
**BUILDING TEACHER ASSESSMENT LITERACY THROUGH E-PORTFOLIOS
IMPLEMENTATION: A REVIEW STUDY**

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ABSTRACT

This paper brings together a range of literature addressing the importance of teacher assessment literacy (TAL). A web-based e-portfolio platform was used for PSTs to present their documents, understanding, and evidence of their teaching philosophy and teaching standards as part of their university experience. Although, TAL plays a key role on improving teaching effectiveness and learning outcomes, the literature finds insufficiencies in the area of assessment literacy (AL) among teachers. To address this issue, the e-portfolios implementation into teacher education program is recommended in this article. This article shows that E-portfolios play a significantly important role on developing TAL through supporting teacher reflection (Mcguire, 2019), fostering professional development (Hoekstra & Crocker, 2015), representing teacher identity (Rowley, Dunbar-Hall, Blom, Bennett, & Hitchcock, 2016), improving teachers' autonomy (Tran & Duong, 2018), and the provision of feedback (Pardo, Jovanovic, Dawson, Gašević, & Mirriahi, 2019). We also provide the implication of the study at the end of the paper.

Key Words: Teacher Assessment Literacy, E-portfolios, Teacher Education Program, Learning Outcomes.

1. INTRODUCTION

This study examined e-portfolio based learning in the context of a theoretical framework which is a combination of constructivism, students' approaches to learning (SAL) and self-regulated learning (SRL) perspectives in order to provide a deeper understanding of how students use e-portfolios to achieve better learning outcomes. Developing teaching competencies from the beginning of teaching journey is essential, and it is highly recommended that teachers develop their professional competencies from the early years of beginning teaching onwards (Voss, Kunter, & Baumert, 2011). Instructional design principles argue that building competency development at the early stages of teaching career is not as effective as embedding professional development strategies in the higher education context. The reason for this claim is that theory and practice should be provided simultaneously for students in the context of higher education (Wrenn & Wrenn, 2009), and starting teaching capacity building programs should begin in the higher education. Biggs and Tang (2011) also criticized higher education for the lack of a link between theoretical and functional knowledge when the teacher provides declarative knowledge to students. Similarly, in term of teacher assessment literacy (TAL), it has been argued that the

main reason behind limited level of assessment literacy (AL) among teachers can be traced back to their training in teacher education program that could not bridge the gap between theoretical knowledge and practice via assessment (Kennedy-Clark et al., 2018). This paper aims to address this issue in the context through embedding e-portfolios into PSTs teacher education program to bridge the gap between theory and practice (Kennedy-Clark et al., 2018) when they are studying to become a teacher rather than when they are in service teachers. The reason behind this claim is that instructional design principles highly recommend simulating workplace challenges for students and adding industry flavor to units and courses that students undertake at the university. As a result, students need to put their theoretical knowledge into practice before graduation (Biggs & Tang, 2011). In order to address this issue, this paper recommends the use of e-portfolios as a potential tool to bridge the gap between theory and practice.

2. USING INSTRUCTIONAL DESIGN FOR PST

Babae, Prosser and Swabey (2017) indicate that students' learning outcomes depend on different aspects of teaching and learning including quality of teaching, appropriate assessment, workload and clarity of goals. A number of research studies are consistent with the association of high quality of teaching and students' learning outcomes (Voss, Kun, & Baumert, 2011; Bayat & Rezaei, 2015; Mellati & Khademi, 2018) and they all focus on a significant link between high quality students' learning and teaching competencies; therefore, this is important to examine how teaching competency can be enhanced in the context of higher education.

Teaching competencies cover a large set of knowledge and skills, and thus, it is worthwhile to focus on building those competencies that have higher impact on students' learning outcomes (Marsh, 2010). A number of researchers are of the opinion that teachers' assessment knowledge and skills, assessment literacy, are the most important attributes that define effective teaching (Leung, 2014; Beziat & Coleman, 2015). Therefore, this paper focuses on this competency for PSTs through the use of educational technologies including e-portfolios to enable PSTs to design and implement appropriate assessment to improve quality of their teaching. TAL has been recently defined as the knowledge, skills, and practices teacher possess and apply to understand, design, administer, make informed decisions, and evaluate students in accordance with the principles and concepts relevant to the fields of testing and evaluation (Al-Bahlani, 2019, p. 20).

3. THE IMPORTANCE OF TEACHER ASSESSMENT LITERACY (TAL)

A large number of researchers argue that having sufficient level of knowledge and skills on how to use assessment information is necessary to be able to effectively support individual students to optimize their learning outcomes (Black & Wiliam, 1999; Hattie, 2008; Popham, 2009; Stiggins & Duke, 2005; Beaumont, O' Doherty & Shannon, 2011; Love, 2013; Mellati & Khademi, 2018). The findings of these studies were consistent in terms of considering TAL as one of the most influential factors to improve students' learning outcomes as TAL enables teachers to adapt their teaching strategies to meet the individual student's learning need as well as to support them effectively to engage in any assessment activities and in their learning. Research evidence strongly recommends the need for integrating assessment with teaching to support students'

learning (DeLuca, LaPointe-McEwan, & Luhanga, 2016; Gotch & French, 2014). This kind of assessment-focused teaching supports the accountability movement to improve students' learning outcomes (Hattie, 2009). As a result, TAL has been considered as the central feature of effective learning and teaching (Mellati & Khademi, 2018; Bastain, Pam, & Lys, 2016; Beziat & Coleman, 2015; Gotch & French, 2014; Stiggins, 2012).

3.1. Research Significance: Teachers' Low Level of Assessment Literacy (AL)

Although there is a consensus on the importance of assessment in literature over a number of years, many teachers experience insufficiencies in AL (Goss, Hunter, Romanes, Parsonage, 2015; Lam, 2015; Mertler, 2012). A recent study found that many Australian teachers are unprepared to interpret curriculum standards to evaluate their students' learning and to adapt their teaching in response to it (Goss, Hunter, Romanes, & Parsonage, 2015). The authors further assert that the assessments which used to recognize where students start from are not accurate to figure out their starting point, that makes it difficult to target teaching. These findings are consistent with the earlier findings of Mertler (2012), which indicated that over 85 percent of teachers stated they were not prepared to assess students. In particular, teachers' poor performance confirmed that they lack assessment skills which negatively impacted students' learning (Mertler & Campbell, 2005; Gotch, 2012). Similarly, a study on assessment knowledge of pre and in-service teachers concluded that the teachers got less than 70 percent of the questions correct (Campbell, Murphy, & Holt, 2002). This was further highlighted in another study by Mertler (2012). He stated that even teachers who completed a course in classroom assessment recently could answer correctly only 68 percent of the items. This insufficiency regarding AL literacy among teachers is also highlighted by Lam in 2015 who argued that teachers are struggling in assessment-related decision making. Similar results persist in the Alkharusi et al.'s (2012) study after assessing 167 teachers' AL.

Most recent studies displayed the same findings regarding limited levels of TAL (Al-Bahlani, 2019; Mellati & Khademi, 2018; Xu & Brown, 2017). Xu and Brown (2017) reported insufficient AL levels among teachers through examining 891 EFL Chinese teachers' AL using TALQ. Their finding is consistent with the findings of Mohamed et al.'s (2016) study. They also found low levels of AL among 187 Malaysian teachers. Similar results persist in Al-Bahlani (2019) as well as Mellati and Khademi (2018) studies. They found that most teachers are under-prepared to assess student learning.

The reason behind this issue can be traced back to inappropriate training during teacher education programs (Ogan-Bekiroglu & Suzuk, 2014; Verberg, Tigelaar, & Verloop, 2015; Popham, 2009). As such, Kennedy-clark et al (2018) noted that there is a gap between theoretical learning and practice via assessment in teacher education programs. As the focus of assessment courses is on the theoretical teaching, therefore, the practical aspects of assessment such as units of work is ignored, and it is provided outside of the classroom with no connection to classrooms. To address this issue, the use of e-portfolios is recommended. E-portfolios have the potential to provide a link between theory and practice (Biggs & Tang, 2011) as it allows PSTs to showcase the implication of theories in practice to achieve competency which leads to provision of a visible teaching and learning environment (Mathew a, Mathew b, & Peechattu, 2017). Kennedy-clark et al. (2018) suggested the use of authentic assessment to bridge the gap between theory

and practice. E-portfolios also have the potential to provide PSTs to apply their knowledge in authentic contexts by authentic activities through their peers, colleagues, and students (Kertesz, 2016).

Another issue that teacher education handles regarding assessment is ineffectiveness of traditional assessment ways as they are not sufficient enough to measure learners' skills in various courses (Yatibas & Yatibas, 2015). In fact, the popularity of student-centered methods with the emphasis on learning by doing makes it difficult to assess learners' learning. To overcome this issue, it demands teachers to use different assessment methods that grant high importance to factors such as students' understanding and personal differences when assessing their performance. Therefore, new student-centered assessment methods are required. E-portfolios is one of these ways as e-portfolios are useful for assessment demands (Yang, Tai, & Lim, 2016; Afrianto, 2017; Ibrahim & Callaway, 2018; Bair, Niemer, & Anderson, 2019). It also provides support for enhancing personalized learning environment through measuring different types of assessment skills that leads to enhancing a range of intellectual abilities which empower learners' self-beliefs of their own learning (Sanna, J, 2006). Furthermore, comparing to traditional methods of assessment which focus on measuring students' learning at a specific time, e-portfolios support teachers to use E-portfolios as an assessment tool that has resulted in a more accurate assessment of what they have learned (Yatibas & Yatibas, 2015; Burner, 2014).

Generally speaking, assessment has a critical role on teacher education programs due to its key role in improving teaching (Rodriguez, 2019; Gotch & French, 2014) and learning (Mellati & Khademi, 2018; Goss & Sonnemann, 2017). As a result, there is a need to develop pre-service teachers' AL. To comply with this demand, e-portfolios implementation is recommended within the literature.

3.2. Relationship between TAL and Teaching Quality

TAL is a critical component of effective teaching. Firstly, it guides teachers to plan and implement needs-based learning and teaching strategies associated with it. Teachers' knowledge and skills regarding TAL bring about familiarity with various teaching and digital assessment tools. This familiarity guides teachers to select relevant and suitable teaching approach and assessment tools for specific learning outcomes (Gottheiner & Siegel, 2012; Stiggins, 2006). Secondly, it helps teachers to set short-term and long-term learning goals for individual students to provide them with a personalized learning experience. Teachers with higher level of AL can interpret assessment data appropriately and communicate with students regarding their achievement, and guide them to set specific learning goals (Xu & Brown, 2017; Gotteiner & Siegel, 2012) and it provides students with feedback-focused learning. Thirdly, it improves teachers' decision-making skills (Stiggins, 2012). As teachers need to make critical decisions including the consistency between learning outcomes and curriculum, the selection of effective methods and strategies to deliver target and content, the development and use of appropriate ways of assessing learning, and the judgment regarding the achievement of learning aims, their assessment literacy plays an important role in all these process (Guskey, 2003). Constructive alignment developed by Biggs (1999) is still one of the most important principles of instructional design also emphasizes on the alignment of the course learning outcomes (CLOs), Unit learning

outcomes (ULAOs), and Generic learning outcomes (GLOs), assessment, weekly content and learning activities.

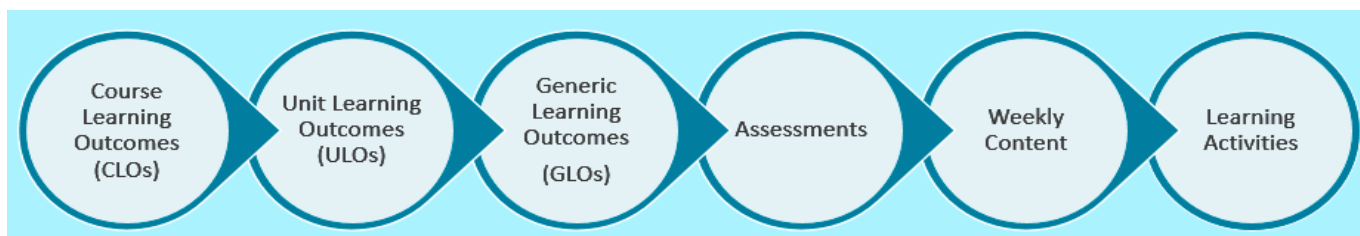


Figure 1: Instructional Design in accordance with Constructive Alignment

Fourthly, it supports teachers in developing their teaching through analyzing and using data on their students' performance (Verberg, Tigelaar, & Verloop, 2015). Finally, it is very likely to develop accountability and responsibility as fundamental teaching competencies among teachers (Brown, 2016).

3.3. Relationship Between TAL and Students' Learning Outcomes

Apart from the critical role of TAL on teaching, it has also direct impacts on student learning, engagement, and motivation. A range of studies provides evidence for the significant impact of TAL on learning. For example, Black and Wiliam (1999) found that TAL is the most effective interventions in improving student learning outcomes among other teaching skills. They have convincingly indicated the learning gains that can be achieved through well feedback-focused teaching and formative assessment enhances students' learning more than any other strategy across age levels and in different contexts. This is further validated by the work of Hattie (2009) whereby he made the connection between TAL and student learning outcomes. He found that assessment practices with the purpose of enhancing student learning outcomes including, self-assessment and feedback, had the highest impact on students' learning outcomes out of more than 100 different instructional and contextual factors (Hattie, 2009).

Hattie highlighted other assessment practices. These are formative evaluation, teacher clarity and reciprocal teaching. His study also proved that a significant improvement in students' learning outcome is possible through the implementation of teacher assessment practices. Recently, a number of studies support the findings of the above earlier studies. These recent studies have shown a positive impact of TAL on student learning as well (Mellati & Khademi, 2018; Love, 2013; Hendry, Bromberger, & Armstrong, 2011; Clements et al., 2011).

3.3.1. TAL is Associated with Active Learning

In addition, TAL enhances students' engagement in the process of learning that leads to high-quality learning (Goss & Sonnemann, 2017). Teachers' ability to select and use appropriate assessment strategies and approaches creates better learning environment in addressing students' needs, which enhances students' engagement (Goss & Sonnemann, 2017) and leads to active learning. In accordance with instructional design principles, student's engagement provides them

with active learning when students are not passive and they effectively interact with the teacher, peers, content and learning activities (Goss & Sonnemann, 2017).

Active learning was first coined by Bonwell and Eison (1991) who believed within active learning, students involves in doing things which then results in thinking about what they are doing. Most recently, the term has been defined as an approach in which learners play a significantly important role through constructing knowledge and developing understanding (Cambridge Assessment International Education, 2019). This approach that highlights student activation (Dakovic, Peterbauer, & Zhang, 2019) provides support for students to do something or make something which then leads to assessing their understanding; consequently, it helps learners to develop their assessment skills (Loan, 2016). Similarly, Cambridge Assessment International Education noted that active learning has massive effect to support learners to use assessment in assistance of learning. For example, it encourages strategies such as high-quality questioning which is considered one type of assessment for learning strategies. Apart from this, active learning can be associated by e-portfolios implementation as well. In fact, e-portfolios have been placed as potential means to enhance students' active role by involving them in their own learning process through taking responsibility of every step of implementing e-portfolio(Loan,2016). Also,within this approach learners are asked to collocate the evidence of their learning progress and this supports then not only in students' activation but in achieving goal setting skills (Chang, Chou, & Liang, 2018). Thus, TAL implemented with e-portfolios enable them to provide active learning environment in their classrooms.

3.3.2. TAL'S Association with Personalized Learning

Teachers' high level of AL enable them to tailor-fit the assessment activities to the individual needs of students making them develop and implement differentiated assessment activities (Guskey, 2003). In other words, assessment-literate teachers have the potential to check whether their approaches, methods, strategies, and techniques meet students' needs that leads teachers to use appropriate teaching methods (Bastain, Henry, Pam, & Lys, 2016; Beziat & Coleman, 2015). Therefore, TAL has the promising potential to develop personalized learning.

Personalized learning is defined by Theobald (2013) as "shaping of students' learning activities and the curriculum/knowledge content that reflect the input and interests of students" (p. 98). Personalized learning has been acknowledged as important due to its critical role in optimizing students' learning (Pane, Steiner, Baird, Hamilton, & Pane, 2017). This point is echoed by Yang et al. (2016) who stress attention to personalized learning as a kind of effective learning. TAL enables teachers to implement personalized learning method by engaging learners in the process of learning which then empowers them to make right decisions regarding their own learning process through developing their self-assessment skills (Yang et al., 2016). In order for this to happen more effectively, personalized learning demands e-portfolios implementation (Sanna, J, 2006). As e-portfolios provide the opportunity for learners to strengths their self-beliefs regarding their own learning through the expansion of measured abilities as well as measurement ways which then results in revealing other intellectual abilities which are not found through traditional assessment (Sanna, J, 2006).

3.3.3. TAL'S Association with Self-Regulated Learning

Furthermore, TAL enhances and sustains students' motivation. In fact, teachers with high level of AL can effectively engage students in self and peer assessment, which are proven to enhance students' motivation (National Tasks Force on Assessment Education for Teachers, 2015; Mellati & Khademi, 2018). Similarly, Wiliam (2011) argues teachers are able to improve students' motivation by placing assessment as the center of learning and teaching. To do so, teachers need to have an adequate level of AL. This is further supported by Dweck (2007) who argues that there is a close link between assessment and students' motivation. It implies from this literature that TAL has the potential function to grow self-regulated learning.

Self-regulated learning has been introduced by Zimmerman as "a self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (2000, p.14). From this standpoint, self-regulated learners are active participants of their own learning (Yatibas & Yatibas, 2015) who are able to learn by themselves through becoming aware of their own learning weaknesses and strengths which assist them to undertake the learning itself (Mellati & Khademi, 2018). In this sense, self-regulated learners are able to identify learning strategies and accomplish them which results in enhancing students' learning outcomes (Yatibas & Yatibas, 2015). TAL has significant potential for teachers to provide self-regulated learning environment for their students (Morreale et al, 2017) as formative assessment and feedback play critical role on self-regulation development (Mellati & Khademi, 2018). Embedding TAL with e-portfolios can be more effective to enhance self-regulated learning. As e-portfolios focus efforts on supporting students to be responsible from the beginning of their own learning (Yatibas, Yatibas, 2015). Similarly, a number of scholars highlighted the effectiveness of e-portfolios in developing self-regulated learners through enhancing their metacognitive skills during the reflection within e-portfolios (Morreale et al., 2017).

4. The Importance of E-portfolios Implementation

A large number of researchers agree on the effectiveness of e-portfolios for assessment demands (Yang, Tai, & Lim, 2016; Afrianto, 2017; Ibrahim & Callaway, 2018; Bair, Niemer, & Anderson, 2019). In Ibrahim and Callaway's (2018) view, e-portfolio assessment has the potential to provide deeper, richer, and more accurate assessment of students' learning, comparing with traditional methods that focus on what students know at a specific time (Yatibas & Yatibas, 2015). Ibrahim and Callaway (2018) in their studies found e-portfolio assessment useful in enhancing student teachers' self-efficacy and academic achievements. Similarly, Yang et al. (2016) believed that e-portfolio assessment is a flexible tool that performs well for both high-stake/summative that refers to evaluation of students' work and reflection as evidence for grading and low-stake/formative which refers to informing and assisting students' ongoing learning process. In the same line, Afrianto (2017) found e-portfolios assessment effective in that it has the potential to provide a valid source of students' learning and achievement. These findings reflect the key findings of Bair, Niemer, & Anderson (2019) who found e-portfolios as effective platforms for learning and competency assessment. Further to these, a number of scholars found e-portfolios as vital means to link informal assessment with formal learning processes (Wild, Spore, Chrzaszcz, Sigurdarson, & Metscher, 2008).

E-portfolios influences self-assessment skills of students. According to Fielke and Quinn

(2011), e-portfolios have the potential to support the development of self-assessment skills through providing an environment for students to think about their progress which results in finding ways to change or develop. Therefore, these researchers believed that e-portfolios facilitate self-assessment skills. Similarly, Yatibas (2013) stressed the effectiveness of e-portfolios on developing self-assessment skills. As e-portfolios enable learners to monitor and track their learning process which aid them to understand their strengths and weaknesses, they then try to address their weaknesses. Another study conducted by Yastibas & Yastibas (2015) confirmed e-portfolios support students to become self-regulated learners through encouraging them to be active in the learning process which is in line with the purpose of self-regulated learning that aims to make students active by supporting them to be in charge of their own learning. Self-regulated learning has a big impact on developing students' self-assessment skills. As such, a number of scholars asserted that self-regulated learners are able to use more advanced self-assessment strategies (Kostons, Varr log, & Pass, 2012).

Generally speaking, the purpose behind employing e-portfolios is encouraging student totake control of their learning process as a whole with the use of e-portfolios which aid learners to develop their autonomy (Tran & Duong, 2018). The tool is capable of supporting TAL principles including reflection, feedback provision, informal and formal assessment with a reflexive and collaborative nature, enabling PSTs to enhance their professional development as well as their identity as teachers.

4.1. Enhancement of Autonomous Learning through E-portfolios

E-portfolios implementation fosters the development of learners' autonomy (Loan, 2016; M. Gámiz-Sánchez et al., 2016; Ivanova, 2017; Tran & Duong, 2018). M. Gámiz-Sánchez et al. (2016) found e-portfolios beneficial to enhance learners' autonomy through addressing the issues of paucity of space and time for students' work both individually and in group in teaching practice, also, for teaching tasks such as monitoring and tutoring students. Similarly, Ivanova (2017) advocated e-portfolios implementation to increase autonomy among learners due to the nature of e-portfolios which demands an active role for students during the learning process. This is because students take the responsibility of every step of implementing e-portfolios from content selection to goal-setting for reflection and evaluation of their learning process. The findings of the mentioned studies confirmed the findings of the study conducted by Loan (2016) that indicated the effectiveness of e-portfolios in students' involvement in learning process which is a significant factor of learner autonomy development.

4.2. Enhancement of Reflection through E-portfolios

E-portfolios have been labeled as effective tools to support reflection. Artifacts collection during e-portfolios creation does not just serve the purpose of showcasing students' learning, most importantly, it engages in reflective reasoning of their learning development (Ching et al., 2016). In the same line, a number of researchers highlighted the potential of e-portfolios to provide different types of reflection including action, after action, written, and videotaped through presenting and demonstrating learning in various ways (Fox et al., 2011). Similarly, the key finding of a study by Ching et al. (2016) pointed out the pedagogical benefits of e-portfolios as important tools for reflection and summative assessment. They also found that summative usage of e-portfolios supports students to reflect on their outcomes. In general, e-portfolios play a large

role on providing and facilitating reflection for students when implemented well (Morreale et al., 2017; Ching et al., 2016).

Reflection within the e-portfolios benefits students in a number of ways. Firstly, it empowers students to monitor their progress (Buyarski et al., 2015). Secondly, it supports students to become self-regulated learners through developing their metacognitive thinking during the reflection process (Morreale et al., 2017). Thirdly, it provides students with the opportunity to use their gained knowledge and skills inside and outside of classroom (Menntkowski & Sharkey, 2011). Furthermore, it raises the significance of e-portfolios for students due to the possibility to reflect on it after they check off a course (Mummalaneni, 2014) and to realize its value after graduation (Kinzie, 2013). Finally, it helps learners to make a link between their learning experiences and their existing knowledge which leads to meaningful learning (Ching et al., 2016).

4.3. Provision of Feedback through E-portfolios

Feedback plays a vital role on facilitating students' development as independent learners to monitor and evaluate their learning (Furgosen, 2011). There is a large literature regarding the effectiveness of feedback on students' learning (Pardo, Jovanovic, Dawson, Gašević, & Mirriahi, 2019; Huisman, Saab, van den Broek, & van Driel, 2019). Feedback provides support for learners to promote learning through promoting students' engagement in learning (Pardo et al., 2019) and through obtaining information that support them to recognize the gaps between their performance and the required standards to improve their work (Boud & Molloy, 2013). Therefore, feedback has a more significant role than error correction in education. This view is further supported by the findings of a study conducted by Heinz and Reiss (2016) who concluded feedback has a major impact on the quality of students' learning. However, students' survey around the world revealed their dissatisfaction with the feedback they received (Nicol, 2010).

The most common complaint about this concept is a lack of adequately timely feedback that is caused a failure for students to apply the received advice (Heinze& Reiss, 2016). It is therefore vital to consider a continuum between instruction and feedback to connect them (Hattie & Timperely, 2007). Another challenge is stated by Furguson (2011) who found the concept of feedback fragile especially in higher education. As the large classes of students lead to less opportunities for having an individual interaction between students and teachers (Pardo et al., 2019). A number of scholars stressed the importance of promoting sustainable feedback strategies (Boud & Molloy, 2013) through dialogue between students-teachers and students-students with the emphasis on connection with learning and higher learners' engagement. Similarly, Furguson et al (2019) highlighted the benefit of interaction on learning facilitation as an essential part of education. However, it is difficult to sustain student-teacher interactions in large classrooms with high number of students (Pardo et al., 2019). Although it is beneficial to use peer feedback methods in that they decrease the required teacher time (Carless, Salter, Yang, & Lam, 2011), teachers are still needed to enhance learning outcomes (Chang, 2011).

To address these mentioned challenges, technology-enhanced learning is recommended (Pardo et al., 2019). In particular, Chuang (2010) recommended the implementation of e-portfolio platforms to provide feedback due to their ease of use and their potential to give a sense of editorship to students which promote discussion. Similarly, Chang et al. (2013) stressed the use of e-portfolios to provide peer and teacher feedback which develop collaboration and

interaction. In the same line, the findings of the study by Padro et al. (2019) that used technology to provide effective feedback indicated a positive result with both students' satisfaction with feedback and their academic performance that considered feedback as a significant factor to students' success. This finding is consistent with the finding of the study conducted by Peacock, Scott, Murray, & Morss (2012) who found e-portfolios useful for feedback provision and revealed learners' satisfaction with the feedback and its timing and its quality.

Apart from the above benefits of e-portfolio implementation, it has significant potential for PSTs who will commence their teaching journey in a challenging world in which the expansion of computer technologies has caused significant changes in their career. Creating an e-portfolio will benefit them in developing their technology skills (Koraneekij & Khlaisang, 2019) which will be resulted in a great deal of interest from higher education to adopt e-portfolios (Faulkner & Allan, 2009). Enhancing technology skills and developing e-portfolios would help them present their online persona to the prospective employers. Apart from e-portfolios promising potential to facilitate students' employability skills (Kuillboer, Murphy, & Lynch, 2018) such as information technology (IT) literacy, the tool has the potential to enables monitoring students' learning and allowing them to create e-portfolios for future employers (Ndoye et al., 2012). It also plays vital role in personal development through reflecting, goal setting, and understanding the wider context (Brown et al., 2015), and finally it has helped to develop lifelong learning (Brown et al., 2015) that all together aid the facilitation of employability skills for student teachers.

4.4. Enhancement of Teachers' Professional Development through E-portfolios

E-portfolios have played significantly important role on teachers' professional development from a number of different perspectives (Hoekstra & Crocker, 2015). Firstly, there is a need to develop reflective practice (Liu, 2017). Secondly, there is a need to link theory to practice as in-service teachers spend too much time on theory and less time on practice (Mathew a, Mathew b, & Peechattu, 2017). Thirdly, there is a need to provide students with classroom realities as some teacher education programs may not prepare in-service teachers for this demand (Ottenbreit-Loftwich et al., 2012). As mentioned earlier e-portfolios implementation has the potential to develop PSTs reflection (Mcguire & Carolina, 2019; Liu, 2017), autonomy (Tran & Duong, 2018), identity (Rowley, Dunbar-Hall, Blom, Bennett, & Hitchcock, 2016), and feedback provision (Padro et al., 2019). Most importantly, it bridges the gap between theory and practice (Kennedy-Clark et al., 2018).

4.5. The Importance of Developing Teachers' Identity and Its Development through E-portfolios Implementation

From teachers' perspective, identity refers to their understanding of who they are as teachers based on the understanding they perceive from their interactions with their working environment (Karousiou, Hajisoteriou, & Angelides, 2019). Teachers' identity helps them to formulate and develop their ideas about their profession (Laurillard, 2012). It also supports them to realize the importance of their role as teachers and to develop their theories of teaching (Trent & Shroff, 2013).

With the use of e-portfolios PSTs enable to construct identities (Rowley et al., 2016;

McNair, 2015; Bennett et al., 2014; Zhou, Chye, Koh, & Chia, 2013). As Zhou et al (2013) believed e-portfolios empower PSTs to construct identity through the provision of structures, tools, and opportunities. It also supports identity development through active involvement of PSTs in activities including uploading, sharing, receiving feedback, and making decision (Trent & Shroff, 2013). Similarly, a key finding of the study conducted by Rowley et al. (2016) seize on the potential of e-portfolios in identity development. In another example, a study conducted at the University of Michigan indicated a high level of self-assessment of those who engaged in e-portfolios' activities deeply that caused them to achieve professional identity development (Peet et al., 2011). In the same line, McNair (2015) found e-portfolios' platform effective to develop PSTs professional identity. The enhancement and provision of the above skills have direct impact on developing TAL.

Following paragraphs will address this claim.

4.6. TAL Development through Enhancing Reflection

PSTs are capable to develop their AL via reflection. PSTs can have reflection on assessment information that leads to teaching effectiveness through pedagogical use of data (Alonzo, 2016). This data can benefit PSTs in having instructional design and planning (Moss, 2003). This data including students' interest (Moss, 2003), prior knowledge and experience (Kalyuga, Chandler, & Sweller, 2001), and learning styles (Dunn, Griggs, Olson, Beasley, & Gorman, 1995). In other words, effective planning of classroom activities is possible when teachers have sufficient understanding in regards to students learning characteristics, a maturity of students learning, and level s of student learning. As Hattie (2003) believed in the importance of the context. He stated that each classroom has its own context that needs to be taken into account by teachers because the complexities of the classroom context enable teachers to set higher expectations for learning that result in learning improvement (Hattie, 2008).

4.7. TAL Development through Provision of Feedback

Students' role in their own learning is of increasingly importance. For this reason, teachers need to involve individual students in assessment, learning and teaching actively (ARG, 2002). Thus, teachers need to provide support for students in ways that result in students' improvement in learning. One way to combat this need is a provision of effective feedback related to their strengths and suggestions on how to further improve their learning (Walker, 2015) which then leads to development of TAL (Alonzo, 2016).

4.8. TAL Development through Enhancement of Professional Development

To be effective for student' learning, an identification of required knowledge and skills for teachers to assist students in their learning is needed. Therefore, there is a need for teachers to have sufficient information with regards to the current level of students' learning, knowledge, and skills to help them achieve their learning outcomes. In order for this to happen, improving the professional development of students is needed (Timperely et al., 2008). This is the most valued strategy used by teachers (Koh, 2011). The importance of professional development in building assessment literacy has also been recognized by various experts. For example, a number of researchers emphasized the effort to build AL and being skillful in this area (Kahl, Hofman, & Bryant, 2013).

Similarly, Black et al. (2003) emphasized the significant role of AL on teacher professional development. They further noted, full engagement of teachers in teaching activities leads them to treat themselves as learners. In other words, teachers should undergo authentic learning that fosters inquiry, experimentation, collaboration, and reflection (James et al., 2007).

4.9. TAL Development through Enhancement of Autonomy

Students' ownership of their own learning plays a vital role on their learning (William & Thomson, 2008). Teachers can provide an opportunity for students to understand some ownership of learning outcomes by developing their autonomy which is caused by practicing with students closely (Black & William, 1998; Hounsell, McCune, Hounsell, & Lijens, 2008). This process enables PSTs to develop their AL (Alonzo, 2016).

5. THE DEPLOYMENT OF INSTRUCTIONAL DESIGN PRINCIPLES FOR THE DEVELOPMENT OF PORTFOLIO-BASED PROGRAM

Babae, Swabey and Prosser's (2016) theoretical framework for e-portfolio based learning is applied to frame the design of the program through adults' learning theories. This theory is a combination of Constructivism, the 3P model of learning, Self-regulated learning (SRL), and Students' approaches to learning (SAL).

There is a need to provide PSTs with an opportunity to reflect on their prior knowledge and experiences to have a better understanding of assessment concept and principles, and facilitate the construction of their AL. Due to the need for PSTs to construct their knowledge based on their experiences and existing knowledge, the most appropriate theoretical framework should adhere to the theory of constructivism.

Constructivism theory revolves around the concept that the learner is active in constructing his/her own knowledge (Piaget, 1970; Vygotsky, 1980; Dewey, 1933). From the constructivist perspective, students learn when they are in transaction with the environment and social context. Also, they learn through an interaction between their experiences and their ideas. Therefore, students create knowledge through validating theory with their own experiences (Arends, 2012).

The use of constructivism in learning and teaching has been proven to be effective in meeting the learning outcomes. First, students' active role impact upon their learning because students learn and enjoy more when they are active (Olusegun, 2015). Second, students are able to develop autonomy, as constructivism gives students ownership of their own learning by providing the opportunity for students to questions and explore (Olusegun, 2015). Third, students benefit since they study in a supportive environment that focuses on interpreting learning outcomes and thinking and understanding rather than on rote memorization (Suhendi & Purwarno, 2018).

As for SAL, it investigates how students take a different approach to learning including a deep or surface approach to learning. According to Biggs and Tang (2011), learning activities such as formative feedback, self-monitoring, self-assessment, and reflection aid students to adopt a deep approach to learning. As illustrated earlier, all these learning activities are possible to be achieved through e-portfolios implementation. Also, Piaget emphasized constructivist aspects with a focus on students discovering relationships and ideas through autonomous learning activities (Piaget, 1970) which is associated significantly with e-portfolios (Tran & Duong,

2018). This active role of students is supported by several studies in AL which demonstrates that students who assume active role in all aspect of learning, teaching, and assessment have higher achievement levels (McDonald & Boud, 2003). Furthermore, in this TAL e-portfolios students reflect what they already know, in fact, they can reflect their prior experiences in response to build effective assessment practices.

There is a consistency with this aspect of TAL e-portfolios that highlights the benefits of linking prior knowledge with the new one with constructivism. As Piaget (1970) also found that learning occurs through the construction of meaning rather than passive transmission and that learning takes place around an activity that is relevant and engaging. Similarly, John Dewey stressed that the students' own experience must be acknowledged as the heart of both the content and the process of education (Ultanir, 2012). He rejected the notion that schools should focus on repetitive rote memorization and emphasized that education needs to be grounded in real experience by which students can only learn through directed living. Hence students need to engage in real-world authentic workshops to be provided with opportunities to think for themselves and creatively construct knowledge (Ultanir, 2012). Therefore, the constructivist theory applies to TAL e-portfolios.

3Pmodel of learning explains how learning occurs at the university level through investigating variables such as prior knowledge and perception. It also focuses on linking prior knowledge to current knowledge to achieve high quality learning. As such, PSTs have the opportunity to reflect on their prior knowledge within e-portfolios to connect their prior knowledge with the current one (Ching et al., 2016) to develop effective assessment practices.

6. PROCESS

The program is designed in accordance with progressive digital pedagogies and learning strategies and we applied SRL, SAL, Constructivism, and the 3P model of learning to frame the program. Zimmerman's (2000) three phase cyclic model was applied in my e-portfolio program as below:

6.1. Strategic Plan Development for e-portfolio implementation

It is important to engage with the stakeholders, professional staff and academics to make informed decision for developing the strategic plan. This allows applying sound pedagogy to align the plan with departmental needs to make a change. Meeting with stakeholders and academics allows conducting a profound need analysis to identify gaps in students' learning experience and, common teaching pitfalls that affect the quality of teaching (Andre, 2010). The plan should be responsive to the academics' and students' feedback. Applying project management skills to map out the findings to learning process and timeline to communicate with the teaching team and stakeholders is the next step. The strategic plan covered the following areas:

- Information gathering and need analysis
- Clarification of faculty-based goals and objectives
- Definition of long-term and short-term strategic objectives
- Aligning the program with university mission, vision and values

- Formulation the strategies
- Implementation phase
- Evaluation phase

6.2. Pre-Implementation Phase: Students Began to Actually Engage in the Behaviours Required to Successfully Use the E-portfolios (SRL)

- Ensuring that students perceived the teaching and learning context including appropriate assessment, teaching quality, clarity of goals, and appropriate assessment (SAL)
- Ensuring that students had the required level of prior knowledge (Constructivism, the 3P model of learning)
- Ensuring that they had required technical skills to use e-portfolios (SAL, the 3P)
- Ensuring that they had a high conception of e-portfolios, for example, clarification on how e-portfolios help reconceptualization of learning (SAL)
- Ensuring that students had a predefined set of cognitions (e.g., goal setting and planning) and self-beliefs (e.g., task interest, self-efficacy) that impacted how they approached their tasks (Zimmerman, 2000)

6.3. The Implementation Phase: Students Used a Study Plan Reflecting Steps towards Success

- Step 1: Using the e-portfolios
- Step 2: Personal information management with the use of technologies (using Blogs as a private journal to set learning goals and plan for course assignments and tasks, manage content, using YouTube to set up a personal media archive and to create content, Creating Linked in profile for networking)
- Step 3: Information aggregation and management (aggregate media from several media archives to refine personal archive)
- Step 4: Social interaction and collaboration (peer-feedback, collaborative editing, commenting, connecting to online communities)
- Step 5: Students' monitoring their learning progress and using selected strategies to perform learning tasks and to build on their new knowledge (Constructivism, SAL, SRL)
- Step 6: reflect on their overall learning experience to enhance the desired learning outcome

6.4. Post-Implementation Phase: Reflection

- During the last phase of the model, the self-reflection phase, students use self-monitored outcomes to make judgments regarding their learning performance.

- During the face to face consultation, students shared their finding.

7. CONCLUSION

Pre-service teachers (PSTs) are increasingly required to reflect on, document and demonstrate their professional competency from the early years of beginning teaching onwards. Supporting PSTs to prepare for the teaching profession through demonstrating their professional competency is a vital role higher education plays to ensure that PSTs can provide evidence of their teaching proficiency. They are future teachers in a world of rapidly developing computer technology. Adopting ePortfolios may provide a model for their future classes, and it may help them to collate relevant information to show they are achieving the standards. They can also prepare for the teaching profession by using e-portfolios as a digital resume, showing their knowledge of teaching and learning, and this can be presented to prospective employers. Through the use of e-portfolios, PSTs can showcase the process of their learning, and they have the opportunity to present their persona to broad or specific audiences (Abrami & Barrett, 2005). However, educational research over the last few decades indicates that there is a significant indirect connection between the way teachers teach and design their courses, and the quality of their students' learning. This thesis argues that even with the provision of well-designed and implemented eportfolio-based teacher education units, significant variation in the PSTs' experience of the e-portfolio-based context takes place. To investigate PSTs experience of the eportfolio-based unit, this thesis explored PSTs' conceptions of e-portfolios and their perceptions of the e-portfolio-based teaching and learning and investigated the role of their perspectives on the adoption of a deep or surface approach to learning when using e-portfolios.

In general, the development of TAL requires time and hence, it is recommended by the literature to implement e-portfolios into teacher education program to ensure that beginning teachers have a functional level of AL before they commence teaching. As it has the potential to function effectively to develop TAL through bridging the gap between theoretical and functional knowledge, linking prior knowledge to current knowledge, supporting teacher reflection, professional development, teacher identity, teacher autonomy, and feedback provision.

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