Students' Consideration on Implementing Problem-Based Learning Online in a Physics Course

FAUZIAH SULAIMAN
School of Science and Technology
Universiti Malaysia Sabah
UMS Road, 88400 Kota Kinabalu
SABAH
E-mail: fauziahs@ums.edu.my; geebots@yahoo.com
fs40@students.waikato.ac.nz;
Phone: +6088 320000 (ext. 5801)
Fax: +6088 435324

ABSTRACT

This paper evaluates students' considerations on the implementation of problem-based learning (PBL) online in a physics course. 50 students were involved in this study which consists of 30 students from the School of Science and Technology (science student) and 20 students from the School of Education and Social Development (pre-service science teachers), University Malaysia Sabah. Ten collaborative groups were then formed (4-6 students in each group). The students then followed all the PBL learning activities. Online learning environment (i.e., learning management system, LMS) was used as the main medium to carry the full learning process throughout the second semester of 2008/2009 academic year. Data were gathered from an open-ended questionnaire and a semi-structured focus group interviews after completed with the learning activities by the end of the semester. Generally, students agreed that: there are some technical issues; and lack of cooperation from group members. However they also remarked that they were more understanding; more cooperative; enhanced efficiency on solving problems; enhanced soft skills; and also become more effective time consumer.

Keywords: Problem Based Learning; Online learning

INTRODUCTION

Problem-based learning (PBL) is a pedagogical approach to science education that focuses on helping students develop self-directed learning skills (Barrows & Tamblyn, 1980; Boud & Felleti, 1991). It was originally developed in a medical school in 1969 at McMaster University (Rideout & Carpio, 2001), but has since spread to other subjects. There is now a substantial literature on how PBL and online learning might be merged (see e.g., Candela et al., 2009; Cheaney & Ingebritsen, 2005; Jennings, 2006; Lee, 2006; Lim, 2005; Savin-Baden & Gibbon, 2006; Savin-Baden & Wilkie, 2006), a combination that is sometimes called PBL online. The argument in favour of this combination is that PBL online is capable of promoting both the development of problem-solving, and student ability to use information technology; emphasizing the advantages of PBL as a promoter of process, as opposed to content, objectives (Watson, 2002). At first, technology was only used by teachers for administrative purposes, or for information dissemination (Lim, 2005), but as teachers became more familiar with such technologies, they sought to explore the potential of ICT in delivering collaborative inquiry through online forums (Lim, 2005). Some authors report integrating constructivist-based education of practical work such as PBL with online learning (Lim, 2005).

Integrating PBL with online learning basically means merging the pedagogy (which in this case is PBL) and delivering the content partly, or entirely, online via the Web. A key feature of PBL online is the online collaboration that occurs as part of the learning activities (Savin-Baden & Wilkie, 2006), and this focuses on team-oriented knowledge-building discourse, and reduced teacher-centred learning (Savin-Baden, 2006). Savin-Baden also notes that PBL online involves students working collaboratively in real time, or asynchronously, and collaboration tools such as shared whiteboards, video conferencing, group browsing, e-mail, and forum rooms are vital for the effective use of PBL online. Students can learn through the use of Web-based materials such as text, simulations, videos, demonstrations and related resources (Savin-Baden & Gibbon, 2006). In some cases, no print materials are provided, and students only can access materials directly from the course website (see e.g., Yong, Jen, & Liang, 2003). In other cases (e.g., Savin-Baden & Gibbon, 2006) there is a focus around a particular site, through which students are guided by the use of strategy problems, online material and specific links to core material, rather than wholly online delivery of PBL. In both cases, use of web sites is mostly student led, and the materials provided support the learning they undertake in face-to-face PBL groups. An example of such a site is that for the SONIC (student online of nursing integrated curricula) project (Savin-Baden & Gibbon, 2006), which implemented PBL in an interactive environment using FlashPlayer-based physiology resources in order to improve students expertise in nursing. Savin-Baden and Gibbon in an investigation of the interrelationship of PBL and interactive media, report that the assessment of combined PBL and interactive media to date have not extrapolated the difficulties of combining these two approaches.

ISSUES AND REPORTED ADVANTAGES OF PBL ONLINE

Savin-Baden and Wilkie (2006) describe how PBL can be implemented successfully in an online learning environment, noting that it must be integrated with the right pedagogy, and must be handled by an experienced practitioner, especially when it comes to tutoring or facilitating learning (see also Barrows, 2002). Hong (2002) reports that PBL implemented in a Web-course in Malaysia at the university level led to enhanced student attitude and academic performance, mostly as a result of implementing a conversation discussion room online, so that students could engage in online discussion asynchronously. Lim (2005)

likewise supports the benefits of asynchronous online forums to support discussion within learner groups to improve the current use of online forums in the PBL approach, and Sulaiman (2004) integrated PBL with online learning, using simulation, pictures, chat rooms and other learning aids. In a variation of PBL online, Lim (2005) incorporated an online forum and PBL in Law so learners could discuss facts and interview their clients electronically. Gosmann, Stewart, Jaspers, and Chapman (2007) sum up much research about PBL online, saying PBL can be integrated into a Web-course delivery and that such PBL online is at least as effective as a traditional PBL curriculum version, and that students enjoy learning via such a PBL approach.

It is reported that PBL online has many of the trademarks of traditional PBL models developed in 1960s by McMaster University, Canada, and delivered through face-to-face pedagogy. PBL online, like traditional PBL, is more than a linear approach to problem solving, where problem scenarios are used as key learning or key issues in online learning environments. However, Savin-Baden and Wilkie (2006) say that many practitioners, educators and researchers hold concerns about whether PBL online might adversely affect the existence of face-to-face PBL, because PBL online may be seen as being more cost effective. One concern here is practitioner anxiety that PBL online may conflict with intentions of PBL generally, since some forms of PBL online tend to put more emphasis on solving closely defined or outlined problems, meaning PBL online may be less successful in encouraging students to become independent inquirers who own their learning. A second concern is that learning in groups online may inhibit students' capacity to work through team difficulties and conflicts in the way face-to-face PBL occurs (Savin-Baden & Wilkie, 2006). Nevertheless, PBL online is an approach that stresses complementing, constructing and improving what is already in existence, rather than trying to replace face-to-face learning pedagogy activities (Gossman et al., 2007; Savin-Baden & Wilkie, 2006), and it is reported that PBL online promotes good cognitive engagement among students   (Gossman et al., 2007).

PBL online also aims to enhance students' ability to form structured approaches to deal with PBL exercises. When undertaking a PBL exercise, students are required to analyse and assess the given situation, make choices as to how they might tackle it, and provide recommendations for future action. They can, for example, make observations, seek further information from various sources and undertake common diagnostic tests. The use of PBL online to deliver PBL can, therefore, integrate the theory and the practice of the topic being studied. A PBL online approach allows students to be presented with a previously unseen problem (Gossman et al., 2007), and the literature suggests that it also can support student learning by reducing cognitive load because of the supportive learning environment (Gossman et al., 2007). What is important is that students have access to the objectives of the module, and the ability to negotiate their own learning needs in the context of the given outcomes (Savin-Baden & Wilkie, 2006). Facilitation of learning in PBL online requires teachers or tutors to have access to the ongoing discussions without necessarily participating fully, giving the groups minimal guidance, and ensuring the group discussion is maintained (Boud & Felleti, 1991; Camp, 1996; Savery & Duffy, 1995). It is important to realise, however, that different forms of environments utilized, whether created specifically for PBL, or adapted to be used with it, all seem to have a strong management genre in terms of the forms of authorship used. In other words, the design and management of the digital space is always strongly influenced by the teacher/tutor and their pedagogical inclinations or philosophies (Savery & Wilkie, 2003). The design of such digital spaces could be seen as being authored; both in the sense of authorial design behind the Web and the

authors of the written text who make up components of the web site(s). While the authoring of text (whether traditional or virtual) and the authoring of design can be seen as very different functions, it seems that both have the capacity to "impede the free circulation, the free manipulation, the free composition, decomposition, and free composition of fiction" (Foucault, 1988, p. 209). This would seem to introduce questions about the extent to which, for example, constructivist-based approaches to learning can be authored and managed in PBL online. Hence, as Ravenscroft (2004, p. 139) argues, "We need to investigate, examine and where possible, design appropriate learning communities if we want to support effective e-learning discourse."

The literature thus suggests that group learning is the norm in PBL whether face-to-face or online, and group characteristics must be taken into account when establishing an effective collaborative learning group. To compose a small effective group, whether cooperative, collaborative, or mixed, a number of factors must be taken into account: students' academic ability, gender and ethnicity (Aronson, 1978; DeVaries & Slavin, 1978; Slavin, 1978a; Slavin, 1978b; Springer, Stanne, & Donovan, 1999). Slavin (1980) says we must also include mutual concern among students. Some authors suggest we should maximize heterogeneity of ability levels (Aronson, 1978; DeVaries & Slavin, 1978; Slavin, 1978a; Slavin, 1978b). There are some outcomes that have also been measured or seen in cooperative learning; such as liking school, self-esteem, time on-task, ability to take the perspective of another person, and various measures of cooperativeness and competitiveness (Slavin, 1980). From a Malaysian perspective, work by Neo and Neo (2009) suggests that to compose a positive, effectively collaborative group, students should be randomly assigned, come from different backgrounds or faculties, and work with someone they do not know.

Though the literature showed that the use of PBL online in several context and other disciplines is engaging, and enabling students to develop a number of cognitive skills (e.g., Albanese & Mitchell, 1993) until now, little research has been done about to seek the students' perception on how the suitability on implementing this particular instructional method specifically in science education course like physics. With respect to development of education in higher education especially the science students and pre-service science teachers and the enhancement of the students engagement it is important to know how good PBL online classroom practices can be enhanced and what are the views of students about how effective PBL online discussion and working together. Hence the purpose of this paper is to explore the students' perceptions about the suitability and appropriateness on implementing the problem-based learning instruction through online in a physics course to better know what the real deal between PBL online and students is.

METHOD

The intervention done in this study was administered in Semester II during the 2008/2009 academic year at the School of Science and Technology (SST) and at the School of Education and Social Development (SESD) University Malaysia Sabah (UMS), Malaysia. The sample consisted of students from the Bachelor of Physics and Electronic Programme (science physics students) and also from the Bachelor of Education with Science Programme (pre-service science teachers) student who were taking Modern Physics course during the semester. There were 50 students who took part in the study. The students were separated into two main groups, one group formed the PBL group for SST (N= 30) and the rest formed the PBL group for SESD (N=20). The students learned in collaborative groups of 4-6 students, and there were total of 10 groups involved (6 group from SST and 4 groups from SESD).

Table 1 show the group sample for the study.

Table 1 *Group sample for the study*

Group	Science Physics Students (SST)	Pre-Service Science Teachers (SESD)
N	30 students (6 groups)	20 Students (4 groups)

The intervention was conducted over 16 weeks. During the intervention the entire learning activities delivered by using learning management system (LMS) provided from the Educational Technology and Multimedia Unit (ETMU) at the university. The researcher prepared and organised the LMS followed the PBL learning activities (including the problem's design) approach to fulfilled the learning and teaching activities via online. Thereupon students can access the LMS anywhere and at anytime they prefer suite to their own period and space. The university's library also provides student with five hundreds computers that have the Internet connection at a computer lab known as The Mega Lab. Thus, those who did not have their own computer can use the computer at the lab.

There were five problems need to be solved by each group. Students were engaged in variety of synchronous and asynchronous PBL learning activities, such as chat rooms; forum; sending and receiving e-mail from group members and facilitator; uploading their own materials to be used by other friends; downloading materials from the Internet; sending assignments and also get feed-back from facilitator. Since there were no fix times during the learning process, they can choose their own flexible time to carry out all the activities by online. A facilitator guided the groups cognitively in collaborative atmosphere all the way throughout the semester, in a very minimum direction.

Data were collected through an open-ended questionnaire they completed, and a semi-structured focus group interview after the intervention finished. The survey consisted of questions about the PBL online approach used during the intervention. In addition a focus group interview was conducted a week after the intervention completed. One of the main objectives of this survey and interview was to seek students' opinions about the suitability of implementing problem-based learning online (PBL online) in a physics course.

FINDINGS AND DISCUSSION

The data finding suggests that students reacted positively on the implementation of the PBL online in a physics course. Feedback for the physics science students and pre-service science teachers is first presented combined and any differences between the cohorts then discussed.

Error! Reference source not found. shows the themes that been categorised upon the open ended questionnaire and focus group interview of students' perception on the suitability of implementing problem-based learning online in a physics course. The themes formed by a question which are: Question 1. *What did you find to be least useful about learning using this learning approach?* And Question 2. *What did you find to be most useful about learning using this learning approach?* Also from focus group interview questions based on their perceptions after experiencing PBL online.

Table 2 *Themes of Students' Consideration on Implementing Problem-Based Learning Online in a Physics Course*

Question 1
Generally
i.   There are some technical issues;
ii. Lack of cooperation from group members
SST
i.   They couldn't get through enough syllabus;
ii. Too much chat session;
iii. Perplexed at the beginning of the assessment
SESD
i.   Least guidance from facilitator;
ii. Out of focus while doing discussion;
iii. Lack of visual picture
Other Perspective (Neutral)
i.   Nothing unbeneficial
Question 2
Generally
i.   More understanding;
ii. More cooperative;
iii. Internet connection as the major medium;
iv. Enhanced efficiency on solving problems
iv. Enhanced soft skills;
v.   Time management

Question 1: What did you find to be least useful about learning using this learning approach? In addition to the positive feedback above, the survey sought direct feedback about things students did not like about the intervention. A broad classification of the problems that students reported they encountered during this whole PBL online assessment shows they consisted of mostly purely practical problems and issues to do with teamwork contribution. Hence two main key themes can be classified as i. *Technical issues*; and ii. *Lack of cooperation from group members*. There also were complaints about the Internet connectivity when engaged in their chat room discussion. The description here also reports on the less common comments; viz., that not of the enough syllabus had been covered; too much monitoring of chat-room activities, and perplexed at the beginning of the assessment.

i.   Technical issues

Technical issues such as the poor Internet coverage and bandwidth around the university also played important role. A participant noted this and suggested that the system needs to be upgraded:

> It's just that I have problems with Internet connection in my area. So, this activity is very much useful if the student has proper Internet facilities of their own. (R1, SST, F, *questionnaire*)

Thus some students also suggested that face-to-face discussion is more effective:

> Chat room. Sometime when the server down, it meant our group cannot discuss effectively. I also thinking that face to face discussion is more suitable. (R5, SESD, M, *questionnaire*)

Issues to do with some students' computer literacy also were noted, and, for example, one student suggested that students needed at least some basic skills before taking part in the intervention:

> In term of online part it is an interesting part, but it could be problems if students have trouble with IT, for example, for those who has very low computer literacy and don't have confident to study via computer like myself. Since this approach is an advantages for us so that we can learn IT more. (R15, SST, *interview*)

Another student felt that it is not necessary to study via online, since many students still end up doing any problems at the last minute. So, from her point of view, students need to be encouraged to take any new learning approach seriously in order to achieve anything useful:

> For me honestly, this PBL is not too good because from my opinion the best part is we use the Internet. But when students use the Internet they often neglect other sources and information, such as books. Such students not taking it seriously, and mostly do these assignments at the last minute. Since the Internet itself means we can find the solution faster, we do not taking this matter as serious as we should while doing this task. So for me the Internet does not help us to improve ourselves much. (R26, F, SST, *interview*)

As noted above, poor quality of Internet connection at the university occasionally annoyed the students:

> I think the most important in this process is Internet connection. As we can see this PBL involve chat, find information [related to PBL]. So if we [as a student] did not get a good wireless connection, it is hard for us to solve the problem given. (R2, SST, F, *questionnaire*)

ii.   Lack of cooperation from group members.

A participant mentioned that despite not really knowing some of their team members that well, it gave them opportunity to arrange some development meetings and to exchange ideas and information that they had never thought of. Besides they also managed to organize their own timetable although each student had their own needs in learning:

> The problem is the teammates. It is really hard to cooperate with teammates because we do not really know each other well. That's the benefits of it because we can learn from them. Because some people learn very fast some are not and maybe that is the problem. Then about the discussion how we manage the timetable, since all of us have other commitment too, so it's hard for us to sometimes gather each other to do the chat room discussion. (R8, SST, M, *interview*)

Some students reported that their team members were indolent and failed to take part in the learning process:

Not all group members cooperated the in group because they are lazy. (R14, SST, M, *questionnaire*)

It was also reported that it was really hard for some students to get together online with their team members since they often had other commitments:

Hard to gather all group mate to discuss due to time and clash of other course. (R11, SST, M, *questionnaire*)

Some of the SST students commented on the syllabus, saying they *i. Could not get through enough syllabus;* there was *ii. Too much chat session* and also they were *iii. Perplexed at the beginning of the assessment.*

i. Could not get through enough syllabus

A participant brought up that the lack of time to cover all the syllabus really does not help much in their learning activities.

Least problem, but yet some topic is not covered: Special relativity, Compton Effect. This PBL just covered radioactive, EM Waves, solar only. (R6, SST, F, *questionnaire*)

ii. Too much chat session

And there was too much chat session to settle a problem, thus the students sometimes lost track while doing their second chat session since they had discussed all the meaningful points in their first meeting, as noted by a participant:

In my opinion, the chat session which will be held every week is the least useful about this learning. This is because there is nothing can be chat inside the chat room since we are required to discuss the same topic for 2 weeks. Actually, one chat session in two weeks is enough to us to discuss and share all views and ideas. For my group, we are having chat session every week. But we are having some trouble because for the second chat session, we are lack of idea since we already find out the best solution in the first chat session. Thus, I think the chat session every week is the least useful in this learning approach. (R13, SST, F, *questionnaire*)

iii. Perplexed at the beginning of the assessment

Students in PBL groups had struggled at the beginning of the intervention since it was a new way of learning for them. However, a participant commented that it is a proper way to encourage and to open their mind to think something that they had never thought before

The least useful is when the problem at first given is out of range and kind of hard for us to understand. It is not a very bad thing because when given problems like this, this will expand our ways of thinking and try to think outside the box for the positive sides. (R20, SST, F, *questionnaire*)

For the SESD students, there was more emphasis on the responsibilities of the facilitator where they felt *i. Little guidance from facilitator* and that the facilitator did not pay enough attention to their discussion session. They also felt they were *ii. Out of focus during discussions.* One participant also spoke about a *iii. Lack of visible pictures,* while chatting and discussing their problem through the chat room.

i. *Little guidance from facilitator*

A participant mentioned that the little guidance from the facilitator did not really help much in their learning outcome and they needed more direct instruction from the facilitator:

> The guide from the mentor was least. Sometimes student may get confuse in learning a new theory and concept, the guide and illustration from the mentor may help to clarify the new term. (R10, SESD, M, questionnaire)

ii. *Out of focus during discussions*

One student remarked that it was hard to justify whether their answer was right or wrong in terms of their final findings. Sometimes this had driven them to talk about a number of things and every so often their discussion covered issues that were unrelated to their research topics:

> But sometime when we discussing academic problem with member, there is a time we will talk something that out of the topic. The time we used to talk about non-related things is wasted. Therefore when doing a discussion problem, we should focus to the problem we facing. (R10, SESD, F, *questionnaire*)

iii. Lack of visible pictures

One disadvantage of online discussion is the difficulty of instantly describing what they are discussing because of the lack and very limited 'space' of the communication medium. Accordingly, a participant mentioned that it is difficult for them to come up with a good discussion:

> Lack of upload visual such as picture while chatting in the chat room. Makes us hard to explain and share our ideas with friends. (R14, SESD, F, *questionnaire and interview*)

Question 2: What did you find to be most useful about learning using this learning approach? There were several themes identified by students as to what they found most useful when learning through a PBL online approach: *i. More understanding; ii. More cooperative; iii. Internet connection as the major medium; iv. Enhanced efficiency in solving problems; v. Enhanced soft skills; and also vi. Time management.*

i. *More understanding*

A participant commented that, by learning with PBL it helps them to become alert to the recent social matters. This is one of the PBL key points, that problem presented must be a daily life problem that should take place in context. Additionally, the learning activities also make them to really relate cause and effect of every problem they have been given:

> I think the most useful about learning using this learning approach is I can know many problem or latest information that happening recently. At the same time, I can find some information which related to let myself more understanding. Besides that, I also discovered some way to solve the problems. The definition, cause and effect help me to improve my knowledge. (R12, SESD, F, *questionnaire*)

Notwithstanding the technology itself, is the PBL approach which most of the students reported to be the most practical way to deal with such complex topics or problems posed during the intervention. It was felt that the PBL approach involved many self learning activities that drove the students towards independent learning:

> This approach is most practical in understanding a complicated and difficult subject like modern physics because this subject is not entirely in closed discussion. So, this approach will provide student to further the research and discussion of this subject. (R1, SST, F, *questionnaire*)

ii. More cooperative

A participant noted that PBL helps them to practice collaborative learning, thus they can manage to give ideas and opinions to solve a problem:

> The most useful about learning using this learning approach is the co-operate giving the idea to solve the problem. (R1, SESD, M, *questionnaire*)

Despite the reservations about lack of cooperation in the teams mentioned above, some students commented that they learned to be more cooperative with team members when sharing their ideas and judgment about best solutions, meaning they felt they had improved their soft skills:

> From my point of view, the most useful about this learning is the discussion among the group to find out the best solution for the task given. It gives us chance to elaborate our idea according to the information which found. Besides that, during the discussion it also led us to be more active in giving out our ideas and views. Indirectly, it had improved my soft-skill. Moreover, the group work also train me to be more tolerate with my group members and understand the important of co-operative. By having discussion, the brain storming also makes me to think and understand more clearly about the concepts and theory of physics modern. (R13, SST, F, *questionnaire*)

iii. Internet connection as the major medium

One of the main things introducing PBL online in this study is to make sure students manage to find information and sources from the outside world without boundaries, and yet this opportunity has lead students to become more competent with their skill to track appropriate and suitable knowledge for their problem, as noted by a participant:

> The most useful is our efficiency on finding the solution by using the new technology were being far more better. (R2, SST, F, *questionnaire*)

Some students also pointed out that this chat room experience had helped them to better communicate their ideas with other friends, outside the intervention:

> I think at the chatting. This method is really helping me to share the knowledge with my other friends although I'm far away from them. (R11, SST, M, *questionnaire*)

The students commented that their competency and skills improved as they sought to find their best solution by the use of technology.

iv. Enhanced efficiency on solving problems

Creative and critical thinking are two main criteria in order for someone to solve problems in a meaningful way. That is what was noted by a participant saying that it is important to use these characteristics especially when finding, tracking and evaluating useful information that will lead to constructive information on that particular learning content:

> The most useful is the new experience in a way of solving question. It needs our critical and creative thinking. When finding a solution we will search many article about the problem and this will expands the knowledge of the student. (R9, SESD, F, *questionnaire*)

One student also pointed out that the real challenge is when the theories need to be applied in the outside world:

> As I mentioned before, the way we can try to relate the usage of out theoretical information learnt on class and apply it to the real life problems. Theories are easy to understand, but the challenge is how we can apply it into reality. By PBL approach, we can prepare early and will not get "culture shock" During our job days. (R20, SST, F, *questionnaire*)

v. Enhance soft-skills

A participant remarked that she managed to polish her soft skills such as communicating in meaningful way, building self-confidence and improving personal skill. In addition, her competency in computer usage were improving:

> Gain knowledge, besides I manage to improve my computer skill, communication skills. Build my self-confidence, and last but not least I manage to improve my inter- and intra-personal skill. (R3, SESD, F, *questionnaire*)

In addition, some of the students commented on their proficiency and expertise such as how to correspond with others. This skill they saw as vital in order to face real challenges when

engaging in communicating with others in the workforce in the outside world after graduation:

> Increased my skill somewhat, to communicate with other people (group members) especially when it come to conveying my ideas to them. Also it forced me to find other ways to manage my time more efficiently. (R23, SST, M, *questionnaire*)

vi. Time management

Students were exposed needing to use and manage their own time through this PBL online, especially when searching very wide for information and sources throughout the Internet. A participant commented that it is very helpful for them to follow the PBL instructions wisely because taught them time to manage their time judiciously:

> Be able to use the computer devices in searching through the Internet. This gives training to the student to be independent and be able to manage their time very well. (R10, SESD, M, *questionnaire*)

A participant commented on the flexibility of time afforded by online learning when arranging their group chat meetings and forum discussions:

> We can prepare our answer and chatting session in our own arrangement, it provide more freedom to us in our solution. Besides that, it can make me more independent and disciplined. (R22, SST, F, *questionnaire*).

CONCLUSION

The main objective of this paper was to evaluate the potential on implementing the PBL online in a physics course based on students' considerations. Two main questions have brought up several main themes from students' reflection. It can be a practical guide for researchers and lectures before implementing a PBL online in their courses generally. In conclusion it is clear that students have reflected some beneficial facts through this PBL online approach. The findings come up with several main themes focused on some technical issues besides there was lack of cooperation from group members. Majority of science physics students agreed that they couldn't get through enough syllabus; too much chat session and also confused at the beginning of the intervention. In other perspectives pre-service science teachers generally agreed that there was lack of guidance from facilitator hence they were always out of focus while doing discussion. However when it comes to their consideration about what is the most useful about the PBL online, they agreed that they were more understand, more cooperative, internet connection as the major medium, enhanced efficiency on solving problems besides improved their soft skills and also they managed to be more effective time consumer.

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