Technology Enhanced Personalised Learning Implementation with Technical Skill Training in Vocational Education and Training

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Abstract

Implementing personalised learning in a large class is always a challenge to teachers because of the number of resources and effort required to efficiently run it. Additionally, there is a lack of case studies on implementing Technology Enhanced Personalised Learning (TEPL) to learn technical skills, which is commonly taught in Vocational Education and Training (VET). This study aimed to deliver technical skill training using TEPL approach in a VET, and understand the TEPL implementation effectiveness in a large class setting. Through an action research approach, TEPL was conducted on three large classes over two weeks in a Singapore's VET to observe its implementation practicality. Through the preparation design, MS Teams, OneNote, and Excel were used as the technology to deliver TEPL on a skill-based training. This study was carried out with mixed-method approach through action research process to investigate the research questions. Using mixed method data collection, quantitative and qualitative data were gathered from students and teachers each week through questionnaires and interviews. The TEPL approach was found to be at least 80% effective to the students as they responded positively to their TEPL experience. A significant amount of time was saved on all the teacher's teaching tasks, which allowed time for teachers to provide individualised feedback to their students.

Keywords: Personalised education, Delivery approach, Action research; Microsoft Teams, Vocational education and training

1. Introduction

Traditional classroom teaching is deemed to be less effective over the last decade. Research has shown that learning as a class is not always ideal because every student has different learning characteristics (Bartle, 2015; FitzGerald et al., 2018a; Kaminskiene & DeUrraza, 2020; Holmes et al., 2018). In addition, Kapp (2016) highlighted that structured curriculum and lesson time restricts students from reflecting and discovering their personal learning needs. As a result, students seldom internalise the content taught in class and apply their learning. Therefore, to increase a student's learning effectiveness, learning needs to be personalised according to the student's learning needs and behaviour (Bartle, 2015). Through personalised learning, students learn at their pace and capacity, which improves their learning motivation and effectiveness. As such, many educational institutes have started shifting the traditional teaching approach towards personalised learning approach over the past decade to improve a student's learning experience (Murphy et al., 2016; Reid, 2019; FitzGerald et al., 2018b).

Much research was conducted to broadly discuss the use of personalised learning to improve student's learning motivation and experience, while only a few research papers discuss the delivery approach (Bartle, 2015; FitzGerald et al., 2018a; Kaminskiene & DeUrraza, 2020; Holmes et al., 2018). In a personalised learning environment, a significant amount of teacher's involvement is required to provide attention to every student in the class, resulting in an increase in teacher's workload and stress (Chatti & Muslim, 2019; Holmes et al., 2018; FitzGerald et al., 2018a). On the other hand, emerging research papers had discussed possible strategies to appropriately adapt online learning technology such as massive open online courses to ease the implementation of personalised learning (Major & Francis; 2020; Redding, 2016). However, the aforementioned technology enhanced personalised learning (TEPL) case studies conducted were limited to primary and secondary education levels, focusing on cognitive and metacognitive competencies such as creative writing, critical thinking and social skills. There is little research discusses the implementation of personalised learning outside this area of studies such as technical skills, which vocational education and training (VET) in Singapore specialise in.

Singapore, despite being proactive in improving the quality of student's learning, is hit with impasse in their attempt to implement TEPL. Although Singapore is seen to be encouraging the education sector to adapt innovative technologies to enhance students' learning, implementing personalised learning with technology raises concern among many teachers (Asfa-Wossen, 2020; Chin, 2016). Such worries were caused by significant increase in teaching load, involvement, and trainings to implement TEPL. Additionally, VET in Singapore normally have an average class size of twenty-three students to one teacher, which results in teachers having less time and attention to individual student's learning (Ministry of Education, 2020). From these articles, implementing TEPL is deemed to be challenging in Singapore's VET because of the large class size, resources, and the approach to effectively deliver it. Hence, this research aims to identify preparation required to conveniently support VET teachers in implementing TEPL in technical skill trainings using existing educational technologies. As such, the following three research questions (RQ) were studied:

RQ1: How should VET teachers prepare and deliver technical skills training using TEPL approach?

RQ2: To what extent can existing technology assist VET teachers implement TEPL productively when training technical skill subject?

RQ3: To what extent is TEPL effective for a big class setting in VET?

2. Literature Review

2.1 Technology Enhanced Personalised Learning

TEPL aims to connect learners' interest and achieve their learning needs through technology platforms that supports differentiated and individualised learning. According to research found, educational technology supports learner to learn at their own pace and choose their learning contents (Holmes et al., 2018; Chatti & Muslim, 2019; Kucirkova & Littleton, 2017). Examples of such technology platforms includes massive open online courses (MOOC), learning management system (LMS) and various proprietary education systems which are created and customised for specific subjects. However, these case studies focused mainly on mathematics and sciences subjects, which helps students to revise theories taught in classes (Holmes et al., 2018; FitzGerald et al., 2018a). There is no research that provides TEPL example on other technical based subjects or life-skills related topics (Holmes et al., 2018). Therefore, these research papers suggest that existing TEPL case studies have not explored beyond cognitive-based learning subjects.

Differentiating and individualizing learning content is a key attribute of TEPL. In Holmes et al. (2018) research, a case study gauges the student's level of learning on science theories through quizzes and tasks which the student had performed, while another case study allowed students to explore learning contents based on their interest. However, Holmes et al. highlighted that these system lacks the capability to indicate the student's learning progress. Additionally, these examples did not elaborate on their delivery approach, nor did other research explain how the TEPL implementation were integrated into their formal learning (Sota, 2016a; Kaminskiene & DeUrraza, 2020; Redding, 2016). Although Holmes et al. (2018) provided a framework to implement TEPL and provided a case study in Germany, he emphasised that only few teachers practiced TEPL due to its implementation challenges, which include technical infrastructure, required training and collecting massive student's data. As such, the aforementioned research indicated the lack of study on TEPL delivery approach to effectively support differentiating and individualized learning.

2.2 Implementation Considerations

Although personalised learning consists of only three main phases, which are goal setting, executing and evaluating, the process can be complex when implementing in class (Chatti &

Muslim, 2019). In FizGerald et al.'s (2018b) research, a student's learning goal is the driver for their learning activity because it is linked to the student's aspiration and learning need. Additionally, Sota (2016a) emphasised that a student's learning goal setting needs to be aligned with the subject's standard. However, the goal setting process is deemed challenging to students and requires co-creation and close guidance by the teachers (Sota, 2016a; Kaminskiene & DeUrraza, 2020). Furthermore, Holmes et al. (2018) highlighted the importance of the teacher's role in guiding students to make choices based on the student's prior knowledge. These research papers suggest that teacher's involvement to implement personalised learning in a large class is significantly resource taxing. Therefore, for a class to implement personalised learning, technology tools should be used to resourcefully support both students and teachers in crafting an appropriate personalised learning plan.

Personalised learning is known to encourage independent learning, but this ability should be taught to or practiced with the students. Chatti and Muslim (2019) closely relate personalised learning with self-regulated learning, where students should have the ability to organised and plan their learning. Additionally, Holmes et al. (2018) suggested the adaptation of an exploratory learning environment to support students in their searching process for learning content. As such, TEPL should equip students with the tools and functions that enable students to plan and find their learning content. On the contrary, Sota (2016a) highlighted that students may not have the skills to source for the right learning content for their learning activity. Layng (2016) identified this intricate process as a metacognitive competency, which is the student's capability to evaluate their planning and actions. The aforementioned research shows the metacognitive competency gap that students may have when experiencing personalised learning. Therefore, teachers are still required to teach and guide students in a TEPL environment, which develops student's metacognitive competency in parallel with the learning objective.

Evaluation of a student's personalised learning progress requires a huge amount of involvement from teachers. Mahon (2016) stressed the importance of providing feedback in terms of quality and frequency. Effective feedback is achieved when it is given immediately upon a student's learning activities, which allows students to act upon it and improve their learning. Additionally, the effectiveness of feedback increases when the feedback occurrences happen often enough for students to observe their learning progress over time. Furthermore, Sota (2016a) highlighted that feedback in the form of formative assessment helps students gauge their learning performance, which encourages students in their self-regulated learning skills Moreover, FitzGerald et al. (2018b) mentioned that TEPL could be used to support teachers in providing some automated feedback, which in turns allow teachers to concentrate on qualitative comments for the students. Accordingly, the implementation of TEPL requires careful design of the feedback system to assist teachers in providing immediate and frequent feedback, and possibly offload teacher's involvement is low level feedback through automation.

Social learning is an important aspect of students' learning, which is essential to be included in a personalised learning environment. Melzer and Schoop (2018) mentioned that peer

learning is an important feature in personalised learning environment because students can learn important information through discussion and collaboration. Furthermore, Redding (2016) highlighted that students develop their personality through human interaction, and they should learn and collaborate with their friends. Hence, these research papers highlighted the importance of embedding social learning elements in personalised learning pedagogy so that students do not feel isolated in their learning experience. In addition, Major & Francis (2020) recommended teachers to focus their effort in facilitating group learning and discussion in a personalised learning environment, which enhances student's social learning skills. These research papers suggest that apart from aiming to achieve academic success, a student's learning experience should encompass activities that nurtures their personality. As such, a TEPL environment should promote social learning by providing functionalities that conveniently allow teachers and students to interact and socialise.

2.3 Users' Experience

From a student's perspective, TEPL plays a learning assistant role to support student's learning needs after class. Major and Francis (2020) indicated that immediate feedback is made possible for students using technology, which proves to be useful when teachers are not available for their students after class. Moreover, in Lim et al.'s (2020) research, using technology to provide analytics-based feedback assists students to keep track of their learning progress and recall the details of their homework. These research papers suggest that TEPL should support students in self-regulating their learning especially after class. Additionally in a personalised flipped classroom, Melzer and Schoop (2018) mentioned that technology can provide direct quality feedback, which improves student's learning motivation and satisfaction. The aforementioned research shows that technology has the capability to assist students in their learning outside class, which increases student's learning satisfaction through fulfilling their emotional needs (Melzer & Schoop, 2018). Hence, a TEPL environment should possess the functionality of providing frequent learning reminders and immediate feedback, acting as a learning assistant after class.

In a personalised learning environment, Sota (2016b) mentioned that the role of a teacher shifts from teaching to coaching or mentoring their students. Flipped classrooms are examples of allowing students to learn at their own pace with the use of online learning platforms. As students return to the class, teachers could spend lesson time to review students' learning progress and facilitate meaningful discussion (Fuchs, 2021). In addition, Redding (2016) highlighted that technology should assist teachers in reducing their teaching role but not replace their role as an educator. Instead, with the appropriate use of technology, teachers could spend less time on repetitive administrative tasks and dedicate more time to provide quality feedback to students (Redding, 2016). Furthermore, Major and Francis (2020) suggest that teachers should focus their effort on tasks that technology is unable or difficult to accomplish. Therefore, these research papers suggest that a TEPL environment should include the capability of offloading teacher's repetitive tasks to free up their teaching and administrative role. In return, teachers could spend their time to provide students with personalised feedback, which enhances their personalised learning experience.

2.4 Existing Technology Limitations

Current classrooms use technology to support teaching, however they do not support students on personalised learning. Even though teachers use different technologies in class for teaching, Holmes et al. (2018) indicated that these technologies were not used to improve student's personalised learning experience. An example of using technology to provide personalised instruction is implemented in flipped classrooms as highlighted by Holmes et al. (2018). However, in Fuchs (2021) research in which students were evaluated on technology enhanced flipped classrooms, there was no mention on enhancing their personalised experience.

Additionally, Chatti and Muslim (2019) stressed that for students to personalise their learning, it is essential to experience goal setting, execution and evaluation. Even so, Chatti and Muslim concluded that such personalisation attributes were not found in the existing technology used in class, and that smart learning capability is absent from these technologies. From these papers, although technology can be seen to be used in class for teaching and learning, there is a lack of customisation ability to aid individual student's learning needs.

While implementing TELP revolves greatly around enhancing student's learning experience, little consideration was given to other stakeholders. Holmes el al. (2018) illustrated a framework of analysis to consider when implementing TEPL, which includes the questioning on why, how, what, when, who and where to personalise the learning for students. Similarly, Chatti and Muslim (2019) broadly categorised the Seven Stages of the Personalised Learning Activity Cycle into goal setting, execution and evaluation. These frameworks demonstrated the need for the school to thoroughly design and plan out personalised learning in the context for students and curriculum before implementing it. However, FitGerald et al. (2018b) discussed the six aspects of personalised learning framework with an additional consideration on the impact of TEPL on all the stakeholders. Apart from the fundamental focus to improve student's learning experience, implementing TEPL should also consider the benefits for teachers, trainers and schools. Yet, there is a lack of research discussion on strategies to implement TEPL that could be easily adopted by educators and support their teaching challenge.

2.5 Synthesis

In this literature review, TEPL can be seen to be beneficial for students, yet it has its challenges in implementing in class. While personalised learning can enhance student's learning effectiveness, educators are not keen in implementing it because of the vast amount of effort, resources, knowledge as well as skills needed to effectively deliver this pedagogy. From planning, executing to evaluation, the process of personalised learning requires an indispensable amount of teacher's involvement to co-create the learning journey with the student. Yet, existing educational technology design is heavily skewed towards individualising learners' experience, neglecting the fact that teachers are also users who are seeking essential technology support in implementing personalised learning in a large class setting. If education technology is appropriately implemented to support teachers in class, certain repetitive

activities can be offloaded from the teachers' responsibilities. In return, teachers could spend more time to provide quality personalised feedback on students' learning or facilitate meaningful group discussion and activities to promote social learning in class.

3. Methodology

This study was carried out with mixed-method approach through action research process to investigate the research questions. The sample for this research was purposively taken from a learning subject in a VET institute in Singapore. This cohort of students were training to use a digital art creation software which was considered a technical skill required for future job employment. The process of learning the software requires students to follow step-by-step instructions and hands-on practice, which the case studies from existing research of TEPL using quizzes and Multiple-Choice Questions (MCQs) would not be sufficient to provide students with proper guidance. Therefore, this sample provided opportunity for this research to explore and discover possible TEPL implementation approaches for students learning technical skills.

3.1 Sampling & Participants

The cohort of students undertaking this subject was the first group of participants for this research, aged between 18 to 21. The assessment of this subject requires students to choose their final digital creation outcome based on their learning. However, the curriculum covered only the fundamental content, and students need to learn additional knowledge to aid them in their creation. Thus, each student must possess the ability to source for and learn content out of the standard curriculum to achieve their desired learning outcome. Therefore, the learning environment was appropriate to implement TEPL because students were learning in a digital environment, and they were required to individualize their learning in terms of their pace and capability.

The teachers of the cohort were the second group of participants for this research to collect data from the teacher's perspective. As the cohort of 65 students were grouped into three classes, a total of three teachers provided their TEPL implementation experience. Since the average class size of this sample was 22, this large class sample size fit the research investigation because implementing TEPL was deemed challenging due to high students to teacher ratio. Moreover, the convenient access to this sample group allowed close observation of the students and teachers as the user of TEPL. This provided the primary data collection directly from the stakeholders which enhanced the credibility and validity of the research findings (Opie & Brown, 2019; Cohen et al., 2017).

3.2 Research Design

This research was initiated by setting up TEPL using Microsoft Teams (MS Teams), which is readily available within the organisation. Adopting Chatti and Muslim's (2019) seven stages

of the personalised learning activity cycle, MS Teams and its build-in software acted as a learning management system (LMS). Mainly, OneNote, MS Teams chat channel and Excel were used to supported students and teachers with TEPL (Table 1).

Table 1: 7 stages of the personalised learning activities mapped with the 6 dimensions of personalisation.

7 Stages of Personalised Learning Activities	**(who) Student**	**(who) Teacher**	**Technology implemented**
Goal What is the final outcome?	(what) personalised project outcome (char) interest, level (how) self-described	(what) aligning project to subject's learning outcome	**OneNote** – student's goal setting, review and feedback by teacher.
Plan How should I schedule?	(char) level and self-regulation (how) self-described	(what) regulate weekly learning and provide feedback	
Specify What should I learn?	(what) choice of learning content (char) level, interest (how) cognitive based	(what) provide necessary learning resources	
Perform How do I learn?	(what) watch video and practice along (char) learning mode (how) cognitive based	(what) recorded teaching instructions, (how) segmentation - social learning	**Online videos** – learning tutorials **Chat channel** – social learning
Perceive What have I created?	(what) self-assessment (how) whole-person	(what) feedback on learning outcome	**OneNote** – student journaling results, review and feedback by teacher. **Excel** – teacher tracking students' progress.
Interpret How much have I learnt?	(what) reflect on learning approach (how) whole-person		
Compare Is this scaffolding to my outcome?	(what) reflect on goal progression (how) whole-person		

Furthermore, the six dimensions of personalisation mentioned in FitzGerald et al.'s (2018b) research were taken into consideration:

1. (What) is being personalised?
2. Type of learning - formal
3. Personal (Char)acteristics of the learner
4. (Who) is doing the personalisation?
5. (How) is the personalisation carried out?
6. Impact/beneficiary

However, the second dimension was fixed at formal learning for this research because the learning is targeting a technical skill subject in the curriculum. Additionally, the sixth dimension (impact) was elaborated in Table 1, taking both students and teachers into account. Investigation on the teacher's beneficiary was targeted to answer RQ1, which is exploring preparation required to improve teacher's productivity and easing the implementation issue.

3.3 Data Collection

A set of questionnaires were used to collect both quantitative and qualitative data through online forms over two weeks from the sampled 65 student participants. The questionnaires, adapted from Cohen et al.'s (2017) questionnaire guide, were developed by the principal investigator which aimed to understand student's TEPL experience with the newly implemented technologies. In each week's lesson of four hours duration, students were given three sets of questionnaires at three different points pertaining to the three main personalised learning activities: goal setting, learning and evaluation (Chatti & Muslim, 2019). In the first part of the questionnaire, a maximum of ten Likert Scale questions were asked with choices of: strongly agree, agree, disagree, and strongly disagree. Following a set of Likert Scale questions, open-ended questions were used in the questionnaire to collect qualitative data (Wellington, 2018; Cohen et al., 2017). These questions allowed participants to share their emotions or voice out their concerns, providing quality inputs for RQ3 (Cohen et al., 2017; Opie & Brown, 2019).

Additionally, questionnaires and interviews were conducted on the teachers for these classes over two weeks after their lessons, which captures teacher's views on implementing TEPL for their classes. The questionnaire was designed with similar approach as used in the student's questionnaire. Furthermore, short semi-structured interviews were conducted by the principal investigator with the teachers each week after their classes to provide synthesis with the quantitative data from the questionnaire (Ivankova, 2014). The conversation of the interviews was recorded and transcribed for thematic analysis, fluidly probe deeper into both teacher's questionnaire input based on their responses (Opie & Brown, 2019; Cohen et al., 2017). Through a ten-minute interview, causation and affective related details that were not easily captured through the questionnaire can be better expressed by the interviewee verbally.

3.4 Data Analysis

Quantitative data collected from the questionnaires were analysed through simple descriptive statistics that illustrate empirical evidence based on the research activities (Opie & Brown, 2019). The Likert Scale question data was further organised under student's and teacher's section, with findings from goal setting, learning and evaluation & overall experience to provide insights on the different stages of TEPL. These quantitative data collected served as empirical evidence to answer RQ2 and RQ3, which were gauging the effectiveness of deploying TEPL in a large class from both teacher's and student's perspective.

Qualitative data collected from the open-ended questions in the questionnaire and interview transcripts were processed with thematic analysis. Similar words or phrases with high occurrence were identified to provide better understanding on the participant's concern for the respective TEPL phases. Since the teacher interviews were conducted to further understand or confirm the findings from the quantitative data, the themes discovered from the transcript provided a categorisation for the rationale supporting their implementation challenge (Opie & Brown, 2019; Cohen et al., 2017).

With the analysis from both quantitative and qualitative data, triangulation from these sources was reflected upon, providing the breadth and depth to answer the research questions (Ivankova, 2014). The quantitative data collected in this research was cross validated with the qualitative data to interpret the causation of the event through convergence, differentiating or both (Kurniawan, 2018). Hence, the triangulation analysing process bounced the collected data back and forth with the TEPL concept, synthesising new findings to hypothesize for this research (Shannon-Baker, 2016).

4. Student's Data Results and Discussion

The following data were collected from the students through questionnaires. Data were organised into three sub-sections: goal setting, learning and evaluation & overall experience, discussing the findings at each stage of the personalised learning approach.

4.1 Goal Setting

Table 2: Goal Setting Data from Student Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Student's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	I know how to set my project goal.	95%	5%	90%	10%
Q2	I am motivated to work towards my goal.	75%	25%	66%	34%
Q3	I have set my project goal clearly.	84%	16%	82%	18%
Q4	I have a clear plan to achieve my goal.	75%	25%	84%	16%
Q5	I can write my goal and scheduling easily using OneNote journal.	92%	8%	82%	18%
Q6	I know what I need to learn.	92%	8%	88%	12%
Q7	I know how to locate the videos I need for learn.	91%	9%	90%	10%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

From the research, there was a minority of students with issues in their goal setting process. While 25% of students may have had issues identifying their long-term goal, they were still able to find resources that they need to learn (Table 2 Q1, Q4 & Q6). Overall, the collected data

shows that up to 80% of the students were able to set their goal and were able to plan to achieve their goal. On the other hand, 25% of the students were not motivated toward achieving their goal, which affected their goal setting process (Table 2 Q4). Based on their feedback, some students were under studying stress caused by learning other subjects concurrently. They were expected to manage their time and prepare for other subjects' assignments, which could affect their learning motivation.

In the following week, student's inputs were generally slightly higher for most of the questions. However, Table 2 Q4 shows that there were a significant 9% more students who had a clear plan to achieve their goal. This shows that given additional time, slower students were able to identify their goal. Another prominent evidence found in week 2 is a 10% increase in students who lack motivation in achieving their goal, bringing the total value to 34% (Table 2 Q2). Based on their feedback, similar issues such as study load, stress and time management were mentioned. Overall, both week's data shows that less than 20% of students have issue setting and working towards their goal. Even so, learning motivation for the subject is still an issue for one-third of the cohort.

4.2 Learning

Table 3: Learning Data from Student Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Student's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	My tutor provides guidance I needed to learn.	98%	2%	95%	5%
Q2	When in doubt, I ask my tutor for support in class.	91%	9%	90%	10%
Q3 Week1	I frequently ask questions on MS Team's chat channel.	50%	50%	-	-
Q3 Week2	I use other communication modes to discuss with my friends	-	-	88%	12%
Q4 Week1	I learn with my friends in class.	80%	20%	-	-
Q4 Week2	I learn from my friends through the progress sharing activity.	-	-	92%	8%
Q5 Week1	I learn with my friends after class last week.	59%	41%	-	-
Q5 Week2	I frequently discuss with my friends about my learning after class last week.	-	-	80%	20%
Q6	I am comfortable with learning at my own pace through watching video tutorial.	98%	2%	98%	2%

Q7	I can follow from video tutorials well.	100%	0%	98%	2%
Q8	I can see my results after following the video tutorial.	91%	9%	100%	0%
Q9	It is easy to journal my learning with OneNote.	95%	5%	95%	5%
Q10	OneNote helps me keep track of my learning progress.	93%	7%	92%	8%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

Most of the students were learning well in the TEPL setting, but there was a lack of social learning aspect in the TEPL setting. Based on Table 3 Q1 & Q2 in week 1, the data shows that most of the students were receiving sufficient guidance from their tutors. These data shows that most of the students were able to or willing to learn to be independent learners (Table 3 Q6 to Q10). However, Week 1 data strongly suggest a lack of social learning element in the learning process (Table 3 Q3 to Q5 in week 1). According to their feedback, students did not feel a need to learn with peers for this subject as every student had different expectations and goals for their learning. Along with the TEPL learning environment, most students were watching their selected video individually, which could further dampen the social learning aspect.

In week 2, a deliberate group activity was injected into the lesson plan to improve the student's social learning aspect. Students were tasked to group up and share their past one week's learning progress with their friends. As for the questionnaire, question 3, 4 and 5 were changed to capture the result of the intervention. Based on Table 3 Q4 in week 2, 92% of the students were learning from their friends through the sharing activity, which shows that the intervention improved the student's social learning aspect. Additionally, 80% of the students were noted to be discussing with their friends as compared with 59% of them learning with their friends (Table 3 Q5 Week 1 & 2). Lastly, 85% of the students did communicate among themselves outside the MS Team's channel (Table 3 Q3 Week 2). Based on the research data, students deemed themselves as discussing with their peers rather than learning with their peers. Therefore, many of the students do interact with each other and learn, except that they communicate through other chatting modes instead of the official MS Team's channel.

4.3 Evaluation and Overall Experience

Table 4: Evaluation & Overall Experience Data from Student Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Student's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	I can easily review my work through my Onenote journal.	100%	0%	100%	0%
Q2	I can see small achievements with what I have created.	98%	2%	95%	5%

Q3	Tutors have the same view on how much I have learnt.	88%	12%	95%	5%
Q4	Tutors provided feedback to help me improve on my work.	98%	2%	100%	0%
Q5	I feel I am working towards my project goal.	93%	7%	95%	5%
Q6	I can see my project progressing with Onenote.	95%	5%	98%	2%
Q7	I've learnt to plan to achieve my goal.	91%	9%	98%	2%
Q8	I've learnt to be independent with my learning.	95%	5%	95%	5%
Q9	I've learnt to gauge how much I have learnt.	98%	2%	100%	0%
Q10	I am comfortable with this subject's learning approach.	93%	7%	98%	2%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

Most of the students were able to evaluate their learning well in this research experiment. From Table 4 Q1 & Q2, more than 95% of the students found it easy to review and see their learning progress through OneNote journaling. Although in week 1, 12% of the students did not have the meet tutor's expectation, feedback given by the tutor had helped them worked towards their goal in week 2 (Table 4 Q3, Q4 & Q5). Overall, 95% of the students had learnt to be independent, learnt to gauge their learning and 93% were comfortable with the personalised learning approach (Table 4 Q8 & Q10 in week 2).

5. Teacher's Data Results and Discussion

The following data were collected from the teachers (A, B and C) that implement TEPL in their classed. The data were also organised into three sub-sections, similar to the student's data. Through questionnaire and interviews (only teacher A and B), the following three sub-sections discuss the findings from the teachers' point of view.

5.1 Goal Setting

Table 5a: Goal Setting Data from Teacher's Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Teacher's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	It is easy to implement OneNote in class.	100%	0%	100%	0%
Q2	I am able to review individual student's goal easily with OneNote.	100%	0%	100%	0%
Q3	I can review the class planning progress with OneNote.	100%	0%	100%	0%
Q4	I can provide feedback to students on OneNote	66%	33%	100%	0%

	easily.				
Q5	It is easy to guide students how to use OneNote.	100%	0%	100%	0%
Q6	I have provided sufficient videos to help students learn.	100%	0%	100%	0%
Q7	It is easy to provide video sources to students.	100%	0%	100%	0%
Q8	I have sufficient time to guide individual students in planning and scheduling.	100%	0%	100%	0%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

Table 5b: Comments from Teachers on Goal Setting Through Interview

Week	Teacher	Theme	Reasons
1	A	Not easy to provide feedback	OneNote long loading time. Typing takes time.
	B	Easy to implement	Students are independent. Have time to provide weaker students with verbal feedback.
2	A	Easy to provide feedback	Attuned to the process. Lesser students' interaction due to typing feedback.

From the teacher's perspective, guiding the student's goal setting in the TEPL setting was generally manageable even though the teacher had some concerns. Based on Table 5a Q1, all the three teachers were able to easily implement and guide the class to use OneNote on the two weeks. However, Teacher A highlighted that providing feedback on OneNote can be slow as the software needs time to load, and he needs time to type in the feedback (Table 5b week 1). Nevertheless, in his second week, Teacher A had overcome his issue (Table 5b week 2). The teacher mentioned that after attempting to type on OneNote to provide feedback on the second week, he found the process was smooth and time saving. This shows that the teacher's initial resistance to provide feedback on OneNote was overcome after he experienced the process.

While providing digital feedback on OneNote is deemed efficient, verbal feedback was still necessary. While Teacher A highlighted that he was efficient in providing feedback as he could focus on typing, he also discovered he had lesser interaction with his students (Table 5b week 2). This in turn reduced the teacher to students' connection and resulted in more questioning by the students towards the end of lesson. On the other hand, Teacher B mentioned that he was able to nudge and probe students with questions while he is providing verbal feedback students (Table 5b week 1). Based on the above findings, while typing feedback on OneNote is efficient, providing verbal feedback encourages closer interaction and learning with the teacher.

5.2 Learning

Table 6a: Learning Data from Teacher's Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Teacher's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	I am able to monitor the class's learning progress well during lesson.	66%	33%	100%	0%
Q2	I have sufficient time to provide guidance to individual student.	66%	33%	100%	0%
Q3	I am able to monitor the class's learning progress well after lesson.	66%	33%	0%	100%
Q4	I am able to support student's learning after class conveniently through the chat channel.	66%	33%	33%	66%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

Table 6b: Comments from Teachers on Learning Through Interview

Week	Teacher	Theme	Reasons
1	A	Monitoring class learning is not easy	Insufficient time to check all students work due to large class with technical questions. Feedback needs to be selective to assist weaker students.
	B	Monitoring class learning is easy	Students provide learning update on MS Teams chat. Able to provide feedback in small groups, which is time saving.
2	A	Monitoring class learning is easy	Attuned to the process and found quick approach to provide feedback.
	B	Monitoring class learning after lesson is not easy	Communication through text is difficult. Prefer feedback and guidance in person.

Providing personalised feedback took up most of the lesson time such that it is challenging to monitor class's learning progress. According to Table 6a Q1 in week 1, one out of three the teachers had difficulty monitoring the learning aspect in his class. During the interview with Teacher A, he highlighted that while providing feedback with previous week's homework, some students might ask technical questions which were time-consuming to answer (Table 6b week 1). Based on the findings, there was a lack of time to monitor students' learning because most of the time was allocated to provide personalised feedback rather than learning guidance.

Requesting students to post their learning on MS Team's channel could be an efficient way to monitor student's learning. In the second week, Teacher A intervened in his monitoring approach by asking his students to post their iterative learning progress on the MS Team's channel (Table 6b week 2). This method allowed Teacher A to quickly monitor the class

progress by checking if students had done some learning. Moreover, Teacher A and B used the 'thumbs up' feature to quickly acknowledge a student's learning which is convenient. They highlighted that the channel posting feature allowed him to provide students with quick advice when necessary. From the above observation, MS Team's channel posting feature allowed quick review of students' work and conveniently communicated with them.

5.3 Evaluation and Overall Experience

Table 7a: Evaluation & Overall Experience Data from Teacher's Likert Scale Questionnaire Over 2 Weeks

		% of students			
	Week #	Week 1		Week 2	
Q#	Teacher's Input Questions	SA & A	SD & D	SA & A	SD & D
Q1	I can easily review individual student's work through OneNote.	100%	0%	100%	0%
Q2	I can easily provide individual feedback through OneNote.	66%	33%	100%	0%
Q3	I am able to identify and support student's learning issue through their journal.	100%	0%	100%	0%
Q4	I am able to monitor the class's project progress well with Excel.	100%	0%	100%	0%
Q5	It is easy to implement personalised learning for a large class.	100%	0%	100%	0%
Q6	Technology deployed supported personalised learning well.	100%	0%	100%	0%
Q7	I have sufficient time for individual students in class.	100%	0%	100%	0%
Q8	I am confident to implement TEPL in my class.	100%	0%	100%	0%
Legend: Q – Question, SA – Strongly Agree, A – Agree, D – Disagree, SD – Strongly Disagree					

Table 7b: Comments from Teachers on Evaluation & Overall Experience Through Interview

Week	Teacher	Theme	Reasons
1	A	Easy to implement TEPL	Seems doable with practice.
		Concern on student's motivation	Students lack self-discipline in self-directed learning. Students need teacher's presence to regulate learning.
	B	Feel positive for TEPL	Flexibility in learning benefits students. Able to provide feedback in small groups, which is time saving.
2	A	Easy to implement TEPL	Confident after practice.
		Concern on student's motivation	Need better approach to motivate weaker students. Scheduling and planning are tough for students.
	B	Monitoring class learning after lesson is not easy	Communication through text is difficult. Prefer feedback and guidance in person.
		Concern on student's	Subject not of interest to some student.

		motivation	Heavy study loads with other subjects. Poor time management and self-discipline.

The implementation of TEPL was seen to become better for all the teachers in the second week. Referring to Table 7a Q2, the feedback aspect aligns with the previous finding in the goal and monitoring findings, where teachers became familiar with implementing after the first attempt. Overall, the teachers that they were positive with TEPL as it provided flexibility and freedom for students to learn (Table 7b week 1). However, they were concerned about weaker students who lacked motivation and direction to learn even with the given flexibility and choices (Table 7b week 1 & 2). Few significant causes of learning motivation mentioned were heavy study load, poor time management and self-discipline. Although TEPL is deemed possible to implement, its success could be affected by other external factors.

6. Discussion and Conclusions

Implementing TEPL with a technical skill training was the aim of this research, to gain deeper understanding of the effectiveness TEPL in a large class setting. Through this research,

- the preparation of TEPL approach in a large class was captured,
- reviews of implementing existing technology with TEPL was discussed, and lastly
- the effectiveness of implementing TEPL in large class was analysed with data collected.

Reflecting on first research question, 'How should VET teachers prepare and deliver technical skills training using TEPL approach?', preparation to implement TEPL when teaching technical skill can be achieved using the seven stages of the personalised learning activities mapped with the six dimensions of personalisation. In this research, this mapping process provided a clearer understanding of the technology required to effectively and efficiently personalised student's learning experience as seen in Table 1. Particularly, teachers need to identify a readily available journaling software that allows students to set goals, capture their learning activities and conveniently for teachers to provide feedback for students to enhance their learning. Next, a tracking software is needed to assist teachers in monitoring their class learning progress. For this research, OneNote and Excel was chosen for journaling and tracking purposes respectively. The two platforms within MS Teams were conveniently available to both teachers and students within the organisation and had proved to be effective and efficient for TEPL delivery.

Additional preparation for TEPL includes imparting metacognitive competencies to the students. While TEPL had been effective for most of the students, this research data showed that one-third of the students were seen to have issues with their learning motivation. From student's feedback, three potential reasons that reduced their learning motivation were student's study load, stress, and time management. Relating back to the literature review, some students might not possess the necessary skills to be independent learners, which includes planning, problem solving and evaluation (Sota, 2016a; Layng, 2016). Therefore, developing student's soft skills in TEPL is essential so that they can become independent learners.

Lastly, the design of the curriculum for TEPL should include social learning activities. As outlined in the literature review, social learning is critical in students' learning because through human interaction, students are able to develop their personality, learn and collaborate with their peers (Melzer & Schoop, 2018; Redding, 2016). However, from this research findings, most of the students were seen learning individually as the content they chose was different. Thus, students' interaction was reduced tremendously because they have less or no common topic to discuss on, which creates individualisation. Hence deliberate group or peer learning activities are needed to improve the social interaction within the TEPL setting. Results of the second question, 'To what extent can existing technology assist VET teachers implement TEPL productively when training technical skill subject?', indicated that utilising MS Teams chat, OneNote and Excel, all the teachers' productivities were improved as they were able to provide personalised feedback to their classes as well as on-demand learning guidance. As teachers leveraged on OneNote to provide personalised feedback with lesser time, the time saved can then be utilised to support students who needed guidance. This finding aligned with the literature review, where teachers make use of TEPL to perform repetitive tasks to provide quality feedback to students (Redding, 2016). Although some teachers felt challenged on their first attempt, they agreed that TEPL was effective and achievable on the second week. Referencing the Literature Review, teachers might resist implementing new teaching approaches because of the complex technology platform (Bartle, 2015). In this research, the teachers we felt challenge with the overwhelming tasks to manage in their first week. However, adequate preparation through learning and familiarisation with the platform equipped the teachers with the required skills to confidently deliver personalised learning. Hence, preparation of new technology implementation through practice can help teachers to overcome their resistance in adopting TEPL approach.

Lastly, data was collected and analysed to understand the third research question, 'To what extent is TEPL effective for a big class setting in VET?'. Based on the results collected in this research, the implantation of TEPL was at least 80% effective to the sampling group of students training for a technical skill. From the research data, all students were satisfied with their personalised feedback, which was given in both weeks. The weekly feedback had helped the students to gauge their learning and improve themselves. Referencing the literature review, frequent quality formative feedback supports students to understand their learning progress over time (Mohan, 2016; Sota, 2016a). This in turn encourages students to regulate their learning and take actions to further improve their mastery.

Out of the three stages of personalised learning, goal setting was seen to be the most challenging phase. From the research findings, 20% of the students had issues with their goal setting process and required more guidance. Based on the literature review, goal setting was highlighted to be a difficult process in personalised learning as students may not possess the competency to plan for themselves based on their existing capability (Sota, 2016a; Kaminskiene & DeUrraza, 2020; Holmes et al., 2018). Furthermore, students may not be resourceful enough to search for appropriate resources based on their prior knowledge (Layng,

2016; Sota, 2016a). Synthesising from the aforementioned discussion, TEPL is not effective to 20% of the students due to the difficulty in student's goal setting. Hence, implementing TEPL in a large class setting was effective only if all students are equipped with the necessary metacognitive competency.

6.1 Recommendations

A technology implementation framework could be formulated, to assist the evaluation and designing of new technology for educational purposes. In this research, only MS Teams and it's given features were used to implement TEPL to the students, where fundamentally these platforms were not designed based on educational needs. Therefore, further research on the framework to evaluate or design new technology would support better decision making in implementing TEPL in class. The framework should consider both teachers and students user experience so that the technology fits their needs. Metacognitive competency should be considered as part of the personalised learning process. TEPL may not be suitable for all students because this learning approach requires a certain level of metacognitive competency, which includes time management, planning skill and self-regulated learning motivation. Additionally, metacognitive competency includes being resourceful and possessing the ability to problem solve issues. Such skills are not specifically taught in school and not all students were able to independently search for suitable teaching materials to aid their learning. Therefore, it would be recommended for future personalised learning studies to consider incorporating building student's metacognitive competency as part of student's learning.

This study suggest teachers should focus their monitoring on weaker students because they tend to get unmotivated in their learning easily. This coincides with the literature review that teachers change their role to a coach or mentor in a personalised learning environment (Sota, 2016b; Major & Francis, 2020). While TEPL provides the platform and support for students to learn, individualised learning could surface easily due to lack of interaction. Therefore, a TEPL environment needs to support teachers in monitoring student's learning effortlessly and increase teachers to students' interaction during class to improve the mentorship quality.

6.2 Limitations

Teachers and students in this research came from an information technology (IT) faculty, who have an advantage of adopting new technology. The level of computer literacy in teachers has a significant impact on their performance because teachers need to use computers to prepare and deliver their lessons (Tumburka et al., 2019). In this research, the teachers have strong IT knowledge that helps them operate the new implemented technology easily. Compared with teachers of other faculties, they may take longer to learn the new software and weave it into their lessons. As such, teachers with low computer literacy are prone to resistance in adopting new technology or unable to overcome technical issues during class.

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