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Navigating the Terrain:
Emerging Frontiers in Learning Spaces, Pedagogies, and Technologies

Understanding TVET students' self-regulated learning and online participation on a blended course

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The purpose of this research was to investigate students' perceived self-regulated learning and participation in a blended environment. A shorten Motivated Strategies for Learning Questionnaire (MSLQ) was administered to 63 first-year students at a Singaporean Technical and Vocational Education and Training (TVET). Trace data was collected from the learning management system to gain insight into students' online participation. The survey show that students were extrinsically motivated, used rehearsal strategy the most, but scored the lowest in critical thinking. Trace data revealed that students primarily accessed group activity worksheets, and spent the most time on quizzes. Positive correlations were found between time spent on resources and organization, elaboration, as well as critical thinking.

Keywords: Blended learning, trace data, self-regulated learning, vocational education, quantitative

Introduction

Blended learning (BL) is a common teaching and learning approach in institutions for the delivery of courses. However, not all students are effective learners in terms of learning with the course materials, participating in discussion with peers or in class, and managing the learning timely in the BL environment. Students are the drivers of their own learning and should be able to demonstrate self-regulated learning (SRL). In Technical and Vocational Education and Training (TVET) institutes, students face challenges in managing their learning in-class and online. There is also a need for instructors to gain insightful information about their students' ability to plan, monitor, and evaluate their own learning. To support the teaching and learning, the institutes have integrated the use of trace data to understand student activity and engagement. However, the students' learning activities are relatively low in terms of participate and access frequency. Such insightful information has suggested that the students could be lacking in motivation as well as self-regulation.

Literature review

Pedagogical, social, and technological factors

Research has shown that pedagogical, social, and technological factors are critical in BL environment (Wang, 2008). In Wang's study, the proposed PST model emphasize how students learn (Pedagogy), interact with peers and instructors (Social), and use technological tools to access their learning (Technology). It serves as a framework to understand the essential factors that influence the effectiveness of BL. By recognizing the interplay between pedagogy, social interaction, and technology, instructors can create BL environments such as flipped classroom, asynchronous and synchronous classrooms, as well as online and face-to-face.

Self-regulated learning

The concept of SRL becomes particularly relevant in BL classrooms as it is key to empowering learners cognitively and affectively. SRL is made up of four phases which include forethought, monitoring, control, and reflection (Pintrich, 2004). The four phases that apply across the four domains are cognition, motivation, behaviour, and context. This creates a cyclical and dynamic approach to learning, where students actively manage the four domains to achieve their learning goals.

Dashboard and trace data

Trace data can be useful in supporting student development of SRL. Trace data refers to digital footprints of users' activities and interactions on online platforms. It can unobtrusively reveal insights about students' SRL based on their online activities, such as the number of visits, duration, and frequency of access. However, students may not always know how to regulate their learning effectively and may not benefit from personalized technology (Molenaar et al., 2019). In such cases, instructors can design learning supports based on the trace data. Learning supports can take various forms, such as formative or summative feedback (Panadero et al., 2022) or even guided resources (Alzahrani, 2023). The implementation of these learning supports should be guided by a BL framework that considers the learning needs of the students, the nature of their interactions, and the function of the technology employed. Using the PST model, this study aims to investigate TVET students' perceptions of SRL and online learning participation to improve the implementation of SRL components in BL. The study addresses two research questions: (1) What are TVET students' perceptions of SRL? (2) What are TVET students' online learning participation?

Methods

Blended learning environment

A total of 63 full-time year one students (45 female, 18 male) from a TVET institution in Singapore participated in this study over a period of 4 weeks. Students' participation was voluntary and their consent was obtained before data collection. Students engaged in a 3-hour BL course held in class weekly. Each session consisted of a 1-hour theoretical component, taught in class using presentation slides, and a 2-hour practical component involving hands-on activities such as individual online quizzes with unlimited attempts, and group activities using worksheets during class time. All learning resources were accessible through the institution's Learning Management System (LMS), which provided instructors with a real-time dashboard displaying students' progress.

Instruments and data analysis

A shortened version of the Motivational Strategies for Learning Questionnaire (MSLQ) with 39 items was employed. The internal consistency reliability for the seven sub-scales was evaluated using Cronbach's Alpha (α). The intrinsic motivation sub-scale consisted of 4 items (α = .82), the extrinsic motivation sub-scale consisted of 4 items (α = .84), the rehearsal sub-scale consisted of 4 items (α = .70), the elaboration sub-scale consisted of 6 items (α = .86), the organization sub-scale consisted of 4 items (α = .72), the critical thinking sub-scale consisted of 5 items (α = .85), and the metacognitive self-regulation sub-scale consisted of 12 items (α = .87). To answer the first research question, descriptive statistics was performed, followed by a correlation test to explore potential relationships between the sub-scales.

Trace data on student activity over a four-week period were collected from the LMS to understand their BL participation and SRL. The collected trace data included access rates (number of students who accessed), counts (number of unique visits), and duration (time spent accessing) for course resources (project brief, course notes, presentation slides, supplementary videos, quizzes, group activity worksheets), as well as quiz scores and attempts, overall login frequency and duration, and online interactions with the instructor outside of lesson time. Descriptive statistics were performed, followed by a correlation test to explore potential relationships between online learning participation and the MSLQ sub-scales.

Findings

Table 1 presents the descriptive statistics and correlation of students' self-reported SRL sub-scales and online participation. Students scored significantly higher on extrinsic motivation (M = 4.20, SD = 0.70) in their goal orientation. In the learning strategies subscales, students scored highest on rehearsal (M = 3.73, SD = 0.67) and lowest for critical thinking (M = 3.47, SD = 0.75). A positive correlation is found between metacognitive self-regulation and critical thinking, r (61) = .85, p <.001, as well as elaboration, r (61) = .84, p <.001.

Table 1
Descriptive statistic and correlation of students' SRL

Sub-Scales	n	M	SD	1	2	3	4	5	6	7
1. Intrinsic motivation	63	3.60	0.75	-						
2. Extrinsic motivation	63	4.20	0.70	.55**	-					
3. Rehearsal	63	3.73	0.67	.43**	.51**	-				
4. Elaboration	63	3.49	0.72	.60**	.52**	.66**	-			
5. Organization	63	3.65	0.69	.50**	.61**	.70**	.72**	-		
6. Critical thinking	63	3.47	0.75	.61**	.58**	.63**	.83**	.73**	-	
7. Metacognitive self-regulation	63	3.59	0.60	.64**	.55**	.71**	.84**	.79**	.85**	-

**p < .001.

Table 2 presents the descriptive statistics of students' online participation. In terms of access rate, most students accessed the group activity worksheets and least students accessed the course notes. In terms of access count, students visited presentation slides (M = 12.79, SD = 21.35) the most and project brief (M = 4.20, SD = 0.70) the least. In terms of access duration, students stayed the longest in quizzes and the shortest in project brief. Students scored an average of 56.52%, and only 39.68% (n = 25) of the students reattempted any of the 2 quizzes. Overall, students visited the LMS 35.75 times (SD = 30.63) and spent an average of 26 minutes 29 seconds (SD = 21:09). None of the students contacted the instructor via the chat platform outside of lesson. Positive correlations were found between time spent on resources and organization, r (61) = 0.79, p < .001, elaboration, r (61) = 0.84, p < .001, as well as critical thinking, r (61) = 0.85, p < .001.

Table 2
Descriptive statistic of students' online participation

Resources	Access Rate		Access Count		Duration (minutes: seconds)	
	n	%	M	SD	M	SD
Project brief	22	34.38	0.60	1.45	0:19	0:59
Course notes	20	31.25	2.33	5.45	2:47	7:31
Presentation slides	53	82.81	12.79	21.35	6:27	10:49
Supplementary videos	35	55.55	1.06	1.17	1:42	7:14
Quizzes	59	93.65	11.89	10.40	12:31	12:50
Group activity worksheets	60	95.24	7.05	5.05	2:42	3:58

Discussion

Pedagogy

The low access rate for the project brief could indicate a lack of initial planning or a limited understanding of course requirements. It is important to have clear task descriptions and learning goals in BL environments to enhance student motivation and self-regulation (Wang & Han, 2020). The option to download the project brief might have contributed to the lower access rate, as students could have chosen to review it offline. Even though the instructor reviewed the project brief in class and emphasized its requirements, additional efforts is

necessary to explicitly bridge the gap between course materials and students' personal learning objectives to foster a sense of ownership and purpose (Kennedy, 2019). The sense of purpose may potentially help students in developing their desire for mastery of the content, as well as metacognitive self-regulation which was found to be lower.

The high access rates for quizzes, coupled with the limited number of attempts, suggest that students might primarily use them for self-assessment rather than actively seeking to improve their understanding through repeated practice (Panadero et al., 2017). Students need explicit scaffolding to utilize formative assessments such as quizzes for deeper learning and improvement, rather than just for self-assessment (Liu et al., 2022). In terms of quiz duration, the short timing indicates a need to encourage deeper engagement and reflection, potentially through providing more detailed feedback or opportunities for quiz review (Sun & Chen, 2019). This pattern could also be linked to students' reliance on surface-level learning strategies as they reported higher usage of shallow strategies such as rehearsal (You, 2023), or extrinsically motivated students using this opportunity to improve simply their scores. Instructional strategies to support deeper learning may also help in students' critical thinking as it was found to be the lowest.

When it comes to the access of the resources, time spent is positively correlated to students' perceived organization, elaboration, and critical thinking. Much of the access occurs in class, the decreased access outside of class hours and the potential reliance on offline resources for learning could be linked to the challenges of promoting SRL beyond the classroom (Bali & Liu, 2018). It might also indicate that students do not see a need to revisit the content unless instructed, reflecting their time management habits beyond the classroom.

Social

The high access rate and count for the group activity worksheet suggest that collaborative activities can effectively promote student engagement (Kay & Knaack, 2020). This can potentially promote students' reflection in their shared learning experiences. However, the lack of instructor-student interaction and low resource access outside class time might reveal students' preference for seeking help in person or their reliance on offline resources (Wang et. al, 2021). Further investigation is needed to understand these behaviours and explore ways to encourage online interaction and resource utilization outside of class hours.

Technology

While the availability of downloadable files might limit the accuracy of trace data regarding the actual duration spent on resources (except for quizzes), the access rate and count data still offer valuable insights into student engagement patterns. Exploring the use of learning analytics tools that can provide more granular data on how students interact with different resources, even when downloaded, could be beneficial. The discrepancy between online and offline engagement underscores the importance of considering the diverse ways in which students interact with learning materials in BL. A need exists for flexible and adaptive learning analytics approaches that can capture the multifaceted nature of student engagement in technology-enhanced learning contexts (Chen & Jones, 2020).

Conclusion

This study investigated TVET students' perceived SRL in Singapore and how the use of trace data can provide insights their SRL. The limitation for this study includes the small sample size and single academic domain. Further research is needed to understand how students' SRL in relation to the trace data using a larger population with different courses. The current study contributes to the field of SRL and how it can influence the design of BL classroom to support students.

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