ASSESSING THE SUSTAINABILITY OF FLEXIBLE LEARNING AND ONLINE TEACHING POST COVID-19

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Abstract

With a few years' worth of experience coming to grips with the COVID-19 pandemic, perhaps the time has come to reassess the sustainability of flexible learning and online teaching. In an attempt to learn from errors of judgement due to a lack of insight, the basic question that could be of interest would be; What could the observed effectiveness of flexible learning and online teaching reveal and what would an assessment of the gain scores obtained from two groups on the dependent variable uncover? Using a mix of analytical, interpretive, and persuasive structure to formulate an argument about the methods that could encompass current advancements, this study will attempt to suggest appropriate updates as required by the educated learner-instructor. This study would also attempt to actualize the real world utility of interrelationships between variables identified in a previous study in an accurate and concise manner as an aid in conceptualization. (150 words)

Keywords: COVID -19, pandemic, sustainability, effectiveness, flexible learning, online teaching, instructional design, & work life balance.

1 Introduction

With a few years' worth of experience coming to grips with the COVID-19 pandemic, perhaps the time has come to reassess the sustainability of flexible learning and online teaching. Naisbitt (1984) had long ago expected that innovative applications and directions would in due course be developed from the technology itself. Take for example, the way in which the Internet as a means of access to computer mediated engagement and interaction has over the years interwoven itself into the fabric of modern society enabling the multiplicative threads of its many users to be seen, heard, and saved (Covey, 2004).

The growth and development of computers in the field of education began sometime during the 1960's when computers took up entire floors of buildings and were astronomically expensive (Skinner, 1968). But by the summer of 1972 when Intel announced the release of its 8008 microprocessor chip, which was closely followed by the release of the 8080 chip in the spring of 1974, the microprocessor revolution had inadvertently been triggered (Gates et al., 1995). Roughly three decades after the introduction of the first pocket calculator, the subsequent maturation of desktop computers, laptops, palmtops, smart phones, and tablets have made such tools more affordable. Such tools have become integrated resources utilized on a daily basis by the modern "Information/Knowledge Worker" (Covey, 2004, p. 6).

How could we have foreseen that the coming of age brought forward by the COVID-19 pandemic has actually resulted in the Personal Computer (PC) and Internet fulfilling their potential to become Information Age learning and teaching resources analogous to how the invention of paper and the subsequent arrival of books became the medium of choice that improved the way humans are able to store and impart knowledge (Lever-Duffy et al., 2003; Shneiderman, 1998). Consequently, what did teaching staff have to do to successfully survive the challenges posed by the pandemic?

As expressed by Grant and Thornton (2007), "a common mistake online course developers or instructors make is trying to emulate the traditional classroom with technology mediated interactions without the benefit of good pedagogy" (p. 347). In keeping with the ideas of Haughton and Romero (2009), because of the lack of visual cues that teaching staff traditionally associate and normally rely upon to develop confidence, engagement and trust, "traditional teaching

methods do not translate seamlessly to the online environment" (p. 571). Instead, "faculty with traditional teaching experience and online instructors with minimal or no teaching experience…. usually rely on trial and error process, until they learn to manage the new environment to teach effectively" (Haughton & Romero, 2009, 571).

Therein, lays the dilemma. How did learners cope with the approaches, methods or techniques employed to rise above the pandemic challenges? In view of the education sector being an indispensable pillar of modern Malaysian society in terms of supplying competent, skilled, and well-trained knowledge workers, how do you find new ways to improve current educational policies to promote the utilization of instructional technology in an encouraging, empowering and engaging manner after a pandemic (Gilbert & Gilbert, 2020)? Is it merely a set of circumstances that requires the incessant purchase, installation and upgrading of computer related infrastructure and paraphernalia to improve your work from home setup? Has your employer done anything since the onset of the pandemic through to the endemic stage to assist you to improve your office setup? Where does the path begin, and when will the journey end (Syaril Izwann, 2012a)? In his book, *The Road Ahead*, Bill Gates said,

> In a changing world, education is the best preparation for being able to adapt. As the economy shifts, people and societies who are appropriately educated will tend to do the best. The premium that society pays for skills is going to climb, so my advice is to get a good formal education and then keep on learning. Acquire new interests and skills throughout your life. (Gates et al., 1995, p. 254)

Furthermore, issues regarding the shift from an industrial to a high-tech/high touch society had been foretold by John Naisbitt in his book *Megatrends; Ten New Directions Transforming Our Lives* (1984) and Everett Rogers in his *Theory of Diffusion and Adoption* (1983). The Naisbitt Group used an intelligence gathering technique employed during World War II to monitor public behaviour and social change. By utilizing the technique of content analysis to gather data, they were able to synthesize what was happening in society and forecast what might be future trends or single out fads. For example, in the Malaysian context the demand for reducing the graduate unemployment footprint post pandemic has gathered momentum although this has been used as a marketing tool by universities in Australia and New Zealand for the past fifteen years and counting ("Tackling graduate unemployment one student at a time," 2021).

Naisbitt was also able to identify and correctly anticipate that computers would firstly, "offer a cost effective albeit capital-intensive way of individualizing education," secondly, "computers simplified the extensive recordkeeping required for individualized instruction," and thirdly, "familiarity with computers is now considered a strong vocational advantage, [or in other words] a [saleable] skill" (Naisbitt, 1984, p. 28). In addition, Naisbitt proposed *The Three Stages of Technological Development*.

Firstly, new technology or innovations would follow the route of least resistance. Basically, this meant that technology would be applied in ways that did not intimidate people or threaten their jobs. Secondly, technology would be used to improve previous technologies. For example, how the film camera and typewriter have been improved upon by the digital camera and word processor, or how the pocket calculator has been assimilated into personal digital assistants (PDAs), smart phones, desktops, laptops, net books and tablets. Lastly, there is the discovery of innovative directions or applications that are developed from the technology itself, which according to Naisbitt has yet to occur. Nevertheless, when considered in the context of post COVID-19 has probably happened as you read this, case in point, Alphabet, Google Workspace, Meta, Moodle, MySejahtera, Wikipedia, and semantic web technologies such as Facebook, Instagram, Twitter, and WhatsApp (Anderson & Dron,2011; "Facebook plans to rebrand itself with new name," 2021).

Meanwhile, Roger's Theory of Diffusion and Adoption suggests that there are many reasons to explain why an innovation may or may not be accepted. For example, there are factors such as the advantages of the innovation, the compatibility of values, needs and experiences, innovation complexity, ability to try the innovation, communicating information about the innovation as well as the social system; the influence of networks and relationships (Morrison et al., 2001). However, within the context of this study it is thought that issues associated with innovation complexity and obscurity of results best explain why lingering doubts about the effectiveness, efficiency and engagement of online learning still exist. In other words, was instructional technology integrated using good pedagogy and did it manifest itself in a familiar manner that enabled seasoned educators to anticipate what to do next, when to do it, how to do so and where to look for tell-tale signs of whether they are failing or succeeding? Or did the whole process of implementation make them feel lost and vulnerable? As similarly reasoned by Reushle and McDonald (2004), "the adoption of online technologies has meant that teachers are experiencing change in terms of their teaching philosophies, their relationships with learners and their work patterns and activities" (p. 6).

Additionally, Rogers also classified those who adopt technology into five categories. Firstly, there are the first adopters who rush out to adopt an innovation as soon as possible, sometimes even going after prototypes or test versions. Secondly, there are the early adopters who adopt an innovation as soon as a commercial version is available. Thirdly, there are the early majority adopters who comprise the first fifty percent to adopt an innovation. Fourthly, there are the late majority adopters who adopt an innovation only after it seems safe. And lastly, there are the laggards who are the last to adopt an innovation or sometimes completely fail to do so (Morrison et al., 2001).

2. Review of Related Literature

2.1. Assimilating Instructional Technology with Good Pedagogy

In an attempt to learn from errors of judgement due to a lack of insight, the basic question that could be of most interest to those reading this study would be; What could the observed effectiveness of flexible learning and online teaching reveal and what would an assessment of the gain scores obtained from two groups on the dependent variable uncover? Terry Anderson and Jon Dron (2011) seem to have articulated it well in their article titled; *Three Generations of Distance Education Pedagogy*. Firstly, "each era developed distinct pedagogies, technologies, learning activities, and assessment criteria, consistent with the social worldview of the era in which they [were] developed" (Anderson & Dron, 2011, p. 1). Secondly, the analogy of pedagogy defining the moves and technology setting the beat while creating the music was used to visualize the relationship between the two (Anderson & Dron, 2011). And lastly, behaviourists, cognitivists, connectivists, and constructivists theories all have an important role to play in a well-rounded educational experience. Regardless of whether a learner is at the centre or is a part of a learning community or network, learning effectiveness requires engagement in different contexts, involves diverse knowledge structures, and with different individuals.

To identify the best mix of pedagogy and technology, the learning and teaching process has to be seen as a progression because a single theory cannot possibly provide all the answers and neither can a single generation (Anderson & Dron, 2011). Over the past three decades many technologies have come and gone, and so has the popularity of different approaches to pedagogy. But each has built upon the foundations left behind by its predecessor instead of replacing the first of its kind so as to continue the cycle of birth, growth, development, maturity, old age and death. A similar notion was also mooted by Ruben Puentedura in 2010 called the *Substitution, Augmentation, Modification and Redefinition* (SAMR) *Model*. The aim of SAMR is not "to use the most sophisticated tool, but to find the right one for the job (Terada, 2020, p. 5).

2.2. An Educational Reboot

Many educators and learners alike initially thought that online instruction, generally referred to in Malaysia as online learning, would be a simple task of going through prescribed content followed by an evaluation of learning based on set responses. This is very much behaviourism and could possibly be a textbook example of operant conditioning i.e. stimulus and response, where the instructional emphasis remains rooted in the tradition of drill and practice and has the tendency to encourage rote learning that results in "the demonstration of learning success being ... [the] accumulation and retention of facts" (Hanafi et al., 2003, p. 357). Such a notion does not come as a surprise because when the "behavioural psychology movement began to influence educational technology" it did take the form of programmed instruction which later "formed the foundation for instructional systems technology (Wager, 1995, p. 6-7).

Later, "newer information-processing theories" such as constructivism were successfully assimilated into the foundation "for thinking about instructional design" (Wager, 1995, p. 7). Constructivists describe learning as an active process that does not happen in a vacuum and is unique because of how each of us constructs understanding (Lever-Duffy et al., 2003). Cognitive-constructivism as espoused by Robert Gagne, advocates that "learning is the result of an individual's cognitive efforts to construct his or her personal knowledge" (Lever-Duffy et al., 2005, p. 16). Active learning, contextual learning, inquiry learning, learning contracts, mastery learning, and meaningful learning are all terms used to describe the various learning activities encouraged by cognitive-constructivists.

2.3. Theoretical Rationale

In modern online courses learners should be taking full responsibility for their own learning either as individuals or as participants in a Community of Inquiry (COI). In the one hand, the aim has always been to harness the potential afforded by communication and Internet technologies via "asynchronous interaction design options" that would enable participants to "maintain engagement in a community of learners when and where they choose" (Garrison & Cleveland-Innes, 2005, p. 133). In the other hand, the goal has also been to "structure the educational experience to achieve defined learning outcomes" using interaction that is structured, systematic, critical and reflective (Garrison & Cleveland-Innes, 2005, p. 134).

However, interaction alone is no guarantee and neither is it enough to facilitate cognitive presence in online learning environments although it is seen as central to "an educational experience, whether it is online, face-to-face, or a blending of both" (Garrison & Cleveland-Innes, 2005, p. 134). Even if high levels of interaction may perhaps be reflective of group cohesion, "it does not directly create cognitive development or facilitate meaningful learning and understanding" (Garrison & Cleveland-Innes, 2005, p. 135).

For example, the use of online tools "to pass documents around, but now in electronic form…" is still regarded as doing "old things in old ways" and this applies to "writing, creating, submitting, and sharing work digitally on the computer via email or instant messaging" (p. 2). What actually needs to happen is for "courses, curricula, and lesson plans [to be] very different and technology influenced" (Prensky, 2005, p. 2).

The impact of the COVID-19 pandemic has actually resulted in the following issues coming to the boil. Firstly, "the missing technological element is true one-to-one computing, in which each student has a device he or she can work on, keep, customize, and take home" (Prensky, 2005, p. 4)? "If…these students still do not have the basic technical skills for engaging in online learning, then the knowledge learned in these early years has failed to equip them with the necessary ability to thrive in today's virtual world" (Balakrishnan, 2021, p. 7). Secondly, "resistance comes from the fact that our public school system has evolved an extremely delicate balance between many sets of pressures… any technological change is bound to disrupt" (Prensky, 2005, p. 5). Such a swing for example, brought about by COVID-19, undoubtedly "…means more work and pressure on educators, who already feel overburdened" and, "some people will no doubt worry that, with all this experimentation [by the older digital immigrants], our [younger digital natives] education will be hurt" (Prensky, 2005, p. 5). But it must also be appreciated that "being spoon-fed by universities is not enough to guarantee marketable graduates. They must also make an effort to enhance their value…. That said, while you can lead a horse to water, you cannot make it drink" (Mohd Juraij & Mohd Shahidan, 2021, p. 7).

The underlying reason for this is that learners must attempt to learn by participating in the learning process, also known as engagement theory (Kearsley & Shneiderman, 1999). The fundamental idea is that students must not be silent sleeping partners. Instead they "must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks" (Kearsley & Shneiderman, 1999, p. 1). In an attempted to challenge and stimulate the minds of students with new perspectives so that they can continue to construct and scaffold schema, the use of "authentic projects provides a higher level of satisfaction [for] students than working on artificial problems since they can see the outcomes/impact of their work on people and organizations" (Kearsley & Shneiderman, 1999, p. 4).

Quite simply multimedia creates an "electronic learning [environment] that fosters the kind of creativity and communication needed to nourish engagement" (Kearsley & Shneiderman, 1999, p. 5). Hence, this makes the distinction by Reigeluth and Carr-Chellman (2009) differentiating instruction and construction all the more compelling due to its "implication that instruction is necessarily done *to* learners (i.e., learners are passive), whereas construction is done *by* learners (i.e., learners are active)" requiring active manipulation of the material learnt which "cannot occur passively" (p. 6).

To encourage even deeper learning, learners can later be presented with authentic tasks and multimedia that match, or better yet, somewhat exceed their proficiency level. In phases, they can be stimulated with challenging perspectives that might hook them to the learning process. The end goal is to encourage learners to construct their own understanding, or as stated by Scardamalia and Bereiter (2006) "All understandings are inventions; inventions are [thus] emergents" (p. 15). Succinctly, this was what the proposed Different Levels of Instructional Strategies (DLISt7) for Online Learning (Syaril Izwann, 2013) was designed to function as, "a set of workable principles that could guide pedagogy in a variety of contexts" (Scardamalia & Bereiter, 2006, p. 24).

3. Research Design

3.1. Statement of the Problem

The proposed study will be a continuation of an earlier effort that successfully merged the Different Levels of Instructional Strategy (Merrill, 2006) with the Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1987). The basic idea then was to determine if the Seven Principles could be revitalised by amalgamating them with DLIS (Syaril Izwann, 2013). The objective was to obtain data that would facilitate the development and validation of a standardized measure for assessing the effectiveness of the newly proposed DLISt7 (Syaril Izwann & Albion, 2016). The resultant standardized measure would then be proposed for use either as a rubric for facilitating the extrinsic implementation of DLISt7, or as unobtrusive diagnostic "process indicators" (Kuh et al., 1997, p. 436) for assessing the quality of learning intrinsically experienced by students in online courses.

The intent was to use the data collected to generate awareness about the likelihood of thrusting into practice varying levels of instructional strategies for communicating expectations and relaying information in view of improving the instructional design of future online courses. In other words, when DLIS is used as a rubric either for treatment purposes or as a toolkit to prompt and stimulate conditional response from students, which explains the *t* in DLISt7, favourable online learning experiences that are in union with the Seven Principles would manifest themselves in ways that are familiar and unobscured paving the way for the instructional design of future "Multimedia Intentional Learning Ecosystems (MILEs)" to be improved (Syaril Izwann, 2022, p. 2).

3.2. The Focus of the Study

The focus of this study was to seek out and explore innovative ways for improving the quality of teaching experienced by students in an effort to improve the instructional design of future learning ecosystems (Syaril Izwann, 2022). Hence, this exploratory study wanted to determine whether the Seven Principles could be revitalised by way of merging it with the Different Levels of Instructional Strategy. A principle, as defined in the context of this study, is "a relationship that is always true under appropriate conditions regardless of the methods or models which implement this

principle" and whose underlying function is "to promote more effective, efficient, or engaging learning" (Merrill, 2009, p. 43).

In their original form, the Seven Principles were designed to be robust so as to always be true under appropriate conditions with each principle having the capacity to "stand alone on its own, but when all are present their effects multiply" (Chickering & Gamson, 1987, p. 2). Upon being updated, the term "instructional strategy" was integrated so as to accentuate the utility of the Seven Principles in promoting effective, efficient, and engaging learning in conjunction with "new communication and information technologies that had become major resources for teaching and learning in higher education" (Chickering & Ehrmann, 1996, p. 1).

Despite the simplicity and practicality of its design, there had been a tendency for the Seven Principles in its various reincarnations to not be fully utilized (Bangert, 2004; Bangert 2008b; Batts, 2008; Chickering & Gamson, 1999; Cobbett, 2007, & Wuensch et al., 2009). A review of the above literature suggests a penchant for the Seven Principles to be implemented and subsequently assessed in their standalone form instead of as a whole. Perhaps the Seven Principles could be resuscitated by being analysed from a different perspective. To echo the words of Merrill, "we need to back up and find out if there's a set of principles we can agree to and then build on these principles. Let's build on what's there instead of starting over and reinventing the wheel every single time" (Spector et al., Wiley, 2005, p.318).

Accordingly, when compared to the *Three Critical Conditions for Excellence* by the Study Group on the Conditions of Excellence in American Higher Education (1984), the *Nine Strategies for Improving Student Learning* by the Oxford Centre for Staff Development, England (1992), the *Twelve Attributes of Good Practice* by the Education Commission of the States (1996) (Cross, 2005, p. 3), and the *Seven Calibrated Scales of Student Engagement* by the Centre for the Study of Higher Education, University of Melbourne (Coates, 2006), "the best known, and certainly most widely distributed" (Cross, 2005, p. 3) framework or "widely distributed set of process indicators" (Kuh, et al., 1997, p. 436) is the Seven Principles.

Hence, in an attempt to make full use of what is already there, and not reinvent the wheel, this researcher attached DLIS as the component that introduces the function of utilizing instructional strategies to enable the learning experienced by students to be systematically scalable to different levels of complexity culminating in the ability to traverse and satisfactorily complete complex tasks (Syaril Izwann, 2013). The reason for this course of action is to move away from "information-only presentations" towards a more task-centred approach that increases in level of complexity to promote more effective, efficient and engaging learning (Merril, 2006, p. 16).

This shift in approach was somewhat similar to what had been earlier suggested in the literature by Hanafi et al., (2003), and Reushle and McDonald, (2004). A good example of a more recent study from a similar genre was the attempt by Swan et al., (2012) to link the design of online courses with utilitarian functionality in conjunction with instructional objectives. In view of the need to link the implementation of online learning outcomes to course design, Swan et al., (2012) recommends starting "with a QM (Quality Matters) review and revision and then use scores on the CoI survey to incrementally 'tweak' [the] course design and implementation" because the findings from the study "suggest that, taken together, QM and CoI revisions can be linked to improve outcomes, but unfortunately not to each other" (p. 86). This is because the two instruments are separate and uncorrelated.

3.3. Research Objective

The primary goal of this study was to obtain the data needed to facilitate the establishment of the temporal validity for the research design used to standardize DLISt7 (Syaril Izwann, 2013). In psychometric literature there are two broad types of reliability "(a) test-retest (temporal stability) and (b) internal consistency: the inter-relatedness among items or sets of items in a scale" (Netemeyer et al., 2003, p. 10). The point is, would it be worth the effort to raise awareness about DLISt7 to see whether or not it would be accepted by participants and teaching staff alike. In view of DLISt7 being a collection of desirable learning experiences that often occur naturally in good learning environments, would generating student Awareness about DLISt7 at the former stage improve the quality of online learning experienced by participants during the latter stage.

Statistically, the answer would be a why not. This is because no matter how well a conceptual framework is specified, the construct validity of a measure cannot be justified without evidence of either convergent or discriminant validity (Brown, 2006; Netemeyer et al., 2003). It is the purposeful act of defining, testing and retesting the boundaries, content domain and dimensions of a construct that make possible the process of validation (Netemeyer, 2003, p. 90).

3.4. Research Methodology

Each and every aspect of research should not be left to chance but needs to be well thought-out and purposeful (Cohen et al., 2005). Without a research design that is sensible and achievable relevant data about hypothesized relationships would be hard to come by. Consequently, the importance of careful planning, the methodical development of instrumentation, the selection of an appropriate sample, the identification of suitable windows of opportunity to

implement the research, limitations of the design, and a thorough analysis of the data are fundamental (Cohen, et al., 2005).

The central problem that was the focus of a previous study is the temporal validity of amalgamating the Different Levels of Instructional Strategy with the Seven Principles to form DLISt7 (Syaril Izwann, 2012a) A sub-problem that was also investigated is the reliability of the items used to define the construct of DLISt7 in order to verify if they are actually measuring what they were supposed to measure (Syaril Izwann, 2012b). A final sub-problem that was also assessed is the perceived effectiveness of DLISt7 by undergraduate students (Syaril Izwann, 2012c).

Consequently, this study sought to determine the validity of DLISt7 as a conceptual framework and the reliability of the items utilized by conducting an Exploratory Factor Analysis (EFA) and a Confirmatory Factor Analysis (CFA). This was in an effort to systematically find answers for the following research questions. Firstly, how many principles from DLISt7 would actually load significantly? Secondly, would the factor loadings indicate that the items are actually measuring the appropriate constructs, and are thus reliably tapping into what is supposed to be measured? Lastly, would an assessment of the summated "gain scores (that is, posttest minus pretest)" obtained from the "two groups on the dependent variable" reveal the perceived effectiveness of DLISt7 (Tuckman, 1999, p. 174)?

In line with the study's inclination towards a post-positivist paradigm, the design was of a pretest-posttest non-equivalent control group Internet quasi-experiment. The pretest-posttest stability of "the correlation between the same person's score on the same set of items at two points in time" is also related to the temporal stability of the responses provided by respondents over time (Netemeyer et al., 2003, p. 10).

3.5. Research Sampling

The sampling frame used was of students in intact clusters who were enrolled in certain courses to be accessed by the study (Johnson & Christensen, 2008). In an effort to avoid sampling the same student twice, intact groups such as First and Later Year students, were assigned to the Treatment group while Second and Third Year students were assigned to the No-Treatment control group. This was because the setting from which the participants were drawn from prohibited the random assignment of participants to form artificial groups (Creswell, 2005). Instead, reliance had to be placed upon existing groups for assignment to either Treatment or No-Treatment conditions.

Consequently, "antecedent data" from the pretest was used to determine the "extent of similarity between groups" also known as homogeneity in an effort to control for selection bias as a threat to internal validity and avoid "misinterpretation of the results" (Wiersma & Jurs, 2009, p. 167). Despite the lack of random assignment "when the term non-equivalent groups is used, it [usually] means non-equivalent in a random sense" (Wiersma & Jurs, 2009, p. 166). This in turn results in the need for a sound and rigorous case to be made for establishing "the similarity of the groups" so that confidence "can be placed in the validity of the results" (Wiersma & Jurs, 2009, p. 166). Besides being used for "statistical control" the posttest minus pretest scores were also used for "generating gain scores" to determine the effectiveness of DLISt7 (Wiersma & Jurs, 2009, p. 169).

3.6. Research Instrument

In his post-graduate research project, Guidera (2003) utilized a variant of the Faculty Inventory that was originally developed by Ehrmann et al., (1989). It was with much effort that this version of the Faculty Inventory was translated from English to Bahasa Malaysia, rephrased and adapted for use as a Student Inventory. The objectivity and content validity of the adapted version of the research instrument was informally evaluated by a panel of experts from a university in Malaysia (Syaril Izwann, 2007). For the pilot study an "excellent" value for Cronbach's alpha ($\alpha = 0.97$, $n = 74$) was obtained with individual items having alphas ranging from a lower limit (LL) of 0.972 to an upper limit (UL) of 0.974, while for the main study a slightly lower but still "excellent" value for alpha ($\alpha = 0.94$, $N = 397$) was obtained with individual items having alphas ranging from 0.938 (LL) to 0.941 (UL) (George & Mallery, 2011, p. 231; Syaril Izwann, 2007). No items were identified to be problematical requiring omission. This was followed by an EFA to determine the construct validity of the intangible constructs that constitute the conceptual framework known as the Seven Principles.

A follow-up revision to standardize the measure involved attaching the Different Levels of Instructional Strategy to the Seven Principles framework to form DLISt7 (Syaril Izwann, 2012a). The research instrument did not however require retranslation back into English from Bahasa Malaysia because the earlier version had been tooled using both languages. The Likert scales were switched to a Sentence Completion Rating Scale "with descriptive statements on either end" (Tuckman & Harper, 2012, 229). This was in an effort to circumvent "the multidimensionality innate in Likert-type scales" and to eliminate "the extra cognitive load associated with the use of item reversals" (Hodge, 2007, p. 289). Furthermore, the use of such a scale would be an improvement in terms of fulfilling parametric assumptions and

coping with issues such as "coarse response categories" and "equating the neutral option with a not applicable response" (Hodge & Gillespie, 2003, p. 53).

By utilizing a Sentence Completion Rating Scale the study was able to capture and then measure the expressed perception of undergraduate students towards the effectiveness of DLISt7 using a scale that offers scores that could be easily interpreted as low, medium or high. To the best of his ability, the researcher avoided making a hash of the original inventory to the point that it would be completely unrecognizable in the eyes of the original author/s. For all intents and purposes, the integrity of the Different Levels of Instructional Strategy and the Seven Principles were preserved and the essential concepts were intact.

3.7. Reliability Analysis

When Cronbach's alpha reliability analysis is used, what is really being ascertained is the internal consistency, or in simpler terms the extent to which the items that constitute the research instrument are either convergent or discriminant in relation to each other via an assessment of the overall index for test-retest reliability (Pallant, 2007). This is for the purpose of answering the "simple question, [to which] there are legitimate disagreements about the correct answer", the issue of "how are such measures developed and validated" in relation to construct validity (Nunnally & Bernstein, 1994, p. 86). As a result, problematical items can later be identified for exclusion from the measure (Coakes & Ong, 2011).

By utilizing the earlier mentioned Sentence Completion Rating Scale, this study was able to capture and then measure the expressed perception of undergraduate students in Australia towards the effectiveness of DLISt7 using a scale that could offer scores which can be easily interpreted as low, medium or high. Accordingly, Cronbach's alpha for the pilot study revealed an excellent coefficient ($\alpha = 0.92$, $n = 39$) with individual items for DLISt7 having alphas ranging from 0.913 (LL) to 0.918 (UL) (George & Mallery, 2011). As for the main study, a slightly higher alpha coefficient ($\alpha = 0.95$, $N = 283$) was obtained using a better sample with individual items having alphas ranging from 0.950 (LL) to 0.952 (UL). Thus, by using alpha coefficients from both the pilot and main study, which were from different samples of the same population, the study was able to establish that the temporal stability of the research instrument was excellent (George & Mallery, 2011). Thus, no items were identified to be problematical requiring omission.

As of the moment, the internal consistency of the measure is looking good because when estimating the "correlation (reliability coefficient) to be expected if two independent, more or less equivalent forms of a test are applied on the same occasion", it is expected that "the stronger the intercorrelations among a test's items, the greater its homogeneity" (Cronbach, 1990, p. 704). Although validation can be obtained from a single study, "the ideal is a process that accumulates and integrates evidence on appropriateness of content, correlations with external variables, and hypotheses about constructs (Cronbach, 1990, p. 707).

Together with the fact that the test-retest (temporal) coefficient for Cronbach's alpha reliability analysis was excellent each time the research instrument was administered, formerly in Malaysia (pilot: $\alpha = 0.97$, $n = 74$; main: $\alpha = 0.94$, $N = 397$) (Syaril Izwann, 2007), and later in Australia (pilot: $\alpha = 0.92$, $n = 39$; main: $\alpha = 0.95$, $N = 283$) (Syaril Izwann, 2012c), it would probably be safe to assume the items are actually measuring "the underlying construct comparably across groups" (Brown, 2006, p. 4). As made clear by Cronbach (1990), a reliability coefficient can reach 1.00 if and when the measurement contains no variable variance, for example "if there is as much error as true information in scores, the coefficient is 0.50" (p. 194).

4. Discussion

In his etymology of teaching, Skinner (1968) was quoted as saying that the modest role of the teacher can be metaphorically assigned as thou "who cannot really teach but only help the student learn" (p. 1). Later, Hyman (1974) summed up the role of the teacher well when he proposed "The *A B C*'s of Teaching" (p. xiii). Consequently, this researcher would like to suggest the use of the revised version of DLISt7 as a lens to advance understanding about the future possibilities of sustainable strategies beyond COVID-19. This is because validation as a process, is unending and requires measures to be "constantly evaluated and re-evaluated to see if they are behaving as they should" (Nunnally & Bernstein, 1994, p. 84).

As defined by Cronbach (1990), "the more reliable a measuring procedure is, the greater the agreement between scores obtained when the procedure is applied twice" (p. 705). Thus, not only would replication make possible a fresh reliability index based on test-retest reliability, but factor analysis could then be used to refine the extent to which a measure actually measures the construct that it is purported to measure, or in other words its construct validity (Netemeyer et al., 2003; Rust & Golombok, 1989).

As originally developed by Spearman, factor analysis was meant to enable researchers to investigate the underlying structure of matrices (Rust & Golombok, 1989). The continued revision of an unobtrusive diagnostic indicator of process would contribute immensely to the process of validating constructs by accruing and amalgamating proof about the suitability of content, correlations and hypotheses (Cronbach, 1990). By continuing to develop, validate and standardize a measure for assessing the effectiveness of DLISt7, it is hoped that further refinements and modifications to the rubric can be made to pin-point exact applications and valuations of good practice in flexible learning and online teaching.

Hence, the real world utility of factor analysis is the ability to "summarize the interrelationships among the variables in a concise but accurate manner as an aid in conceptualization" (Gorsuch, 1983, p. 2). A conceptual framework is only as good as it can "reduce the amount of trial-and-error effort, and people who explore theories stand at the vanguard of each field of science" (Nunnally & Bernstein, 1994, p. 317). Only through such effort can the hierarchical levels of a construct, also known as depth psychometry, be studied (Cattell & Schuerger, 1978b, p. 223). Hopefully, this can stimulate further research and scholarship about digital pedagogy by making this study freely available in support of a greater global exchange of knowledge.

As a research technique, factor analysis is supposed to begin with the proper selection of "identifying marker variables from related analyses in the literature" (Gorsuch, 1983, p. 352). This was by the way, how this study began (Guidera, 2003). Subsequently turning your back on fundamentally good research prevents science from moving forward. The results from a good factor analysis would contribute to existing bodies of knowledge by giving "rise to a set of variables that will, hopefully, be interrelated in causative and explanatory ways" (Gorsuch, 1983, p. 354). A theory is just another theory unless measurement operations can be used to represent the constructs being studied. "The concepts identified by factor analysis that are the same as previous concepts do not add greatly to an area, but the serendipitous results could, with further research, aid in the development of the substantive area" (Gorsuch, 1983, p. 371).

Among the pitfalls that this researcher wanted to side-step were; assuming generalizability of factors from just one research study, overlooking important unobtrusive diagnostic indicators of process because of tunnel-vision, inadequate reporting of what had been previously done for the purpose of approximating findings from one analysis to another, and lastly factors that have already been well replicated are re-discovered only to be given a different name (Gorsuch, 1983).

For example, if the oblique solution is equal to or provides a better solution and adds to the hyperplane count over the orthogonal solution, then further analysis is warranted to examine in detail the higher-order relationship among factors (Gorsuch, 1983). Although such ideas have been with us for quite a while, it is only now that technology has caught up and made it practical for such complex calculations to be performed on modern desktop computers using the appropriate software.

However, the task of naming factors is still "a poetic, theoretical, and inductive leap" (Pett, 2003, p. 210). Normally, researchers would be looking for a common theme to emerge from an absolute minimum of three items per factor that survived the analysis (Hatcher, 2007). It has been suggested that "a descriptive name should be selected that would be representative of all the items loaded on that factor" (Pett, 2003, p. 210). A useful tip is to consider the item with the highest loading first because it should provide the strongest clue.

When selecting the factor name "it is best that the interpretation remain simple but at the same time suggestive…. Being too clever, imprudent, or indifferent in the naming of factors in an instrument is unwise" (Pett, 2003, p. 210). Usually, "the identity of the items is often lost and the given name of the factor is what is communicated to those who are interested either in using the instrument for other research or in applying the results of studies that have used the instrument" (Pett, 2003, p. 210). Thus, this study tried to be considerate of the original descriptions used to identify the factors and carefully selected new designations that convincingly characterize the factors and their sub-components.

As for the pursuit of simple structure, Cronbach (1990) proposes that a factor be defined as a hypothetical or latent variable that "accumulated research has produced consistent interpretations [of]" (p. 373). Consequently, during exploratory factor analysis it is expected that "the investigator twists and turns the factors until satisfied with the pattern" (Cronbach, 1990, p. 378). With confirmatory factoring "a positive answer does not prove that the author's structure is best; it says only that the data do not contradict her idea" because the results are supposed to "look neater and seems to provide stronger support for the test structure" (Cronbach, 1990, p. 378).

The most important concept that can be extrapolated using the law of parsimony, also known as Occam's razor, is that although the simplest explanation that fits the data should probably be selected, the supposed simple structure from the "factor analysis would be a worthless scientific procedure if the factors changed from study to study" (Kline,

1994, p. 66). In other words, the mapping of factors will only stabilize after many replications "in which factors have been located in their correct strata in a hierarchy of primaries, secondaries, tertiaries" (Cattell & Schuerger, 1978b, p. 212).

5. Conclusion

As an educator, where do you see yourself standing in terms of conceptualizing flexible learning and delivering online teaching to learners? What use is there of knowing what instructional technology has to offer when educators themselves are cautious and made confused by the myriad of tools available to support learners and the teaching process. According to Sekaran and Bougie (2016), "…it is important that every so often you consider the philosophical underpinnings of your research" (p. 30). Consequently, how will this improve the "digital savvy" needed to utilise pedagogy when facilitating the communication of expectations, and the relaying of information across different cultures that operate using different value systems for the purpose of improving the flexible learning and online teaching experience (Yeigh & Lynch, 2020, p. 2)?

Clearly, there is a need for a guiding philosophy that educators can adapt based upon their acumen, personal style, course content, student population, and available technology (Shneiderman, 1998).

> The impact of forced immersion in online-only teaching and learning [during the COVID-19 pandemic] has increased our awareness of the need for teachers to be made more technologically adaptable, and thus we need to look beyond the original online versus F2F [Face to face] debate, and take a closer look at what schools can do to address the issues these effects have created (Yeigh & Lynch, 2020, p. 2).

This is because the increasing demand for education by the world's population cannot be met simply by building more schools and training more teachers. Instead, education has to become more efficient through revision of curricula and the improvement of classroom materials and techniques using the latest available technology (Skinner, 1968). More recent developments in terms of climate change have also impacted the demand for education in terms of "the potential social, economic and environmental benefits" of learning and teaching online (Lane et al., 2014, p. 115).

Specifically, the impact of "a carbon-based environmental assessment" that focuses on measuring "energy consumption and carbon conversion factors" with the aim to "provide both economic and social returns on the investment of time and money" (Lane et al., 2014, p. 118 - 121). Thus, it is proposed that in order for the science of learning and the art of teaching to become more sustainable in future intentional ecosystems, the eclectic selection of appropriate pedagogy should consider the systematic use of conscientious and contextual engagement (Syaril Izwann, 2022).

Moreover, the factors that had been previously identified have been located using a stratoplex that visualizes the different hierarchy of primaries, secondaries and tertiaries that constitute the strata levels of DLISt7 in the form of a stratified uncorrelated determiners (SUD) model (Cattell, 1978a; Cattell & Schuerger, 1978b; Syaril Izwann 2013). Thus, the resultant standardized measure is ready to be used either as a rubric for facilitating the extrinsic implementation of DLISt7, or as unobtrusive diagnostic indicators of process for assessing the quality of learning intrinsically experienced by students in online courses having been developed using depth psychometry. Further research could be conducted because it "adds a higher degree of external validity in addition to its internal validity" (Braver & Braver, 1988, p. 150).

The sharing of a clearer understanding about how to transition from teaching in the traditional classroom to the online environment using sustainable strategies that augment your "personal ideas" about the whole experience while at the same time enable you to "make informed decisions" about continuing the practice of good teaching whilst integrating with instructional technology should be encouraged in contribution to the field of digital pedagogy for individual, group and collaborative learning (Sekaran & Bougie, 2016, p. 30). This empowerment was done via preorganizing and visualizing "the anticipatory support mechanisms that build out capability, [encourage,] empower, and upskill when making the transition to flexible learning and online teaching" (Syaril Izwann, 2022, p. 5). With a few years' worth of experience coming to grips with the COVID-19 pandemic, perhaps the time has indeed come to reassess the sustainability of flexible learning and online teaching.

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