The Impact of Coronavirus 2019 (COVID-19) and the Adaptation of Problem-Based Learning Through Online Learning
ผลกระทบของโรคติดเชื้อไวรัสโคโรนา 2019 (โควิด-19) และการประยุกต์ใช้การจัดการเรียนรู้โดยใช้ปัญหาเป็นฐานผ่านการเรียนการสอนออนไลน์

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Received: March 2, 2022
Revised: April 10, 2022
Accepted: May 6, 2022

Abstract

After the pandemic of Coronavirus 2019 or COVID-19, there have been harmful effects on several dimensions e.g., society, economic, education, etc. there has been the policy of closing educational institution in order to reduce the opportunities to spread out the contract the pathogenic viruses. however, everything, including education, needs to move on. there fore, the methodology to deal with this situation is to learn online. Notwithstanding, online learning has both pros and cons; for example, learners can apply technology to studying and researching more effectively by themselves, while they can perhaps be distracted by outside stimulations. as a result, one of the appropriate solutions is problem-based learning (PBL) that the learners have a major role to understand and, focus on the lesson and create a new set of knowledge by themselves. this article presents different perspectives of literature review related to problem-based learning (PBL) online. several resources and information are collected, analyzed, and synthesized to achieve the goal of this work that is to demonstrate the pros and cons of online problem-based learning (PBL).

Keywords: Problem-based learning, online learning, coronavirus 2019, Impact of COVID-19

บทคัดย่อ

เนื่องจากสถานการณ์การแพร่ระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 (โควิด19) ได้ส่งผลกระทบอย่างเห็นได้ชัดในหลายมิติ ไม่ว่าจะเป็นด้านสังคม เศรษฐกิจ หรือแม้แต่การศึกษา โดยมีคำสั่งปิดสถานศึกษาเพื่อเฝ้าระวังการแพร่ระบาดของโรคดังกล่าว แต่การศึกษายังคงต้องดำเนินต่อไป ดังนั้น วิธีการจัดการกับการเรียนการสอนในช่วงสถานการณ์เช่นนี้ การจัดการเรียนการสอนออนไลน์จึงเป็นคำตอบที่เหมาะสมที่สุด กระนั้นก็ตามการจัดการเรียนการสอนออนไลน์มีทั้งข้อดีและข้อเสีย เช่น ผู้เรียนสามารถใช้เทคโนโลยีในการสืบค้นข้อมูลเพิ่มเติมได้ด้วยตนเอง และยังฝึกทักษะการใช้เทคโนโลยีเพื่อการศึกษาได้ อย่างไรก็ตาม ผู้เรียนอาจจะถูกสิ่งเร้าจากภายนอกทำให้ไม่มีสมาธิกับการเรียนการสอน

เหมือนการเรียนในชั้นเรียนได้ ดังนั้น หนึ่งในวิธีการแก้ไขปัญหาที่เหมาะสมนี้คือการจัดการเรียนรู้โดยใช้ปัญหาเป็นฐาน เพื่อให้ผู้เรียนได้มีบทบาทและโอกาสในการทำความเข้าใจและเพ่งความสนใจไปยังบทเรียน เพื่อสร้างองค์ความรู้ใหม่ที่ตนสืบค้นขึ้นมาเอง บทความนี้ทบทวนวรรณกรรมที่เกี่ยวกับการจัดการเรียนรู้โดยใช้ปัญหาเป็นฐานผ่านการจัดการเรียนการสอนออนไลน์ จากแหล่งข้อมูลการเรียนรู้ต่างๆ อาทิ บทความวิจัย บทความวิชาการ หนังสือและตำรา โดยทบทวน วิเคราะห์และสังเคราะห์ข้อมูลเพื่อประโยชน์ในการศึกษา บทความนี้มีวัตถุประสงค์เพื่ออธิบายถึงข้อดีและอุปสรรคของเรียนจัดการเรียนการสอนออนไลน์โดยใช้ปัญหาเป็นฐาน

คำสำคัญ: การจัดการเรียนรู้โดยใช้ปัญหาเป็นฐาน, การจัดการเรียนการสอนออนไลน์, โรคติดเชื้อไวรัสโคโรนา 2019, ผลกระทบของ โควิด19

Introduction

Coronavirus 2019 (COVID-19) began to raise from December 2019, first found in China. This pandemic hindered all fields of business and education, as business offices and educational institutes were closed. As a result, online teac hing provided an alternative teaching tool for edu cation. However, the efficiency of online teac hing and student preferences for online teaching is still in need of development. It is due to the fact that less interactive study could lead to less understanding of the lessons. Since the COVID-19 began to spread out all around the world recently and seemed to continue its infection endlessly, there have been significant changes of every life. The pandemic causes world-wide problems leading to multi-dimesional socio-economic problems which are to be solved by a generation, instead of experts or specialists of problem solving (Buheji, M., & Buheji, A., 2020). It also affects world-wide supply chain, import-export goods, travelling, holidays, or even entertainment activities. In addition, education is also affected by this pandemic due to the fact that students are currently supposed to study online instead of onsite in a classroom classroom in order to reduce the risk of the pandemic contraction from touching and using the same utilities. They are required to study online. Therefore, they tend to have less classroom interaction, especially in-person interaction with classmates and teachers. Because of this limitation, education is in need of earning strategies to cope with the problem and to fill the gap of online education. This article presents problem-based learning for online learning during the pandemic of COVID-19.

Compared with the other two major pandemics of the 21st century, Severe Acute Respir atory syndrome (SARS) and Middle East Respir atory Syndrome (MERS), Coronavirus Disease 2019 (COVID-19) seems to possess a much higher speed of transmission. It has resulted in a global pandemic reaching over 100 countries and locations in such a short time. In addition, the frequency of infection is diverse in each country because of socioeconomic and meteorological factors (Jiang, et al., 2021). International travel surely contributed to the outbreak to some extent. Kaohsiung Medical University in 2007 has employed PBL in the International PBL Workshop in July 2007, revealed that one of the cases portrayed a hypothetical outbreak of pandemic influenza, in which is a case in the curriculum of the University of Hawaii,

John A. Burns School of Medicine. This activity created much discussion as well as formal lear ning issues through the development as one of a set of PBL cases on preparedness. Students and faculty from Taiwan, Hong Kong and Singapore also reflected on their experiences of the severe Acuteb Respiratory Syndrome (SARS) which had an outbreak in 2003 (Marshall, et al., 2008). The participants' response to the pandemic was a local phenomenon that could bring about a huge impact on the entire sectors of society besides the health care system, as the study found with SARS epidemic. However, Moreover, there have been few studies concerning training for a coordinated and culturally appropriate response to public health emergencies.

The objective of this article is to demonstrate the pros and cons of online problem-based learning (PBL). The article gathers a number of previous studies until the most recent study on the day of writing this article. This is to discover the change and development of problem-based learning application, both online and offline. In this article, the author will investigate the advantages and disadvantages of online learning through problem-based learning.

Literature Review

According to John R. Savery (year: page), Problem-based learning (PBL), a strategy to transfer solutions through the process of research and project. It is the combination of theory and practice, as well as the application of knowledge and skills (Savery 2006). He also claims that that PBL is "an instructional approach that has been used successfully for over 30 years and continues to gain acceptance in multiple disciplines." Problem-based learning was firstly developed in 1969 by Faculty of Health Science, McMaster University, Canada. It was employed with training medical students to analyze treatments of any symptoms. After that, other fields of study and other institutions also adapted this learning method for their teaching and learning (Norraratch, 2019). PBL, in other words, is the ability to conduct 'root cause analysis' that can bring and effective solution. Its structural learning is learner-center approach. Moreover, PBL needs an attitude of "inquiry-based learning (IBL)", in which encourages critical thinking (George, 2011). However, the study by Sansin-Fisher and Lynagh (2005) suggests that although the available evidence is methodologically flawed, the support for the different findings from this study together with a little range of learner population indicate a need for further study. Norraratch (2019) concludes that the significant characteristics of problem-based learning consist of the following aspects.

1. There must be problematic situations in which problem-based learning would be applied to stimulate learning process.

2. The problems to be learned should be those can be occurred in daily lives.

3. Learners gain knowledge through self-directed learning by searching for answers, managing time, selecting learning methods, and evaluating learning income by themselves.

4. The smaller groups, the better learning achievements. Learners also learn to work as a team. They can share and learn within the group.

5. The methodology should be integration between knowledge and skills so that the learners would have clearer answers.

6. Knowledge gained after the problem-based learning process.

7. Learning evaluation is according to the real situation, which considers the learners' learning progress.

The characteristics of problem -based learning include real-life experiences, often-occurred problems, adequate information for research, ambiguous or complex problems, controversial issues, no exact answers, trendy and unknown-solution problems, problematic situations, true statements but being wondered by learner, problems that cannot be solved right away, problems that improve knowledge and skills based on curriculum. Albanese and Mitchell (1993), and Vernon and Blake (1993) who employ problem-based approach to instruction which is similar to traditional approaches in terms of conventional tests of knowledge, such as score from the examination find out that students who involve in PBL manifest better clinical problem-solving skills.

Barrows (n.d., as cited in Savery, 2006) has described the initiation of problem-based learning in detail as a set of Generic PBL Essential as follows:

A Set of Generic Problem-based Learning Essential

1. Students must have responsibility for their own learning. Because problem-based learning is the learner-centered approach, the students should engage the problem with their existing experiences/knowledge affords.

2. The problem simulation used in problem-based learning must be ill-structured and allow for free inquiry. The real-world problems are that they would not be problems, on the other hand, they are ill-structured. PBL enhances critical thinking in order to identify the problem and indicate the factors to develop the solution.

3. Learning should be integrated from a wide range of disciplines or subject. The more people in real world need to recall and apply information integrated from diverse resources in their work, the more the students need to access, the more study and integrate information from all the disciplines that perhaps are related to understanding and resolving a particular problem are necessary.

4. Collaboration is essential. After grad uation, the students will join the world of working where they need to share and work productively with others. Therefore, the PBL helps them about the development of the mentioned skills.

5. What students learn during their self-directed learning must be applied back to the problem with reanalysis and resolution. When students have a chance to use their existing knowledge and skills to share with the group, the problem will possibly be solved.

6. A closing analysis of what has been learned from work with the problems and discussion of what concepts and principles have been learned nature is essential. As for experiential learning, learners are often very close to the instant information of the problem and solution. Learners examine how all aspects of the PBL process to better understand what they have experienced.

7. Self and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit. Teac hers should reinforce the self-reflexive the self-reflective nature of learning and improve the processing skills.

8. The activities carried out in problem-based learning must be those valued in the real world. A rationale and guidelines in choosing PBL activities are discussed in several articles (Severy & Duffy (1995), Stinson and Miller (1996), Wilkerson and Gijselaers (1996, as cited in Severy, 2006), and Macdonale (1997).

9. Student examinations must measure student progress toward the goal of problem-based learning. Knowledge-based and process-based learning are the goals of problem-based learning. Students are required to engage with problem, recognize, and articulate what they know and how they have learned.

10. Problem-based learning must he pedagogical base in the curriculum and not part of a didactic curriculum. This is the important aspect due to the fact that tutors should be just the facilitator of learning while learners should be self-directed and self-regulated in their learning, also, PBL is clearly described as "the essential element in the design of ill-structured instructional problems as the driving force for inquiry" (Savery, 2015, p. 9).

These aforementioned elements shed light on the instructor's role, in which would change to be a facilitator of learning so that the learners' responsibility would be more self-directed and self-regulated in their learning. Furthermore, this is the challenge for instructors in adopting a PBL transform themselves as knowledge providers to tutors or as managers to facilitators of learning. Severy (2015: 1) also clarifies PBL in the book tilted The Tutorial Process by Barrows (1988), that "some of the information needed to understand the problem or situation has to come from knowledge in the memory of the problem solver; recalled facts, concepts, and prior experiences relevant to the problem" (p. 1)

Marshall et al. (2008) claim that PBL is the efficient methodology to prepare multidisciplinary learner groups by giving examples during problem-solving of community health centers outbreak of SARS pandemic in Hawaii. PBL experiences enhance knowledge of bio event preparation and increase the value of multidisciplinary group process. The PBL experience revealed that it helped the overall increase in knowledge of bio event preparation. This could be concluded that experience increased the value of the multidisciplinary group process.

Jiang et al. (2021) further justifies that the dental students are very satisfied with the PBL courses. However, some students give an opinion that the courses are general and are not satisfied. The participants prefer Lecture-based learning (LBL), case-based learning (CBL) to PBL for online classes. The study revealed that the dental students accepted online learning during COVID-19 pandemic, therefore, the courses on COVID-19 helped them understand how to prevent COVID-19 transmission in the dental clinic better.

Condition of Problem Solving after COVID-19 and the New Normal Era

Society demands new set of knowledge and skills in this the 21st century, which are known as 21st-century competencies or abilities (Yurniwati & Utomo, 2020). Several studies investigate the requirement of problem solving in post-covid-19 and the new era. For example, Nurtanto et al. (2020: 34) study with a question that the learner in the new normal is expected to resolve, collate and understand existing information to build a new form of knowledge, discuss the results and experiences and reflect on establishing "new profound knowledge". It would be assumed that the numerous PBL attitudes development come from instructors that use IBL or inquiry-based learning or learning by exploring. The technique to ask types of questions which are selected carefully to deliver the desired effects.

Problem-based learning and inquiry-based learning are very similar to each other. The study by Walker et al. (2015: 11) and the characteristics

of each kind of leaning will be summarized as shown in Table 1. The Italic sentences are those definitions that are similar to each other.

Table 1

Comparison between problem-based learning and inquiry-based learning

Problem-based learning	Inquiry-based learning
• An instructor supports the process and expects lear ners to make their thinking clear, but the tutor does not provide information related to the problem—that is the responsibility of the learners. • It is a strategy to transfer solutions through the pr ocess of research and project. It is the combination between theory and practice, as well as the applic ation of knowledge and skills. • Its structural learning is learner-centered approach • Its activities begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new - found knowledge.	• An instructor is both a facilitator of learning (encou raging/expecting higher-order thinking) and a provider of information. • It starts with the learner's curiosity. • It is a student-centered, active learning approach focused on questioning, critical thinking, and pro blem solving. • Its activities begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new - found knowledge. • It is frequently used in science education and encourages a hands-on approach where students practice the scientific method on authentic pro blems (questions).

Problem-based learning creates more critical thinking, problem solving, self-managed problem-solving, self-managed learning, adap tability, communication, interpersonal skills, and teamwork. This capacity is considered an advantage of PBL. The unexpected COVID-19 pandemic results in a sudden consequence of broader changes in the modern world. Notwit hstanding, we are in need of new attitudes and behaviors which could shape our life; amongst the top ones are the capacity to learn through problem-solving (Bird, 2020).

This rapid change causes the new possibilities for the new type of problems to be solved. Some meaningful types of questions should include more higher-order and thought-provoking questions, rather than only a number of questions (George, 2011). Carder et al. (2001, as cited in Buheji, M. & Buheji, A., 2020) believed that

"the case-base, problem-based, learning (CBPBL) is what could change and demonstrate and identify any information needs. There is a specific type of problems and thinking that would address new normal requirement and improve what enhance the learning capacity that could come from collaboration, creative problem-solving and openness to new ideas"

Carder et al. (2001 as cited in Buheji, M. & Buheji, A., 2020) also suggest that the following key information in the questions such as "What is happening?", "Who is being affected?", "Where is it occurring?" "When and how frequently is it happening?", "How does the problem take?", "How to quantify of the impact of the problem?" is the most suitable problem to work

during the new normal. Coiado, O. C., Yodh, J., Galvez, R., & Ahmad, K. (2020) conclude how the COVID-19 transform problem-based learning at Carele Illinois College of Medicine in which students are subject to terminate in-person instructions. The study showed that the online environment tends to run slower since it is needed to pause to allow time for people to speak and others to understand as well as there is an opportunity that the students can be distracted from surroundings. Therefore, the instructors are supposed to perform a greater role to keep students focused and engaged during the class. However, when studying online, students find some creative ways to participate the class such as pressing "reactions" or "emoji" button and online chat. Not only students react creatively, but instructors could also, but instructors could also comment to a certain student privately during the class. In sum, online learning can manifest immediate reactions and comments or feedbacks while in the class. The study also revealed that not only does online problem-based learning prove to be an efficient model of learning, but it also presents opportunities to enhance medical education in the future.

Marshall et al. (2008: S40) argue that even though the problem-based learning (PBL) has been recognized by the World Health Organization (WHO) as the most appropriate pathway for teaching multidisciplinary teamwork, a report published by an expert panel of the Association of American Medical Colleges on the "broad spectrum of teaching strategies" for training future clinicians to respond to large-scale health emergencies makes no mention of a PBL-based approach to learning about and training for preparedness. It is unfortunate, because PBL as a process in which participants learn through scenarios to determine what information they need to understand and address the problems presented. However, the result of their study manifested that the evaluation of the PBL program usage to show the issues surrounding a pandemic response and preparedness in multidisciplinary, community-based settings was the first of its kind. It also revealed that PBL approach is useful in educating community-based health professionals from different trainings about issues related to pandemic preparedness. Conduc ting PBL with divergent students brought issues of multidisciplinary communication and collaboration to the front. The study suggested that PBL ought to be further utilized in such training. By studying several studies about problem-based learning and online learning during the COVID-10 pandemic, it could be concluded that the problem-based learning has a major role to encourage learner's creativity and inquiry-based learning in order to show their findings and new set of knowledge based on their finding.

The results of the study by Marshall et al. (2008: S40) have been divided into five categories:

(1) effect of the module on knowledge of bioevent preparedness.

Comparing the pre- and posttest scores, there was an overall increase in all testing components.

(2) PBL case content and process.

Participants were asked to rate the PBL case content and process. Participants indicated that the case used a practical scenario and was written in a way that provided for group discussion. They also added that all health perspectives were sufficiently addressed in the case. They explained that they could investigate the learning issues on their own access a variety

of resources to discover their works.

(3) multidisciplinary group process.

Participants felt that they had actively participated because they had provided ideas to the success of the issue and show their thoughts without judgment. They also accepted that the group had worked cooperatively rather than competitively.

(4) overall review of the PBL case.

The overall results showed that participants strongly agreed with the PBL process as the traditional lecture format for learning about bioevent preparedness. They also felt better when prepared to cope with a similar event and agreed that the PBL process benefited from the multidisciplinary environment.

(5) qualitative data.

The participants from all disciplines rated high score to the PBL approach, in which indicated that they preferred the PBL process to the traditional lecture format for learning about bioevent preparedness. It also proved to be of educational benefit, with pre- and posttest scores showing that self-reported knowledge increases in several classes. They also agreed that the PBL process was benefited from the multidisciplinary environment. Therefore, multidisciplinary education was called as the best tool to prepare professionals to improve collaboration.

Roles of the instructors

Cross out this part since it is irrelevant to the topic and the results from Jiang et al. study did not support PBL.

The roles of instructors are vital in PBL. As mentioned earlier, the instructors support the process and expect learners to make their thinking clear, but when the instructors play the roles as tutors, they do not provide information related to the problem; it turns to be the responsibility of the learners. However, they should differentiate the needs and interests of their students and try to make their questions based on the interests and needs. Therefore, the instructors are supposed to put the questions into contexts. In order to build in-depth questions, it is needed to design an understanding criterion to create a width of ideas by asking divergent questions that the answers vary. This opens the horizon to think, reflect and be creative.

Problem-based Learning Online During the Pandemic: Online Learning the New Normal

The 21st-century skills can be categorized into two main types: ICT competencies and high-level skills. ICT competence or digital competence is considered as a set of knowledge and skills. to master several technological resources for use in various academic assignments and training activities (Yurniwati & Utomo, 2020). High-level skills include cognitive skills: critical thinking, creative thinking, self-managed learning, problem-solving, and communication skills.

To prevent the outbreak of such pandemic among students, an online class seems to be a reasonable alternative. technology and smart gadgets such as the Internet, smart phones, tablets, and laptops which make it easier to listen to classes and contact with teachers. For the web-based virtual environment, learners can continue to engage with live academic lectures and even save and review them later whenever and wherever they choose.

Online learning is opposite to face-to-face learning platform in class. Students learn outside the classroom through lecture materials such as

videos, e-books, e-notes PPT etc. using different online platforms.

COVID-19 has disrupted all activities of life and livelihood in learning. As a result, in order to prepare and prevent against the worst, the mindset in new normal is needed, as well as capacity to do business and deliver service in the future. General perception of the need of this new era and rising demands of the community or organization condition need to be tested and stimulated in order to measure the necessary of problem-based learning in the new normal era.

O'Brien et al. (2019) suggests a balance between problem-based learning and current crisis trends, technological updates, imple mentation strategies, and research methodologies, which emphasize the significance of workplace learning that are different in each organization and depending on the type and technology used. The design and implantation of PBL program would be influential factors to promote PBL for learning opportunities, regardless of the sector and industry type. This program is related to the emerging of technological platforms and applications we are using, significant improvement in 'experiential learning' that supports the workplace learning. Regarding to the aforementioned benefits of the PBL, 'innovative thinking' is beneficial in the development of the the new normal workplac e-related professional competence (Buheji and Buheji, 2020).

Online Problem-based Learning

At present, there are several meeting applications mainly used in different teaching groups such as Zoom Meeting, Google Meet, Microsoft Teams, etc. On the contrary, Jiang et al. (2021) investigate the employment of PBL online at Zhejiang University School of Stomatology (ZUSS) which use DingTalk (Alibaba, Hangzhou, China) and Voov Meeting (Tencent, Shenzhen, China). These applications provide free HD online meeting, texting, and file-sharing systems. They allow most of the teaching activity to be carried out online. ZUSS was long-established and refined databases for PBL which has been in use for offline teaching for a long time. In the lecture, the groups would be given an online presentation to manifest their understanding of the problem or their diagnosis and treatment plan for the case. In the meanwhile, students in other groups, facilit ators and teachers could give some opinions and questions right after the presentation by posting comments on the chat box or speaking online.

After the study, Jiang et al. (2021) concluded the results of the questionnaire on opinions of PBL online classes. The excerpt of the results is as shown in Figure 1 (p. 5).

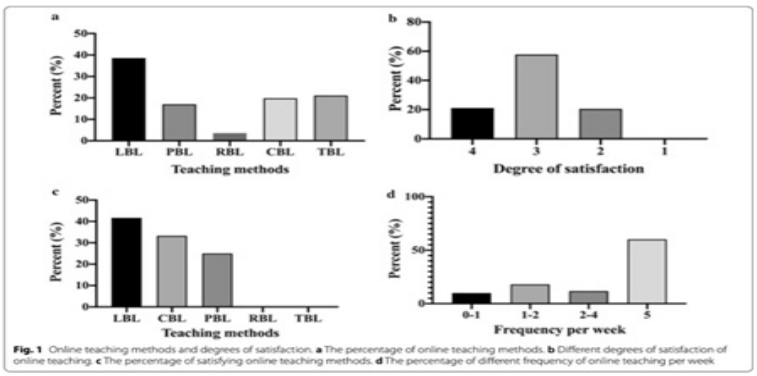

Fig. 1 Online teaching methods and degrees of satisfaction. **a** The percentage of online teaching methods. **b** Different degrees of satisfaction of online teaching. **c** The percentage of satisfying online teaching methods. **d** The percentage of different frequency of online teaching per week

Figure 1 *The results of the questionnaire on problem-based learning of dental students from the faculty of ZUSS Resource: Jiang, et al. (2021)*

Figure 1 presents the results of the questionnaire on problem-based learning of dental students from the faculty of ZUSS, which reveal that "Dental students accepted online dental learning during the COVID-19 pandemic".

González-Gómez (2019) conducted a study of the effect of flipped classroom (a type of blended learning in which the traditional class setting is inverted) on self-efficacy and scientific attitudes towards pre-service teachers in Spain. Experiments were held online with a website platform containing videos and questions. Students discussed complex problems using rules and case-based reasoning during the class. The result of the study revealed that it can improve self-efficacy and create positive attitudes.

John (2020) recommends seven key ideas for making PBL learning a reality in distance learning as follows:

1. Make it optional: sometimes learners struggle with PBL, so there should be integration of both traditional way such as worksheet, and development of critical soft skills.

2. Take it away from the screen: because distance learning does not mean to spend hours only in front of a screen, learners can engage in movement as they work on projects at home.

3. With true collaboration, group member does not feel like work: working with teammates possibly creates something extraordinary that one could have never done alone. Teamwork supports interdependence in which is in between being independent and dependent, as shown in Figure 2.

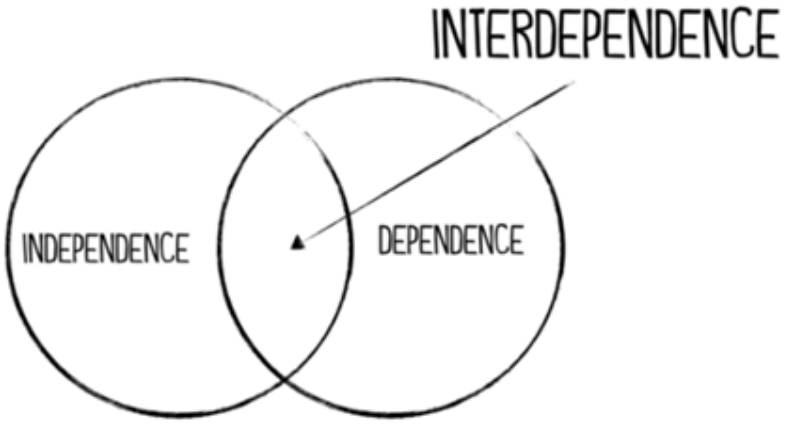

Figure 2 *The overlap of being independent and dependent: interdependence Source: (Spencer, 2021)*

4. Boosting creativities with structures: Projects seem to break apart when they are unstructured. The first type of structure is at the larger macro level which includes phases in a project. There could be an inquiry phase, a research phase, a planning phase, and a crea ting phase. They might also follow the publishing process, the scientific method, the engineering process, or the design thinking process. However, the idea is to break it into phases.

Conclusion and Suggestion

The pandemic brought challenges and chances which overwhelmed with many untapped problems that still need to be dealt with. Due to the fact that the pandemic of COVID-19 is currently changing the world norm, many sectors are severely affected, including the education

sector. The implementation of education is no longer done face-to-face in the classroom, but education will be carried out remotely. The distance education would be carried out by using the technology. Therefore, the ability of teachers and students using information technology to manage classes truly influences the process of distance learning. This could be the new needs of humanity due to the pandemic. The solutions formed a central part of the early responses to the pandemic, and the new environmental management is created (Marshall et al., 2008).

PBL takes out the curiosity spirit which could be called the root cause. It ensures that the problems would not only be addressed by the symptoms, but also by the causes of those problems. It addresses what is needed to learn to find the root cause through experimentation or research. In addition, problem-based learning could solve the problem of limited resources such as cost and expense in education. In order to solve this problem, it is significant to prevent not to make the problem worse before improving the problem. Problem-based learning could help reduce the limitation of the cost in which is the most needed in the era of social distancing and lockdown era. For instance, Laxton et al. (2020) revealed that COVID-19 pandemic brought many limitations, such as policy, collaboration, individualization, leadership, reorganization, and education of post-acute and long-tern care. Since the new normal of education is full of uncertainty and complexity, tailored plot and structured learning programs in the workplace will not become disruptive conditions in different communities. As a result, problem-based learning (PBL) program could be considered the most suitable altern ative way of learning. It also helps the workplace to apply 'learner centered approach' faster without undermining the educational and training requirements. In addition, learners are free to research and find the answers of the problems by themselves. By doing this, they will be more confident with what they have found and be able to present to the class.

Learner-centered and problem-based learning approach have proved to be effective in interdisciplinary education. As a matter of fact, there have been several successful evidence in medical science and engineering filed. These experiences need to be transformed into other disciplines in the new normal to enhance the capacity and viability towards newly realized life and livelihood challenges. Problem-based learning online can be well achieved if the instructors manage their teaching well; for example, using effective teaching materials, obtaining teaching tips and extra information to guide the students to think further. In addition, students engaging in using problem-based learning are recommended to pursue their knowledge according to their proficiency. Problem-based learning online is a teaching model which can be applied in the teaching of different disciplines which are conten t-based. However, its limitation should be considered. For example, there should be adequate space for learners to learn in groups, appropriate and easily accessible resources, and most importantly, good attitude to PBL. In conclusion, the aforementioned management is the key to success of employing problem-based learning in different fields of study. As a matter of fact, PBL should be further employed across disciplines such as humanities and business administration as well. In the future, there is supposed to be an adaptation of PBL in the context of Thai educational management,

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