative technologies, systems and services that best provide students with access to learning.

4.4.3 Uptake and resilience in involuntary situations

This study showed fluctuation in students' feelings of positivity and negativity. Positive feelings were traceable to behavioural and cognitive outcomes and opportunities afforded to them through the intervention. Negative

feelings were noted partly on account of the pressures of the involuntary situation and personal contextual factors.

The mix of feelings resulted in varying levels of online learning uptake. These findings are similar to Zembylas's (2008, pp. 82) "emotions in online learning …. influenced adults' learning experiences", and, Beltman and Mansfeld's (2018, pp. 6) "resilience is shaped by individual, situational and broader contextual characteristics that interrelate in dynamic ways". Behaviours can vary over time on account of a range of reciprocal push-pull influencing factors.

The insight into feelings and behaviours suggests a need for a 'pedagogy of care' that embraces curricula and social elements, as opposed to the need for curriculum content coverage. According to Vaccarelli (2018, pp. 29) a pedagogy of care is potentially central to combining the "psychological, social, and community dimensions that are usually kept separate". This leads us to recommend that all educational activities be framed within situations that allow for: time flexibility; guidelines/clarity; safe spaces and opportunities to speak and receive feedback and empathetic responses. A practical way to achieve this is through an online learning ecosystem comprising: curricular and psychological support and physical and cognitive access to teaching and learning.

5. Conclusions

We conclude, that contextually, SRL behaviours were shaped by the online learning intervention in which preservice teachers worked on their own. The three core elements of SRL represent personal contextual factors on which, the intervention had only some influence. There were clear differences in the SRL practices on account of students' deeply rooted learning habits and the quality of the intervention. In this study, we offer that the intervention (21CP) represented a cornerstone for SRL development. We offer that providing sufficient quality opportunities to develop SRL is necessary to hedge the chances of developing and progressing online learning. In an era that is bound to experience other educational disruptions and global developments, our educational endeavours ought to be pro-actionary and not re-actionary.

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