

Collaborative Problem-Based Learning Models Implementation in Vocational High Schools

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Abstract: The low quality of vocational graduates and vocational graduates' competitiveness in Indonesia are influenced by various factors. Not only because of the lack of teachers who apply the authentic learning, but also the low of students' ability to collaborate and solve the problems. This research aims find out how Collaborative Problem-Based Learning Models (CPBL) are able to develop students' ability to solve problems and be skilled in working both individually and in groups. The type of this research is a literature study, where the research data is collected from various relevant sources according to the research topic. The data analysis technique used is descriptive-qualitative. The results of the study show that (1) the implementation of CPBL is able to help students develop problem solving skills; and (3) the implementation of CPBL is able to help students develop student work skills both individually and in teams.

1 INTRODUCTION

The learning model is one of the instruments used by the teacher in carrying out the learning process in the classroom. Through the learning model, the teacher can design learning schemes according to the learning concepts needed based on the material criteria and students' characteristics. The learning model applied by the teachers will have a broad impact on the learning process, and students learning outcomes.

In this modern era, ideally, the learning model used is the models that lead us to the authentic learning. Authentic learning is a learning model that uses problems in real life as the basis of the learning process. Besides, the learning concept used needs to be adapted to the demands of the workforce in the 21st century. In order to produce VHS graduates that are able to compete towards the 21st-century world of work, according to Kivunja (2014), there are four skills that students can provide: (1) critical; (2) communication; (3) creativity; and (4) collaboration.

One learning model that began to be developed and has relevance to collaboration skills is collaborative problem based learning models (CPBL). The basis of this model is a problem-based learning which is integrated with collaboration skills.

Collaboration is one of the most important skills to be taught during the learning process, considering that humans are social beings (Barrows, 1985). Through this model, students are not only directed to be able to develop their learning independence and creativity but they are also encouraged to be able to do problem-solving in groups (Mühlfelder & Chandrasekaran, 2015).

The Implementation of collaborative problem based learning models is not only based on certain levels of education, but also can be implemented at the level of basic education to the higher education. One of the appropriate education levels for this learning model is vocational high school (VHS). Vocational high schools are considered to apply this model because VHS is one of the educational levels that is expected to be able to produce a skilled workforce in accordance with the demands of the 21st-century.

Learning materials in VHS taught by teachers are generally useful material for students when entering the workforce. In the world of work, not all work can be done independently but must be done using cooperation because it is natural if the teacher begins to familiarize students to begin to foster an attitude of cooperation or collaboration skills among students. However, until now there has been no apparent

reference for implementing collaborative problem based learning, especially at the vocational level.

Generally, learning materials that are taught in VHS by teachers are the material needed by the students when they work. In the workforce, not all work can be done independently, but must be done through the teamwork. Knowing the importance of collaboration skills, teachers should begin to accustom their students to promote a cooperation or collaboration skills among students. However, unfortunately until now there has not been a clear reference for implementing collaborative problem based learning especially at the vocational level.

Based on several reasons as described above, there are two questions as follows: (1) how can CPBL develop students' ability to do the problem-solving?; (2) how can CPBL develop students' ability to be skilled at work, both individually and in teams? Therefore, to answer these questions, it is necessary for the researcher to conduct a research entitle "The Development of Collaborative Problem-Based Learning Models at Vocational High Schools (VHS)".

2 LITERATURE REVIEW

2.1 Problem-Based Learning Model

Problem-based learning is a student-centered learning model. This model directs students to be able to carry out investigations, integrate theory and practice, and apply the knowledge and skills they have to solve (Savery, 2006). PBL's primary goal is to improve students' ability in solving the problems. This model according to Hung, Jonassen, & Liu, (2008) has several characteristics, as follows:

First, Learning has a focused problem. With the focus of the problem in the learning process, students can begin to deal with authentic and unstructured problems. Focused problems emphasizes to the students's ability to connect the knowledge they have with their experience in solving problems.

Second, student-centered learning, so the school tends not to be able to intervene in the learning process. Third, independent learning. In the learning process, this learning model requires students to form groups of 5-8 students to maximize the diversity and experience of each student (Justo, Delgado, Vázquez-Boza, & Branda, 2016; Scott, 2014). Based on the difference and expertise that has been achieved, students are required to be able to develop their abilities, both individually and help each other in groups.

Fourth, self-reflection's learning. Students are required to be able to monitor or reflect on their understanding. They also need to be able to adjust learning strategies that are match with their characteristics. Fifth, the teacher only acts as a tutor or facilitator. This learning model emphasizes the role of the teacher who is no longer a disseminator of knowledge, but change as a student's facilitator.

2.2 Advantages and Disadvantages of Problem-Based Learning Models

Problem-based learning (PBL) is a useful model to be implemented in a learning system. This learning model provides the opportunities for students to exchange ideas, knowledge, and respect each other when there are the dissent within the group (Alrahlah, 2016). Besides having advantages, PBL also has a disadvantage in its implementation. The advantages and disadvantages of PBL seen in Table 1.

Table 1: Advantages and disadvantages of Problem-Based Learning Models.

No.	Advantages	Disadvantages
1.	Student-centered learning: It encourages, active learning, enhances understanding, reference, and development of lifelong learning skills	The teacher cannot "teach": The teacher emphasizes that students can construct their knowledge and understanding so that they tend to frustrate students
2.	General competencies: PBL allows students to develop the desired general skills and attitudes in the future workplace practice	Human resources: Requires more than one teacher in the learning process
3.	Integration: PBL facilitates and supports integration in the core curriculum.	Other resources: All students are directed to access information from the

No.	Advantages	Disadvantages
		library, the internet, and other sources simultaneously
4.	Motivation: PBL must be conditioned to be a fun learning model for students and teachers, and the process requires that all students be actively involved in learning	Role of the model: The opportunity for students to ask teachers is reduced
5.	Deep learning: PBL encourages deep learning (students interact with learning materials, connect concepts with daily activities, and improve their understanding)	Excessive information: Students may become less confident when studying independently
6.	Constructivist approach: Students activate prior knowledge and build on existing conceptual knowledge frameworks	

Adopted from Alrahlah (2016)

2.3 Collaborative Skills

Collaborative skill is the students' ability to solve problems, complete the tasks, or make products that are created in groups. This emphasis on skills is demonstrated by the way students are accountable for each action, respecting the abilities, and contributions of all group members (Laal & Ghodsi, 2012)

In another definition, Austin and Baldwin explain that collaboration skills are the ability to work together in groups to achieve results as expected.

Implementation to achieve goals and obtain these results requires mutual trust, precise coordination, and awareness to do work with full responsibility (Austin & Baldwin, 1991).

Collaboration skills consist of five indicators that need attention. These indicators are designed by adjusting the characteristics of students so that they can help the teacher in giving an objective assessment. Five indicators of the assessment of collaboration skills are in Table 2.

Table 2: Collaborative Skills Assessment.

No.	Indicator	Aspects Considered
1.	Participation	a. Have active discussions
		b. Able to provide useful ideas
		c. Able to divide tasks clearly
2.	Time management	a. Allocate time as needed
		b. Help each other to complete assignments on time
3.	Task completion	a. Able to complete tasks that have been shared and agreed upon
		b. Able to develop workaround solutions based on ideas from other members
4.	Teamwork	a. Receive input from other members
		b. Able to communicate well
		c. Able to encourage other members to produce group decisions
5.	Evaluation	a. Able to process information both found by themselves and other members
		b. Able to help groups in compiling reports on the results of investigations or lab work
		c. Able to present the results of an investigation or practicum in front of the class

Adopted from Brookhart (2015)

3 METHOD

This research is a literature studies, where the research data is collected from various relevant sources according to the research topic. In the primary step, a review of the literature that can support the analysis was carried out: a review of the regulations, relevant research, and procedures for implementing collaborative problem-based learning. Meanwhile, the source of the study is in the form of reference books, scientific journals, and any kind of relevant references. The data analysis technique used is descriptive-qualitative.

4 RESULTS AND DISCUSSION

Problem-based learning (PBL) is a collaborative, constructivist, and conceptual learning model that uses real-life problems to construct students' knowledge in the learning process. According to Schmidt (1993), Jerome Bruner's states that motivation is one of the strengths that encourages students to more understand the real-world problems. PBL is not a model that only directs students to

receive information, but students must be able to construct new knowledge.

This opinion is supported by Regehr & Norman (1996) which explains that humans can collaborate their previous abilities and be internalized to achieve a new knowledge. Besides PBL is also supported by the results of the Gijsselaers (1996) study entitled "Connecting Problem-Based Practices with Educational Theory" which shows that students' metacognitive abilities and social factors have a strong influence on the learning process.

In PBL, the students' role is more dominant during the learning process, so this model is better known as a student-centered model. While the teacher's role during the learning process is as a facilitator, so that the teacher can only provide feedback to students when needed. There are 6 learning phases that need to be considered by teachers who want to apply PBL, while to implement collaboration skills there are 5 indicators that need to be considered such as (1) participation; (2) time management; (3) task completion; (4) teamwork; and (5) evaluation. The concept of integration between PBL and collaboration skills is shown in Figure 1.

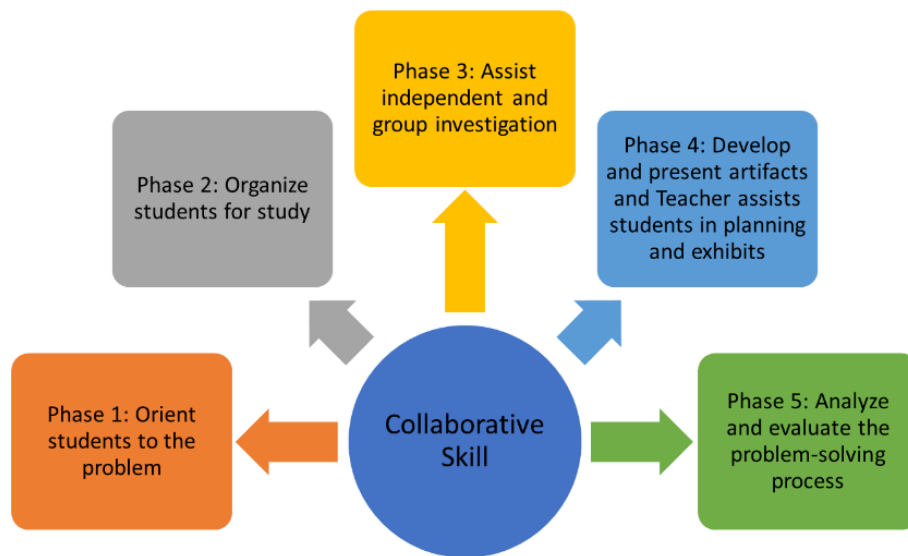


Figure 1: The concept of integration between PBL and collaboration skills.

Following Figure 1, it is known that PBL's first phase is Orient students to the problem. In this phase, the teacher briefly describes the material being studied to give students an understanding about the purpose of learning the material. When giving explanations related to the material, the teacher also explained the requirements needed when doing a lab

work in workshop. Students must observe the explanations given by the teacher. If required it's required, students must record essential points from the teacher's explanation (Arends, 2012). After the teacher has already explained, students are allowed to ask questions that are relevant to the material that has been delivered by the teacher.

In this phase, students have directed to be able to develop their communication skills by asking questions to the teacher. Furthermore, Cohn (2007) in his scientific article entitled "*Developing Effective Communication Skills*", Cohn states that effective communication can only occur if a student can listen effectively. In communicating, the information to be conveyed must be adapted to the ability of the opponent's communication. So, in giving explanation, the teacher is advised not to use language that is too complicated in order to reduce the miss communication among students.

Besides, Wicaksono & Naqiyah (2013) in his research entitled "*The Application of Role Playing Techniques in Group Guidance to Enhance Interpersonal Communication Capabilities of Multimedia Class X Students of IKIP Surabaya Vocational High School*" also concluded that communication would be more effective if the situation was equal. Equality does not require us to accept and approve the information obtained. Equality is defined as the ability to open up and accept the arguments of others.

After the first phase is completed, students are then directed to continue in the second phase namely, Organize students for study. In this phase, the teacher instructs students to form heterogeneous groups where, each group consists of 5-8 students (Scott, 2014). After each group is established, then the teacher shares the problem with the groups. The teacher instructs students to diagnose the cause of the problem given, then based on the diagnosis given, students arrange the improvement's steps or treatment's steps. In this phase, the teacher also provides an opportunity to ask questions, so students can ask several questions related to the problem that will be solved by the group.

Ardeniyansah & Rosnawati (2018) through their research entitled "*Implementation of Problem-Based Learning in terms of the Student Mathematical Creative Thinking*" reminded that in the implementation of this learning model the role of the teacher was only as a facilitator. The role of students must be more dominant in the learning process. The teacher is only limited to provide assistance in the form of direction rather than providing support in the form of action. Besides, feedback is given by students only when needed.

In the second phase participation is one indicator of collaboration skills that need to be considered by the teacher. Related to this, Wiznia, Korom, Marzuk, Safdieh, & Grafstein (2012) in a scientific article entitled "*PBL 2.0: Enhancing Problem-Based Learning Through Increased Student Participation*"

found that in general, the ability of participation can be demonstrated by students when discuss actively to discuss solutions in solving a problem.

Complementing this opinion, Masek, Yamin, & Aris (2013) conducted a study entitled "*Student Participation and Facilitation in PBL Tutorial Session*" which concluded that determining the level of student participation when doing discussions was very subjective. Therefore, to be more specific, the activeness of students in discussions is measured through the useful ideas expressed by each student as they conduct discussions in study groups.

The conclusions from the study were then reinforced by Sumarji's research (2009) entitled "*Application of Learning Problem Based Learning Models to Increase Stipulation Motivation and Problem Solving Problems in VHS*" which concluded that active participation is an important ability that must be grown by students. Through the pattern of actively participating in discussions, students can share knowledge, experiences, and important ideas needed in the problem-solving process.

Besides the participation's indicator, the ability to manage time is also a part of collaboration skills that are important to be considered by the teacher. Uğur (2000) through his research written in Turkish with the title "*CALIsma Hayatında Zönetimi Age*" which means, "time management in work life", explains that study groups can be said to be effective and efficient if: (1) have clear goals and targets; (2) able to make plan work well; (3) able to choose which jobs need to be prioritized; and (4) the selected job has high usefulness.

The results of this study are supported by research conducted by Nurhidayati (2016) with the title "*Increasing Understanding of Time Management Through Guidance Groups with Problem Solving Techniques in Students*" which concluded that time management has a significant role in student learning success. Students who can manage time well, generally have proper learning planning, consistent in completing tasks, discipline, and have clear learning goals.

The third phase is to assist independent and group investigation. Sihaloho & Ginting (2017) in his research entitled "*The Effect of Problem Based Learning (PBL) Model toward Student's Creative Thinking and Problem-Solving Ability in Senior High School*" concluded that in this phase students are directed to be able to design their problem-solving activities. Students must be able to think creatively. Generally, the ability is shown by students when describing the steps to solve problems in more detail.

In this third phase the teacher sets the groups, so that each group can work effectively. Besides, all group members can be involved actively in the problem-solving process. Sagala, Rahmatsyah, & Simanjuntak (2017) in his research entitled "*The Influence of Problem Based Learning Model on Scientific Process Skills and Problem Solving Ability of Student*" found that during the investigation process, students must be able to develop critical thinking skills through a series of observations and experiments.

Then Silver & Barrows (2006) through his research entitled "*Goals and Strategies of a Problem-based Learning Facilitator*" reminded that in this phase the teacher guides students to find the correct answers independently but the teacher should not provide solutions. Students are given freedom in reasoning possible results obtained from the results group discussions, then the results of the practicum are arranged in the form of lab reports.

The indicator of collaboration skills that are shown in this third phase is the ability of students to complete tasks in teamwork. Tarmizi & Bayat (2010) through his scientific article entitled "*Effects of Problem-Based Learning Approaches in Learning of Statistics among University Students*" concluded that at this stage task completion was measured through students' ability to complete individual tasks, develop alternative problem solving, and solve problems based on ideas given during group discussions.

Supporting this opinion Dwiyatmoko (2018) through his research entitled "*Implementation of Problem Based Learning Models to Improve the Activity and Learning Outcomes of Class XI Students at PCPT Subjects in Yogyakarta 2 Vocational High School*" found that in completing tasks, student enthusiasm was emphasized. Because of students' enthusiasm, the learning process will run pleasantly. Besides, habituation to the discussion is also emphasized to exchange knowledge and information with group members.

While for the ability to teamwork, Keeling (2008) in his scientific article entitled "*We Are Scholars: Using Teamwork and Problem-Based Learning in a Canadian Regional Geography Course*" states that students' ability to work together is measured by students' willingness to accept input and ability in communicating during the learning process. Another study conducted by Barbour (2006) with the title "*Team Building and Problem-Based Learning in the Leadership Classroom: Findings from a Two-Year Study*" concluded that problem-based learning could be one strategy that gives students authentic

experiences through a series of lessons during practicum.

Furthermore, the fourth phase is developing, and presenting artifacts and Teacher assists students in planning and exhibiting. Bédard, Dalle, & Boutin (2012) in his research entitled "*Problem-based and Project-based Learning in Engineering and Medicine: Determinants of Students' Engagement and Persistence*" concluded that this phase directed students to compile reports and present the results of their work immediately. In this case, other groups are allowed to ask questions according to the topic being discussed.

Completing the results of the study, Minarni & Napitupulu (2017) in his research entitled "*Developing Instruction Materials Based on Joyful PBL to Improve Students Mathematical Representation Ability*" found that in this phase the teacher helped students to (1) plan and prepare reports according to results practicum of each group; (2) present the results of the lab through LCD media; and (3) directs students to share roles with their group members.

Collaborative skills in this phase are demonstrated through the evaluations that include students' ability to help group members in compiling reports and presenting the results of their group's work. For students' ability to help group members in compiling report,. Sukrawan & Komaro (2011) through his scientific article entitled "*Problem Based Learning in Basic Subjects of Mechanical Engineering Vocational Competence*" states that in compiling reports, each member is required to share roles. But that does not mean not helping each other. Each member is obliged to help each other with the purpose that the report can be resolved quickly, precisely, and according to the time allocated.

As same as the idea of Almeda & Sahyar (2017) in their research entitled "*The Effect of Problem Based Learning (PBL) Model and Self Regulated Learning (SRL) toward the Physics of Problem Solving Ability (PSA) of Students at Senior High School*". From the results of these studies, it is known that in this fourth phase one focus is on students' ability to help each other among group members. Therefore to facilitate the process of preparing reports, students are required to understand the problem correctly, interpret issues, plan solutions, implement plans, and evaluate solutions.

As for students' ability to present the results of their group work, Williams, Lo, & Hin (2017) in their research entitled "*Measuring the Impact of Context and Problem Based Learning Approaches on Students' Perceived Levels of Importance of Transferable & Workplace Skills*" concluded that the students' ability in presenting are measured based on

(1) the ability to deliver topics orally; (2) students' confidence when making presentations; and (3) the maturity of students in understanding the topics presented.

In addition, according to Ahmed, Wagdy, Refaat, Ahmed (2014) in his research entitled "*Measuring Students' Satisfaction with Implementing a Student' Centered Seminar on Problem-Based Learning, the Faculty of Medicine-Canal-Canal University*" stated that when presenting presentation, students must utilize the best available time allocation where all students in the class can actively participate. Interactive discussion take place when students can present the problem and be able to answer questions raised by their colleagues.

The fifth or final phase of the problem-based learning stage is to Analyze and evaluate the problem-solving process. Kim, Belland, & Walker (2018) through his research entitled "*Effectiveness of Computer-Based Scaffolding in the Context of Problem-Based Learning for Stem Education: Bayesian Meta-analysis*" concluded that in this fifth phase teachers and students discuss to reflect on reports that have been prepared by students.

Strengthening these opinions Reza, Ibrahim, & Rahayu (2018) through a scientific article entitled "*Development of Problem-Based Learning Teaching and Learning Students' Mastery of Concept and Critical Thinking Skill*" added that after reflection, both teachers and students together conclude about what has been done. A positive experience can be used as a reference for further work, but the negative experience can be used as a reference for improvement.

Collaborative skills in the fifth phase are more likely to lead to student participation. When reflecting, both the teacher and students discuss each other. Students' experiences during the practicum are delivered to the teacher. If the experience is positive, the teacher should give appreciation. Whereas if the experience is negative, the teacher must provide input and reinforcement, so that in the next practicum, students get a positive experience.

5 CONCLUSIONS

Based on the results of the study as described above, it was concluded that in the implementation of CPBL in VHS: (1) there are 6 phases that need to be implemented by teachers who want to apply PBL. Besides, there are 5 things that need attention by teachers in developing student collaboration skills namely participation, time off management, task completion, teamwork, and evaluation; (2) the

implementation of CPBL is able to support students in developing problem-solving skills; and (3) the implementation of CPBL is able to assist students in developing work skills both individually and in teams.

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