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Integrating a Mobile-Learning Platform for Enhancing Clinical Teaching: The Learners' Perspective

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Abstract. The role of mobile technology has become an integral part of daily activity among today's society, including medical schools and hospitals. This study aimed to establish a mobile-learning platform for providing high-quality clinical teaching in undergraduate medical education. It was a mixed-methods design of quantitative survey and qualitative focus-group discussions to analyse the learners' view for acceptance of technology-integrated learning in clinical teaching at Universiti Sultan Zainal Abidin. Forty-two undergraduate medical students from years 3 and 5 participated in this study. The vast majority

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found that a mobile-learning platform was a helpful medium for the integration of leaning resources and collaboration with other health-care professionals in a clinical setting ($p<0.001$). They generally agreed that there is an improvement in clinical competence, confidence in clinical reasoning and focusing on the discussion by providing constructive feedback ($p<0.001$). The qualitative focused group discussion's findings indicated that most of the participants expressed their satisfaction with improving their intellectual skills and their anticipation of achieving strategic learning via integrated bedside teaching with mobile-group discussions. Overall, the participants accepted that a mobile-learning platform integrated bedside teaching is a constructive, productive approach for enhancing and facilitating their learning in a clinical setting. This study offered a unique insight into learners' perceptions of benefits and the limitation of technology-enhanced learning in undergraduate medical training. The essential attributes of mobile technology are crucial for technology integration in high-quality clinical teaching.

Keywords: mobile technology; mobile learning platform; bedside teaching; medical students; clinical teaching

1. Introduction

Bedside teaching (BST) is the teaching in the patient's presence in a health-related environment. It is one of the integral teaching modalities for teaching clinical skills that are important for the medical profession. Despite technological advances in the clinical setting, BST is still valuable; and simulated-based learning will not replace authentic learning with patients (Narayanan & Nair, 2020). Hence, BST remains an indispensable part of clinical teaching (Sultan, 2019). Teaching in the clinical environment is stressful, complicated, and often challenging for clinicians and the medical students without adequate preparation or orientation in advance. Bedside teaching has declined, despite introducing several innovative models over the years (Garout, Nuqali, Alhazmi, Almoallim, et al., 2016; Stickrath et al., 2013). The quantity and quality of clinical-bedside teaching (cBST) has declined for several reasons, including workforce constraints, clinicians' busy schedules and the rising trends of technology dependence, such as digital-case records, computer-generated results, and diagnostic imaging (Garout, Nuqali, Alhazmi, & Almoallim, 2016).

In Malaysia, private medical universities are increasing in number, with few hospitals able to accommodate the growing number of new medical students. This issue has resulted in declining BST practice, with **the** increased use of simulating-based clinical teaching for replacing traditional BST (Watson et al., 2012). Using simulated standardised patients to replace authentic patients is an alternative approach for clinical-bedside teaching during the COVID-19 pandemic (Ajab et al., 2022). However, simulated-based learning merely complements authentic bedside learning, rather than completely replacing it. In this study, mobile-group discussion is integrated into conventional BST by using an MLP1-Bedside-MLP2 (MBM) approach, in order to create constructive and productive clinical-bedside learning (Appendix A**).** This MLP offers the opportunity for individualised and group learning regardless of location and timing, thereby enabling the learners to establish a more integrated, self-regulated and creative way of learning.

Diagram 1 provides the comprehensive conceptual framework of this study.

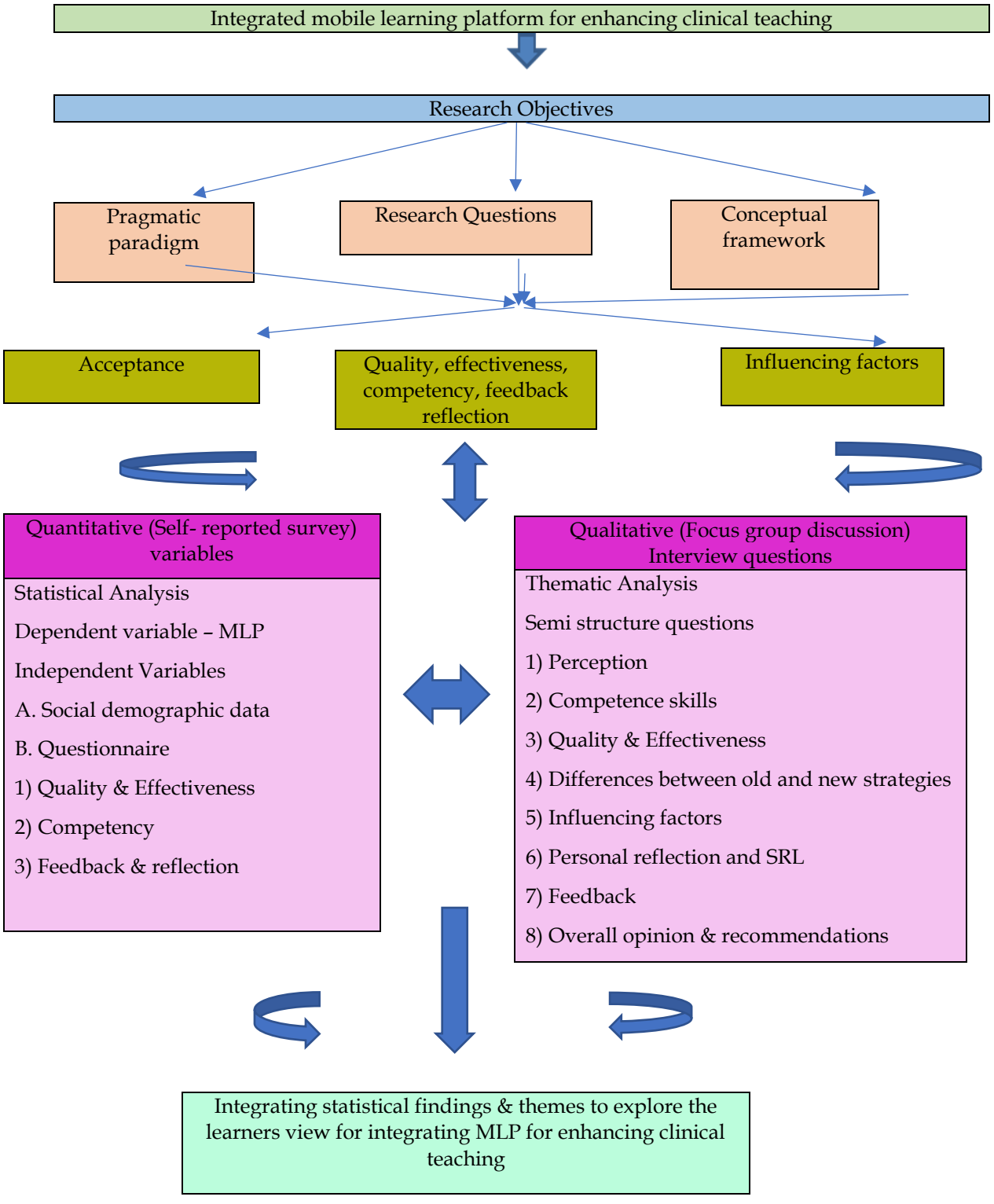

Diagram 1- Conceptual Framework

Technology-enhanced learning (TEL) allows the students to develop self-regulation (SRL)approaches to acquiring knowledge with self-confidence and the motivation for lifelong learning in a busy clinical environment (Siddaiah-

Subramanya et al., 2017). During the MLP- integrated BST session, mobile technology is integrated into the SRL approach, thereby encouraging the learners to engage in proactive learning, rather than merely reacting to situations in conventional BST. The lecturers' feedback and the peers' views are vital sources of self-reflection and motivation for their future learning process.

Overall, the literature review has identified several factors that influence the adoption of mobile technology and learners' acceptance of MLP for enhancing their learning in a clinical setting.

However, there is limited information regarding the learners' choice of mobile apps with their advantages and disadvantages and their acceptance of technology-enhanced learning. There are very few studies on integrating MLP in clinical BST (cBST) in Malaysia. The integration of mobile technology in the clinical environment is a constant challenge due to the rapid advances in technology. Consequently, further enquiry is required , in order to determine the students' acceptance of TEL in cBST.

It has revealed several gaps, namely a gap in capturing the learners' experience of using mobile devices in the clinical setting, focusing on the benefits and risks of technology-integrated learning compared to the conventional approach, and for identifying the influencing factors for the acceptance of mobile technology for enhancing clinical-bedside teaching.

2. Research objectives and questions

In this study, mobile-group discussion is integrated into conventional BST, using mobile technology to create constructive and productive clinical-bedside learning. This MLP offers the opportunity for individualised and group learning, regardless of location and timing, thus enabling the learners to establish a more integrated, self-regulated and creative way of learning.

This study aims to reveal the learners' perspectives on integrating mobile technology, in order to enhance their learning of clinical-bedside teaching. It should help to identify the drivers for further improvement in the quality of clinical teaching. Despite the ubiquitous use of mobile technology in a clinical setting, few studies have investigated the main influencing factors for adopting mobile technology in cBST. Revisiting and restructuring the core teaching strategy to maximise mobile-learning benefits has led to the formulation of the research questions:

(1) To what extent do learners accept the integrating MLP for enhancing clinical BST?
(2) How do learners describe the benefits and limitations of MLP integrated BST, based on their experience of the differences between conventional and integrated BST?
(3) What factors do learners identify for the usage of mobile technology in their clinical-bedside learning?

With this new strategy of integrated BST, this research potentially extends and refines SRL as the essential concept of the technology-enhanced learning approach.

3. The methodology

This study was carried out from February 2019 to June 2019 at Universiti Sultan Zainal Abidin. In this study, the conceptual framework is a pragmatic guide to select for research design, methods, sampling, collecting, analysing of the data and data interpretation. The is the quantitative and qualitative convergent parallel mixed-method design with the phenomenological approach, in which a self-regulated learning concept is adopted to construct the research phenomena for informing the research enquiry. (Details in appendix B**.)** The integration of the questionnaire survey and the FGD interviews brings together the advantages of the breadth and the depth of the research enquiry. The survey and FGD questions are in Appendix C. Ethical approval was granted by both Universiti Sultan Zainal Abidin and Dundee's School of Ethics Committees (SREC) (Appendix D).

3.1 The Sample population

This study investigated the third and fifth-year undergraduate medical students' experience with conventional and MLP integrated-clinical bedside approach at UniSZA. However, the 4th-year medical students were excluded from this study: as they were in district hospitals for short postings without BST. A total of 42 students in six groups participated in this study. Each group consisted of an average of 6 (range of 5-8) participants.

3.2 The sampling method and the sample size

The maximum variant sampling is employed, in order to provide the relevant information on the research problems for addressing the research questions (Creswell & Creswell. David J, 2017). The participants' voluntary participation and the exploring of their opinion in a coherent, meaningful, and contemplative way is essential, in order to inform the research enquiry. In this study, the sample size is according to the saturation of information when no new information is emerging and the giving of a theoretical saturation point (Francis et al., 2009). The data-gathering instruments were piloted, in order to check their reliability and content validity. Cronbach's alpha was calculated, in order to verify the internal consistency of the research instruments (Tavakol & Dennick, 2011).

3.3 The data collection

The paper questionnaires were distributed in sealed envelopes before starting the FGD interview; and it takes 15-20 minutes to complete the survey. The GDs lasted between 40 to 60 minutes. Each was audiotaped and transcribed. The FGD was arranged as per schedule with the participants' availability.

3.4 The data analysis

The quantitative data were introduced into a Statistical Package for the Social Science (SPSS) software version 21. The one-sample t- test was done to determine the overall participants' perspective on MLP integrated BST with statistical significance by comparing the mean value with the test value. The value of 3 (neutral) was assigned as the test value for this analysis. Mean values above the

test value were considered as agreement with the statements; whereas mean values below the test value were considered as disagreement with the statements and the level of the significance set at $p< 0.05$. The data were collected by using the same variables and categories from the same participants, in order to solve the unequal sample size by weighting the equal number of participants in both the quantitative and the qualitative databases.

The thematic analysis was employed for the qualitative data analysis. For the data analysis, manual transcribing was applied for the coding, the categorisation, and the construction of the themes, in order to arrive at a general principle from the categories and the essence revealed from the original interview data in this study. The analysis was done iteratively for the subsequently coded transcripts until theoretical saturation was achieved. Adding was done on new codes when the present set failed to capture or elicit an observed or listed item. The survey and the interview data were analysed independently; but the results were interpreted from the findings concurrently, in order to address the research questions. Lastly, both the datasets of the results were integrated and triangulated, in order to present a quantitatively established effect and a detailed qualitative description of the research enquiry (Howe, 2012).

4. The results

The two datasets are combined and triangulated, in order to strengthen the validity of the research findings (Howe, 2012).

The quantitative results

The quantitative research findings were analysed, in order to capture an overview of the research enquiry.

4.1 The demographic characteristics of the participants

Descriptive analysis was performed to describe the participants' demographic data. There were 42 participants (18 males, 24 females; 22 from year 3 and 20 from year 5) (Figure 1). All were under the age of 27 years. Despite the wide range of apps available, the students only used WhatsApp. The easy installation, application, password-encrypted security, free user-friendly, suitability for group discussion, long duration of data retention are common reasons for WhatsApp usage over other mobile apps at the current institution (Table 1). Students favoured smartphone usage in their undergraduate clinical training, regardless of differences in the characteristics of the participants and the academic year.

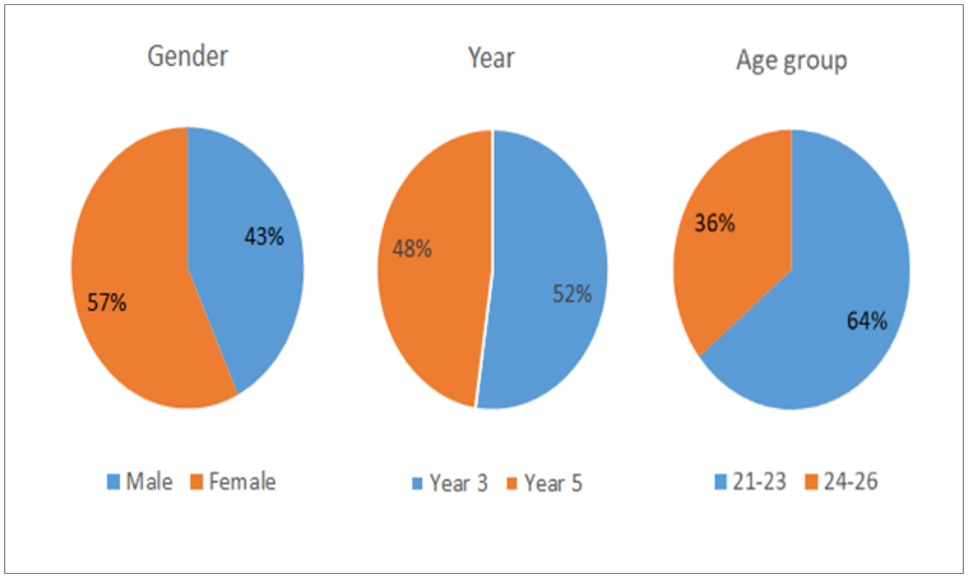

Figure 1: Gender, age, and clinical year of the respondents

Table 1: Participants' usage of mobile devices and their purposes (n= 42)

No	Variables	Frequency	
		Number	Percentage (%)
1	**How do you use your mobile device for everyday studying purposes?**		
	During lessons	2	4.8
	Between lessons	11	26.2
	For independent studying	16	38.1
	For group work	5	11.9
	For peer discussions	8	19.0
2	**How often on average would you use your mobile device on any given day?**		
	0-2 hours	6	11.9
	3-4 hours	21	50.0
	5-6 hours	10	23.8
	7-8 hours	6	14.3
3	**How often do you use WhatsApp on your mobile phone?**		
	Every day	41	97.6
	Every week	1	2.4
4	**How long do you use mobile Apps for learning purposes during undergraduate training?**		
	One year	5	11.9
	Two years	3	7.1
	Once joined clinical year	25	59.5
	Once start WhatsApp bedside teaching group	9	21.5

5	**What mobile Apps do you use on your mobile device for learning purposes?**		
	WhatsApp	42	100
	Viber	0	-
	Tango	0	-
	Line	0	-
	WeChat	0	-
	Hangout	0	-
	Messenger	0	-
	Snapshot	0	-

Over half of the respondents started to use mobile apps for learning within the last year, the majority for 3-4 hours per day for both learning and other activities (Table 1)**.** Some used mobile technology for independent learning, and others for peer-group discussions and searching for information during lessons. Despite the wide range of apps available, the students only used WhatsApp.

4.2 The benefits and limitations of MLP integrated BST

The benefits and limitations of MLP integrated BST were categorised into quality and effectiveness**,** competence skill and feedback and reflection.

Regarding quality and effectiveness, the vast majority found that MLP is a helpful medium for integration with other health-care professionals and collaboration and enhancement of learning in a clinical setting ($p<0.001$). Most students perceived that they had an opportunity for peer-group discussions with self-respect in MLP integrated BST ($p <0.001$). However, there was a potential for compromise in sharing information ($p=0.001$) and technical illiteracy ($p<0.001$) (Table 2).

Table 2- Mean perspective view for quality and effectiveness of MLP integrated BST (n=42)

No	Quality and Effectiveness	Mean	SD	*P*-value
1	Improve quality of clinical teaching	4.36	0.73	<0.001
2	More opportunity for discussion	4.26	0.54	<0.001
3	Improving learning productivity	4.21	0.65	<0.001
4	Encouragement to become a constructive learner	4.31	0.64	<0.001
5	Integrating with all aspect of health care & multidisciplinary team approach	4.19	0.63	<0.001
6	Encourage collaboration and facilitation	4.43	0.59	<0.001
7	Experienced some connectivity issues	2.76	1.03	0.142
8	Difficulty in participating in discussion groups	3.31	1.20	0.102

9	Lack of contents and function for sharing information	3.60	1.13	0.001
10	Confidentiality issue while sharing in group discussions	2.74	1.04	0.109
11	Mobile devices need a back-up plan	2.64	1.25	0.070
12	Lack of familiarity with advanced technology	4.12	1.09	<0.001
13	Mobile learning platform is beneficial	4.62	0.54	<0.001

Notes: * Positive statements are highlighted in bold.
** Significant p-values are highlighted in bold.
*** One -sample t-test for mean perspective and level of significance set at $p < 0.05$.

With regard to competence skills, the participants generally agreed on an improvement in clinical competence, confidence in clinical reasoning in group discussions ($p<0.001$). Again, some of them have an uncomfortable feeling of sharing video or audio recordings in discussion forums though there was no substantial negative impact on their learning ($p=0.018$) (Table 3).

Table 3- ***Mean perspective view for competence skills of MLP integrated BST*** **(n=42)**

No	Competency skills	Mean	SD	*P*- value
1	More confident to do clinical reasoning via mobile-group discussions.	3.88	0.97	<0.001
2	Improved clinical competence	4.33	0.53	<0.001
3	Confident to make a management plan	4.10	0.91	<0.001
4	Effective participation in Mobile-group case discussions	4.17	0.79	<0.001
5	Some unpleasant feelings of video or audio recording in a discussion forum	3.43	1.13	0.018
6	Technical issue and small screen size for sharing information	3.10	1.34	0.648
7	Difficulty in downloading video or clinical presentation on a mobile phone due to its limited capacity	3.33	1.30	0.104
8	Mobile technology has useful resources	4.38	0.58	<0.001

Notes: * Positive statements are highlighted in bold.
** Significant p-values are highlighted in bold.
*** One-sample t-test for mean perspective and level of significance set at $p< 0.05$.

For feedback and reflection, the participants from both groups generally agreed on receiving professional opinions for focusing the discussion by providing constructive feedback and integration of learning resources ($p<0.001$). However,

some participants from both academic groups suggested an uneasiness for sharing negative feedback ($p<0.001$) and exploring personal reflections in on-line group discussions ($p= 0.046$) (Table 4). Nevertheless, most participants did not consider that those negative impacts were the primary issue, and they were familiar with technology advancement in the self-regulation learning approach, without any adverse effects during group discussions.

Table 4- Mean perspective view for feedback and reflection of MLP integrated BST (n=42)

No	Feedback & Reflection	Mean	SD	*P* -value
1	The opportunities for continued discussion and feedback	4.43	0.63	<0.001
2	The professional opinion and coherent communication of ideas in mobile-learning discussions.	4.31	0.68	<0.001
3	New strategies provide focus and integration of learning from different resources.	4.31	0.68	<0.001
4	Some difficulty for getting learning resources for preparation before bed-side teaching	3.67	1.07	<0.001
5	Some uneasy feeling of sharing feedback, particularly negative aspects in groups discussion	4.12	1.04	<0.001
6	Uncomfortable with exploring personal reflection in on-line group discussions	3.36	1.12	0.046
7	A new strategy provides effective feedback for professional development.	4.45	0.50	<0.001

Notes: * Positive statements are highlighted in bold.
** Significant p-values are highlighted in bold.
*** One-sample t- test for mean perspective and level of significance set at $p< 0.05$.

Most participants stated that MLP integrated bed-side teaching promoted peer collaboration, teamwork with self-regulation in a co-ordinated way; and it improved motivation with productive feedback and self-reflection.

4.3 Qualitative result findings

The analysis of the transcripts of the FGD interviews (six groups) revealed 17 themes. The themes of comparing MLP integrated BST with traditional BST are illustrated per category. These were categories of quality and effectiveness: (1) mobile efficiency (2) enhancing the quality of learning with self-regulation (3) information overload (4) educator ignorance, category of competence: (1) intellectual skilfulness (2) simulation (3) lack of standardisation ,category of feedback and reflection: (1) instant feedback (2) self-efficacy (3) lack of confidence (4) technical illiteracy, category of influencing factors: (1) educational references (2) self-strategic learning (3) distraction (4) mobile technology challenges (3) superficial learning (4) textbook references. The details are shown in Figure 2.

However, there are possible chances that qualitative data would comparatively overspread with each other.

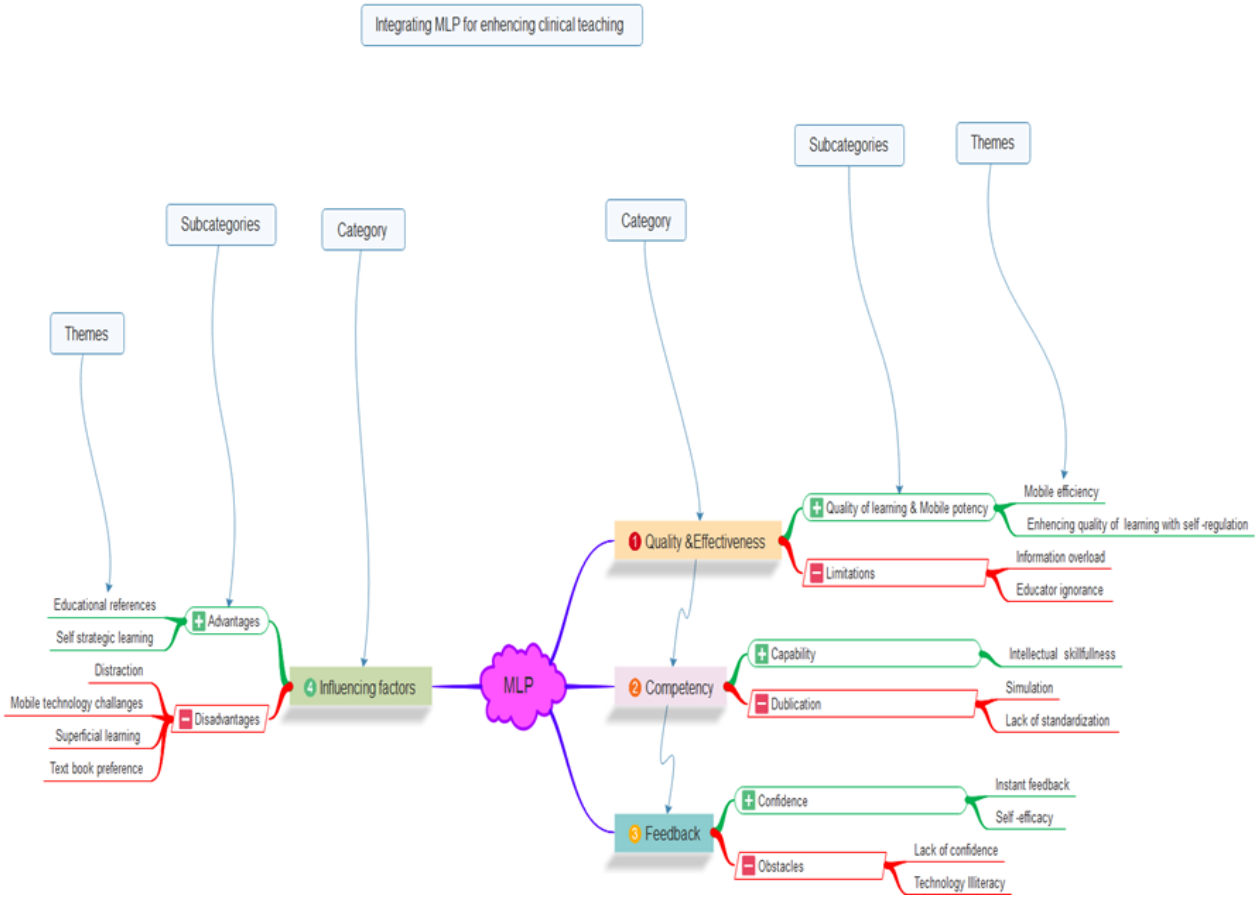

Figure 2 -Mapping of Categories, Sub-categories and themes of MLP

4.3.1. Quality and effectiveness of MLP integrated BST based on the experiences between two BST approaches

The participants reported more benefits than limitations. The majority identified mobile efficacy as beneficial: *"We can ask the questions and give answers immediately without any restriction: since mobile phones are portable and practicable* **(5A1).** This contrasted with the views on asking questions in the traditional setting, which often invoked anxiety: "*However, we do not have an opportunity to ask the questions whenever we want to, because we are very anxious and afraid to get scolded in the conventional BST approach*" **(5A1)**.

The benefits, however, do not come without challenges or limitations. Most mentioned a feeling of information overload: "*Information overload is one of the main issues in MLP*" **(5B4**). Another limitation was educator ignorance: "*Lecturers ignored the question posted by a student and neither replied nor answered. This is very disappointing and frustrating*" **(3B8).**

4.3.2. Competence skills of MLP integrated BST based on the experiences of the differences between two BST approaches

Most of the participants reported that they had used the smartphone for social connections and learning purposes. They reflected that learning through their mobile could enhance their intellectual skills for discussion or organising information during BST. They thought that additional skills could be learnt by using a mobile device, such as communication skills specifically: "*This learning platform helps me to improve my communication skills with health-care professionals, educators, colleagues, and peer groups*" **(5B2)**.

Writing skill was identified as a specific communication skill: "*One of the skills that I have developed is when we answer the question online, we have to type it out, so it trained us to write it appropriately and to practise for essay-writing skill. This writing skill couldn't be practised in conventional BST, as there was no further discussion after the BST session*" **(5A1).** Self-efficiency and organisational skills during clinical practice were also highlighted. However, they still felt there should be duplication, due to the simulation not being sufficient on its own: "*I feel that there may be differences between performing the examination on a real patient compared to on a simulated patient or manqué; since they are not real patients. I prefer to examine real patients; and I feel that the authentic bedside teaching is still valuable; but integrated BST with MLP makes BST more interesting and engaging* "(**3B3).** Some were concerned about various clinical examination techniques with different lecturers and the need for the standardisation of examination techniques in BST practice was suggested.

4.3.3. Feedback and reflection of MLP integrated BST based on the experiences between two BST approaches

Most participants perceived that MLP provided the opportunity for feedback and reflective practice. The participants felt that MLP could be used for instant feedback: "It *gives me satisfaction; since whenever I have a question then I can ask and get an instant reply. I feel very delighted whenever my answer is correct, it really improves my self-esteem*" **(5B5).** This compared favourably with traditional BST: "*In traditional BST, there is only a limited opportunity for us to have effective feedback, due to consultants' busy schedules and insufficient BST time*" **(5B5).**

Nevertheless, most identified negatives, such as unsatisfactory feedback from lecturers: "*Some negative responses can give discouragement*" **(5C5).** Some participants described frustration concerning technological illiteracy among mobile-device users of retired lecturers **(3B3).**

The Integrated BST enhanced self-regulated learning and facilitated collaboration through communication and interaction between students and lecturers. Discussions on the MLP produced moments that led to the learning of soft skills, such as compassion, comprehension, and consideration.

4.3.4. Influencing factors on the use of mobile technology at clinical teaching.
The advantages of mobile technology

Most reported that the MLP promoted integrating and sharing of information, providing relevant educational resources: "*The best part of this new strategy is*

learning a new way and the sharing of information from relevant resources with rapid access at anytime and anywhere, and as many times as we needed them" **(3A1).**

All the participants felt that mobile technology was flexible, accessible, and going beyond the classroom lecture. It provided not only new opportunities for interaction among students and lecturers, but also self-regulation with personal learning.

The disadvantages of mobile technology

Most said that they were distracted from targeted learning while using mobile devices, due to misdirection and the misuse of Apps: "*I definitely find myself in a dilemma, as it is very annoying; and it disturbs our concentration on study, because of constantly messaging in WhatsApp group discussions"* **(5A5***)*. Many found themselves reviewing social media, such as Facebook or Twitter, rather than participating in group discussions." *But it is good for us to review our discussion any time we want to, instead of WhatsApp group discussions compared to the discussion at bedside without any continuation in the conventional approach* **"(5A5).** Furthermore, some participants have concerns about more superficial learning without any in-depth detail description of discussions in MLP.

Most favoured was adopting mobile technology for enhancing their learning during clinical bedside teaching. The participants have expressed their satisfaction with improving their intellectual skills and anticipation for achieving strategic learning via integrated BST during bedside group discussions. They have reported that MLP provided a platform for sharing information resources by promoting a self-regulation learning practice that is not yet available during traditional BST.

5. Discussion

This study is the first to explore the learners' acceptance of technology-enhanced learning in the clinical context at UniSZA. The participants felt that smartphones are significantly helpful for obtaining learning resources, collaboration and sharing information in their daily life. All the participants used WhatsApp for social communication and mobile learning as it is free and user-friendly, when aligned with the findings from other articles (Clavier et al.;, 2019; Raiman et al., 2017). However, it varied with the usage of mobile apps, according to geographical location. WhatsApp usage is higher in Malaysia, when compared to WeChat apps usage, which is common in China (Ohn et al., 2018; Wang et al., 2017).

The participants expressed satisfaction with integrating MLP in mobile group discussion after BST sessions. It indicates that learners are ready to adopt multimedia learning Apps for various learning purposes in clinical bedside teaching. Hence, MLP is invaluable for integrating theory into clinical practice, in order to enhance learning in a clinical setting (David et al., 2014; Wallace et al., 2012).

The participants have reported that integrating MLP during BST has a potential benefit for learning through access to resources "just in time" in a clinical setting.

Some authors have reported on how mobile devices enhance students' learning. This conforms with the findings from other Malaysan studies, but not in a clinical setting (Adams et al., 2018; Ismail et al., 2016). Other international articles argue that the new technology offered the potential benefits for enhancing clinical learning. Nevertheless, the possible disadvantages associated with its use were comparable to the findings of this study (Bullock et al., 2015; Wallace et al., 2012). The participants also have identified several potential challenges with MLP-integrated BST, such as distraction, technical issues, and superficial learning. Like any other form of medical pedagogy, MLP has drawbacks. The advantage of accessibility can become a disadvantage while exceeding the purpose of utilization, such as diversion, time-consuming with internet disruption and the lack of in-depth learning (Davies et al., 2012; Rashid-Doubell et al., 2016; Wallace et al., 2012).

The participants take opportunities to schedule, arrange, and support their learning at any time and anywhere, including when on-the-move with self-management strategies. This agrees with the conclusions reached by some authors, who explored the levels of self-regulated learning, success in academic achievement and clinically competent skills in a clinical environment (Cho et al., 2017; Zheng & Zhang, 2020). An essential finding from this study is the insight into the influence of feedback on the learners' self-reflection for motivation and self-management in their clinical bedside learning. The participants have agreed that the mobile-learning platform is an effective educational platform for improving the quality of the BST approach; and they are keen to embrace mobile technology in the clinical setting. These findings agree with the non-Malaysian context of learners' motivation and self-efficacy with the self-regulated learning principle (Koorsse et al., 2014; Zheng & Zhang, 2020).

Mobile technology is seen as an essential tool for daily life in the modern era of technology transformation. Nevertheless, based on the findings from the current study and other studies, integrating MLP is a global trend, supporting and enhancing the learning process and metacognition with self-regulation (Koorsse et al., 2014).

The findings of this study highlighted that communication, collaboration, connection, and engagement with feedback via WhatsApp mobile-group discussions not only facilitates but also enhances student learning during and after clinical bedside sessions, which agrees with some research findings locally and globally (Bullock et al., 2015; Hussin et al., 2012; Raiman et al., 2017).

The participants listed several benefits, as well as the disadvantages associated with MLP- integrated BST. The benefits of MLP aligned with the findings from other works of literature, such as a dual purpose of building knowledge and learning, and connecting among teams' members (Rashid-Doubell et al., 2016; Siddaiah-Subramanya et al., 2017). Knowledge- building is part of learning for students and lecturers during BST; although this knowledge gain can be transient (Wallace et al., 2012). In general, the students perceived that there was an improvement in cognitive skills with MLP-integrated BST sessions.

Most of the participants stated that mobile technology offered better and faster access to local and global information, regardless of time and location. Clinical skills are an essential part of bed-side learning, and it is necessary to be seamlessly integrated into the process of learning to become confident and competent health-care professionals. In the category of competence skills, most of them perceived an improvement in their confidence in performing clinical procedures in survey questionnaires. However, the participants reported that they had the opportunity to practise writing, communication, comprehension, critical thinking, and problem-solving skills, rather than direct clinical-examination skill acquisition following the online group discussion in the FGD interview. Nevertheless, with progressive digital transformation, the learners increasingly utilise mobile devices for writing and reading, instead of using a desktop or laptop for their learning (Baron, 2013). SRL has a significant impact on medical training, and it is not adopted spontaneously in the clinical learning environment (Sandars & Cleary, 2012; Zheng & Zhang, 2020).

This study has explored how students adapted self-regulation to learning at the bedside; and they found that students adapted SRL skills during mobile-group discussions when transitioning from face-to-face to online learning. These findings are consistent with the information from other studies during small group-teaching sessions and clinical rotation (Cho et al., 2017; Woods et al., 2011).

The participants with numerous choices on an MLP can benefit from SRL skills; because these can support the learners to manage various obstacles like a distraction, in which switching to browse Facebook or YouTube during their learning with the strategic learning process (Baron, 2013; David et al., 2014). One of the compelling findings here was a mixed feeling of the impact of feedback among the participants, despite having a positive perspective with a different view for exploring negative feedback in group discussions. It aligned with findings from another study (Ada et al., 2017). The participants felt that they had developed self-awareness and self-regulation of multi-tasking habits. This is a necessary skillset among medical students in the modern workplace.

The participants did express concerns about the potential intrusion of personal matters with compromising professional behaviour in group discussions. Technology illiteracy is the main barrier to employing MLPs in clinical teaching. In this study, some educators were not familiar with mobile app usage, although it did not adversely affect the quality of BST.

Self-regulation skills are a powerful predictor of academic success in online learning (Jouhari et al., 2015; Siddiqui & Malik, 2019). The importance of SRL with self-management is one of the positive perceptive views for integrating MLP in a clinical setting in the current study. All the participants perceived the MLP as a beneficial learning platform in their academic endeavours with opportunities for an instant asset to relevant educational resources via the MLP; and it allowed learners to make the best use of downtime between their clinical activities (Payne et al., 2012). Over the study period, the students became aware of the potential

advantages of integrating the MLP. Their initial concerns were found to be mostly unfounded.

The learners' preference for technology transformation in medical education is debatable; and there can be dissimilar views between their wishes and their needs (Kirschner & van Merriënboer, 2013). In this study, the learners remained concerned about the increased disruptions, due to the technical problems of mobile devices, higher dependence on MLP and privacy invasion, as was found in other studies (David et al., 2014; Payne et al., 2012). Although they still have some doubts about mobile apps usage compared to the traditional study materials, overall medical students have a favourable view of medical apps usage. In this study, some participants raised concerns about the potential for distraction, superficial learning, and some technical issues that led to interruption or partial task completion.

The participants in this study identified the limitations of using MLP for in-depth learning; and instead, they used them mainly for quick reference and short notetaking. These findings are comparable to the outcomes of other studies (Wallace et al., 2012; Davies et al., 2012). Nevertheless, the participants have the self-awareness to solve superficial learning problems by searching for the relevant information for reconfirmation, rather than depending on browsing the social webs. The participants reported that MLP is a supplementary tool for conventional BST with a positive influence for enhancing their learning in the clinical setting, which aligned with other literature reviews (Gormley et al., 2009).

During the Covid-19 Pandemic, lectures were conducted in an e-learning platform except for clinical bedside teaching. Most students happily accept technology-enhanced learning for a conducive educational environment and engagement with good internet facilities (Dyrek et al., 2022).

The educator's feedback plays a vital role in improving learners' achievement. However, sub-optimal feedback and high student numbers can act negatively (Ada et al., 2017; Evans, 2013). The participants appreciated engaging with peers and lecturers for further opportunities to receive feedback. Continual communication maintained the positive relationship between educators and learners; and it promoted peer discussion for improving self-reflection among team members. The medical curriculum is evolving consistently to accommodate rapid changes in the technologically-adepted world. During the COVID-19 pandemic, the use of e-learning has increased significantly with students 'receptive attitudes to interaction and high motivation for digital skills (Delungahawatta et al., 2022). The online platform is a creditable educational tool for undergraduate clinical medicine, and further exploration of the risks and benefits of technology-enhanced learning is warranted (Delungahawatta et al., 2022).

Many of the participants anticipated that MLP would soon replace the traditional textbooks. The use of mobile devices is gaining universal acceptance in a diverse range of clinical environments. All the participants in this study felt that

integrating MLP into clinical teaching has made a significant contribution to the learning process, with the potential for enhancing both cognitive skills and clinical practice. Students have accepted the use of technology and recognised its benefits and limitations together with its challenges. Enhancing self-regulation skills among students is an essential attribute for the implementation of technology-enhanced learning (Romli et al., 2022).

This study has revealed that mobile technology has more benefits than risks for enhancing student learning in clinical teaching. The perceived benefits outweigh the risks from introducing this new strategy; and the learners' acceptance and preference are crucial for integrating MLP and for enhancing clinical bedside teaching.

6. Conclusion

This study has provided a diverse description of learners' personal experiences and how these elements have influenced their positive or negative perceptions of the acceptability or the disapproval of using the MLP in clinical teaching. Self-regulated learning continues to be an integral part of lifelong learning for health-care professionals. It will remain an essential skill to be encouraged and developed in medical students. This study has explored how mobile technology can facilitate the transformation of the clinical-learning process with a self-regulation concept to design and develop learning activities. Medical students are likely to continue to have integrated MLP into clinical teaching; as they can access the relevant information, regardless of location or timing. This study has identified the significant influencing factors in how learners currently work with mobile technologies in a current institution. This study has also provided crucial descriptions of the advantages and the disadvantages of MLP integrated BST in clinical teaching.

Mobile technologies, like other technologies, are not essentially good or bad, to be desired or rejected. This study has concluded that digital transformation has provided information technology; and mobile apps have made MLP a helpful tool in clinical bed-side teaching. The findings from this study place another piece in the complex jigsaw of technology-enhanced learning in a busy clinical setting.

7. Further recommendations

There are areas for future research on educators' acceptance of mobile technology in community health-care practice with e-health platforms for improving patients' and community health education and different levels of health-care environments.

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Appendix A

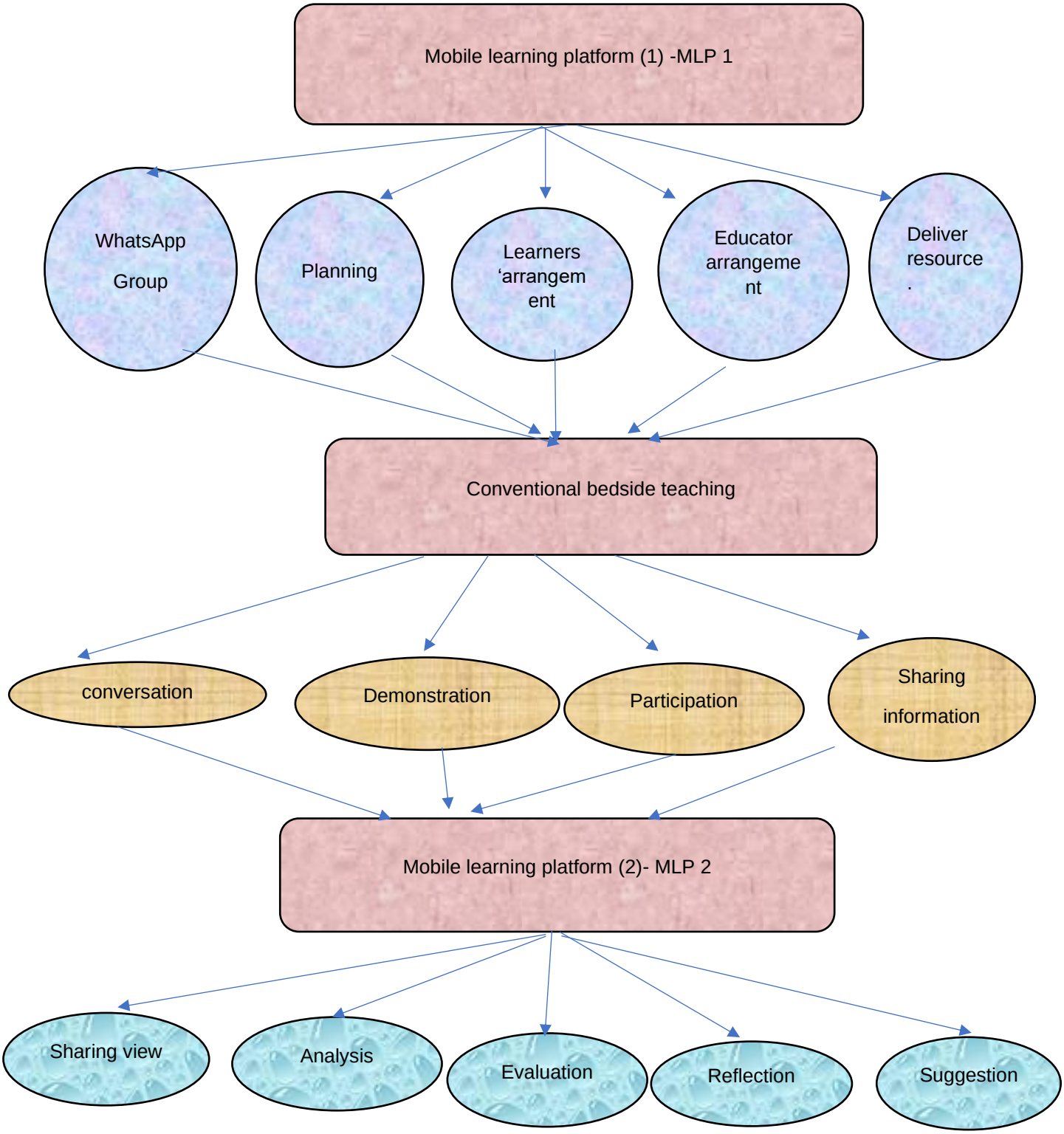

Diagram - MLP1-BST-MLP2(MBM) BST and the learning approach

Appendix B

Research methodology

No	Process	Selected element	Purpose
1	Research Paradigm	Pragmatic paradigm	This research paradigm supports concurrent use of qualitative and quantitative approaches for generating evidence to inform research inquiry.
2	Research Framework	Conceptual framework	In this study, the researcher has adopted the self-regulated learning concept to construct the research phenomena for exploring the learners view of Integrated BST approach.
3	Research Method	Mixed method	The triangulation of data from both approaches to capture the depth of research inquiry while balancing the weakness of both methods.
4	Research Design	Convergent parallel Different types of mixed method Designs 1) Convergent Parallel 2) Explanatory 3) Exploratory 4) Embedded 5) Transformative 6) Multiphase	It is one of the data-collection design that collect both numerical and text data simultaneously and integrate the data at the same time within a limited time frame.
5	Research approach	**Quantitative** Survey **Qualitative** FGD Phenomenology (Action Research) There are 5 types of Qualitative research 1) Ethnography 2) Grounded theory	It consists of series of questionnaires for gathering information to describe and interpret the experience of MLP integrated and conventional BST perceived by the group of participants. Aim to determine the essence of the experience as perceived by the participants.

		3) Case study 4) Narrative 5) Phenomenological	
7	Research sample population	Medical students	Medical students from year 3 and year 5 in clinical posting are included. However, year 4 students are in district short posting without BST sessions.
9	Research sampling method	Purposive sampling Types of qualitative research sampling 1) Purposive sampling 2) Snowball sampling 3) Quota sampling 4) Convenience sampling	It is a type of non-probability sampling technique which focuses on the elements that meet specific criteria and purpose.
10	Sub- category of purposive sampling	Maximum variant sampling Different types of purposive sampling 1) Maximum variant sampling 2) Homogenous sampling 3) Typical case sampling 4) Extreme case sampling 5) Critical case sampling 6) Total population sampling 7) Expert sampling	Maximum variation sampling is one of the purposive sampling techniques that used to capture a wide range of data to address the research questions. The basic principle of this method is to gain greater insights into a research phenomenon by looking at it from all angles.
11.	Data integration	Data triangulation Different types of triangulations 1) Data 2) Methods 3) Investigator 4) Theory	This study adopted the data triangulation with the use of multiple data sources in a single study for enhancing the research credibility. It provided a more comprehensive perspective view of the phenomenon of interest.

Appendix C

Survey questions- Benefits and limitations of MLP inegrated BST

I. Quality and effectiveness	**1**	**2**	**3**	**4**	**5**
1)Quality improvement with technology enhancing					
2) Gain respect and have opportunity for discussion in WhatsApp group discussion					
3) Increase the learning productivity					
4) Become constructive learner with positive. guidance and encouragement via a new approach					
5) Integration with all aspect of health care with multidisciplinary team approach					
6) Encourages collaboration and facilitation					
7) Connectivity issues during discussion					
8) Difficulty in participating due to lack of support					
9) Lack of contents and function for sharing information					
10)Confidentiality issue while sharing personal view in group. discussions					
11) Need of back-up plan for battery with limited expiry time frame					
12) Lack of familiarity to mobile technology					
13) Mobile learning platform is beneficial					
II. Competence					
1) Confident to do clinical reasoning					
2) Confident in clinical examination techniques					
3) Confident to make a management plan					
4) Participate in Mobile group case discussion					
5) Some unpleasant feelings of video or audio recording in a discussion forum					
6) Some technical issues and small screen size					
7) Difficulty in downloading video or clinical presentation due to limited capacity of mobile phone.					
8) Mobile technology is useful resources					
III. Feedback and reflection					
1) Opportunities for continue discussion with receiving feedback for personal reflective practice					
2) Receive professional opinion and coherent communication of an idea					
3) Provide focussing and integration of learning from different resources					
4) Difficulty in getting learning resources with poor internet connection.					

5) Uneasy feeling of sharing negative feedback in a group discussion					
6) Uncomfortable with exploring personal reflection in group discussions					
7) Provides effective feedback. for personal reflection.					

Focus- group interview questions

1) What skills have you developed from MLP integrated BST and how?

2) What were your best and worst experiences and how?

3) How do you perceive feedback and reflective view of a new strategy?

4) What are the differences you identify between a new strategy and an old conventional BST and how?

5) What are the factors influencing for accepting or rejecting integrating MLP in clinical BST?

6) What is your expectation and recommendation of a new strategy for enhancing learning practice in a clinical setting?

Appendix D - Ethical approval

Ethical approval (University of Dundee)

approval letter 054-18.pdf

Ethical approval Dundee(Amendment)

Ethical approval (Universiti Sultan Zainal Abidin)

UHREC (UniSZA).pdf