# Problem Based Learning With ICT
# For Student's Cognitive

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**Abstract: Problem Based Learning With ICT For Student's Cognitive.** Cognitive learning outcomes still one of the determinants to getting a job. Based on this, lots of attemps was made to improve student cognitive outcomes.This research aims to improve the learning outcomes of students with a problem based learning (PBL) model integrating ICT-based media. This research uses the action research approach by using cluster random sampling techniques in Boyolali, Indonesia. The source of the data used in this study, are the informant, place or location, events, and documents or archives. Data collection used in this research are observation, interviews, tests, and documentation. Test validation that used is by triangulation of methods and data sources, so that the resulting data is actually valid. The results of this study showed an increase in student learning outcomes through learning problem based learning with ICT media. This could be proved by the increasing number of SMK Negeri 1 Boyolali students who passed the test from only 21 passing student to 51 passing students in the first cycle and increased again in the second cycle with 63 passing students. This also experienced in SMK Negeri 1 Banyudono with only 17 passing student in the beginning to 40 passing students in the first cycle and 56 passing student in second cycle out of 71 students.

**Keywords:**PBL, ICT, Learning Outcomes


***Abstrak: Problem Based Learning dengan Media ICT untuk Meningkatkan Kognitif Siswa.****
*Hasil pembelajaran kognitif masih menjadi salah satu factor penentu keberhasilan siswa untuk mendapatkan sebuah pekerjaan. Berdasarkan hal tersebut maka berbagai upaya dilakukan untuk meningkatkan hasil kognitif siswa. Penelitian ini bertujuan untuk meningkatkan hasil belajar siswa dengan model pembelajaran berbasis masalah (PBL) dengan mengintegrasikan media berbasis ICT. Penelitian ini menggunakan pendekatan penelitian tindakan dengan menggunakan teknik cluster random sampling di Boyolali, Indonesia. Sumber data yang digunakan dalam penelitian ini, adalah informan, tempat atau lokasi, peristiwa, dan dokumen atau arsip. Pengumpulan data yang digunakan dalam penelitian ini adalah observasi, wawancara, tes, dan dokumentasi. Uji validasi yang digunakan adalah dengan triangulasi metode dan sumber data, sehingga data yang dihasilkan benar-benar valid. Hasil penelitian ini menunjukkan peningkatan hasil belajar siswa melalui pembelajaran berbasis masalah (PBL) dengan media berbasis ICT. Hal ini dapat dibuktikan dengan peningkatan jumlah siswa yang melebihi batas tuntas dari 21 siswa pada pra siklus menjadi 51 di siklus I dan menjadi 63 pada siklus II di SMK Negeri 1 Boyolali. Hal yang sama terjadi pada SMK Negeri 1 Banyudono dari 17 siswa menjadi 40 pada siklus I dan menjad 56 di siklus II dari total 71 siswa.*

***Kata kunci:****PBL, ICT, Hasil Belajar.*

## INTRODUCTION

Every country believes the future of a nation is determined by the quality of its human resources, therefor education needs to be adjusted to build qualified human resources (Akareen and Hosein, 2017). One alternative to improve human resource quality is by certain differentiation of formal education. Differentiation of formal education level grouped into three levels e.g. elementary education which occurs in elementary school, secondary education occurs in junior high school, senior high school and vocational high school and higher learning which occurs in college.

Ones of formal education level is vocational high school. Vocational study prepares the young generation to be ready in marketplaces. Educational improvement in vocational study or vocational high school is needed to improve the students' skills before they graduate. Educational aspects that need to be improved are its facility and teaching-learning method, among these two, teaching and learning is the most important aspect. (Al-Barwani, Al-Ani dan Amzat, 2012) stated that teaching model is about students obtaining specific academic skills. The center of learning is students' learning activity which would impact to their performances or cognitive skill. Cognitive skill is an aspect of mental or brain activity with six levels i.e. to remember, to understand, to apply, to analyze, to evaluate and to create (Taxonomy Bloom, 2016). Indonesian students' cognitive level is considered low among others. Based on report by UNESCO in 2017, Indonesian education is in $5^{th}$ place from 10ASEAN countries and $64^{th}$ place from 124 countries worldwide. Based on report by PISA in 2015, Indonesia Education is in $69^{th}$ place from 72 observed countries. This could be caused by the ineffective learning process that occurs in Indonesian schools.

To improve the quality of Indonesian education, teaching and learning system need to be altered from the conventional method. Conventional learning system caused unwillingness and unmotivated to learn in students. Less motivation makes students not interested in the subjects which will severe their learning outcome. Many approaches is utilized to increase students learning outcomes e.g. co-operative learning, integrated learning, quantum learning, inquiry, discovery, discussion, experiments, QA, role-playing, simulation, project-based learning and problem-based learning (PBL). Each method has advantages and disadvantages. This may be caused by unsuited subject to the learning method. Hence, teachers is expected to be able to choose the best method in each subjects to be used in learning process and activity. (Al-Bawarni, Al-Ani, and Azmat, 2012) states that the learning model is expected to change the behavior of learners in terms of acquiring skills and knowledge. The method is expected to make the subject easy to comprehend therefor the learning outcome could be improve significantly. (Florence, 2011) stated that creative teaching could improve the education quality and make the learning meaningful also open new exciting ways in approaching the utilized curriculum. This performance could be enhanced by the use of (Problem-based learning) PBL as teaching method.

Problem based learning is a learning model that utilized problem that need to be solved by the students with the help of their ability and knowledge. (Surya and Saputra, 2017) stated that problem based learning (PBL) is learning that uses problems as a driver of learning. PBL starts with problems that must be solved in such a way that students

need to find and gain new knowledge that they can then solve the problem. Students not only find for one correct answer but students interpret problems, gather necessary information, identify possible solutions, evaluate options and then draw conclusions.This is consistent with (Chen, Lin and Chang's statement, 2011) which explains that Problem Based Learning refers to a learning approach that focuses on the problem-solving process by learners in acquiring necessary knowledge. (Eggen and Kauchak, 2012) state that problem-based learning is a set of teaching models that use problems as a focus for developing problem-solving skills, materials, and self-organization.The problem that taken in problem-based learning is a practical, open-ended, real-life-oriented problem where students integrate their knowledge by looking for various information to be able to find a solution, (Fukuzawa& Cahn, 2019). So, PBL is truly a student-centered learning model, that's because PBL can motivated students to be curious so students can explore, investigate, and then be able to learn the content of teaching materials themselves so its improving their critical thinking, reasoning, teamwork and independent learning, (Huijer, Kek &Terwijn, 2015). Problem Based Learning has the most powerful teaching methods to invite learners in applying a responsibility to learners in learning (Chakravarthi and Vijayan, 2010).According to research report by (Endogan and Senemuglu, 2014), problem based learning impact significantly towards the learning outcome of the students, whether on the base of knowledge, understanding or thinking ability of the students. Implementation of problem-based learning (PBL) model will be more impactful if it's combined by another learning media which supports the problem-based learning model.

PBL learning models will have more impact when combined with learning media. This statement is agree to research report by (Chen and Chen, 2010) which stated that digital media is needed to support the problem based learning (PBL) method. Media is utilized to clarify given messages, create passion and excitement among students hence the students could follow the learning process and make them understand the knowledge easily. (Ebner and Holzinger, 2007) said that learning without media will make the learning process feels heavier which will severe the learning outcome. One of the media utilized in problem-based learning model is ICT Media.

ICT or Information and Communication Technology is a media utilized as practice and exercise work, tutorial, game and simulation (Sutopo, 2012). ICT Media utilization in learning process may conduct some advantages i.e. concept or complex subject could be explained in simple way thus the student will learn easily (Buckingham, 2003). The long term impact on ICT Media utilization i.e. student will have deep understanding about the learning subject which expected to improve the learning outcome. (Gilakjani, Leong and Ismail, 2013) stated teachers' attitude in ICT media utilization could influence the learning goals. This agrees with the research by (Almekhlafi and Almeqdadi, 2010) which stated that there is a positive impact on the teachers with the utilization of ICT Media in learning process of students in the classroom. (Fukuzawa & Cahn, 2019) also stated that there is a relation between PBL learning models using ICT media, but there are also things that must be considered such as the conditions of student learning environment. (Beckmen & Weber, 2016) stated thats technology can improved critical thinking students, so students has a lot knowledge.

Research by (Kristinawati, Susilo, & Gofur, 2018) states that the PBL-based ICT model significantly improves their student cognitive learning outcomes in Biology subjects. This agrees with the research by (Fukuzawa & Cahn, 2019) which says that students become more motivated in learning when using PBL based technology. In this research, the effect of ICT media assisted problem-based learning model on Indonesian

accounting students' learning outcome is investigated. The ICT-media utilized in this research is an interactive media of problem presented in videos. To the best of our knowledge, such approach has never been reported.

**RESEARCH METHOD**

As an approach, this research used action research. The research procedure consisted of (1) planning, (2) Acting, (3) observing, and (4) reflecting. The source of data for this research was obtained from interviewing with informants, at certain a location or place, occurrences, archives and documents. The informants of this research is basic banking subjects teacher, 10th grader accounting students of class 1 and class 2 SMK Negeri 1 Boyolali in 2019 that consist 71 students and 10th grader accounting students of class 1 and class 2 SMK Negeri 1 Banyudono that consist 71 students. Documents or archives obtained from student daily evaluation tests script and students personal informations. Data collecting is performed by observation, interviews, tests, and documentations. Data Validity Test for Action research used validity testing in order to gain credibility and the degree of trust or degree of truth of the study. Data validity test were performed under source-method-valid content triangulation. Data analysis of this research is in the form of quantitative and qualitative data.

**DISCUSSION AND ANALYSIS**

Cognitive data of the students were obtained from evaluation tests result which consisted of five questions total in each cycle, with the total score of 100. The learning outcomes of the students were measured based on basic-banking subject which utilized five competency achievement indicators developed by five indicators in each cycle. Each indicator represented by one problem made by utilizing cognitive domain in Taxonomi Bloom between C4, C5 or C6. The questions were consulted to the experts before being tested in the experiment class in SMK Negeri 1 Boyolali specifically to 11th grader accounting class.

The experiments were performed to 36 students by utilizing eight questions for the first cycle. In the first cycle, those eight questions were validated in a level validation test. The result of the validation test producing five questions with different level of difficulty in each of them. In the test, three out of eight questions were not used for the experimental test in class because the questions were not valid based on criteria therefor only five questions passed the test categorized in easy, medium and difficult with the amount of one question, two questions and two questions respectively.

The second trial test were performed due to unsatisfing result from the first cycle. The second trial test were performed toward 36 students using eight questions which satisfy the competency achievement indicators. In this second cycle, five out of eight questions passed the validity test with the difficulty level of medium and hard with amount of questions of three and two respectively. Based from the data obtained, it is shown that the students' score are affected by the learning method using ICT media assisted problem based learning model. In each cycle i.e. pre cycle, first cycle and second cycle, the students' score were increased.

Based from the action research in the first and second cycle, it is concluded that there were an improvement of cognitive learning outcome of accounting students by utilization of problem based learning model assisted by ICT media. Table 1 presented the improvement of cognitive learning outcome.

Table 1 Improvement of Cognitive Learning Outcome of 10th grader accounting students of SMK Negeri 1 Boyolali

| Criteria | Pre-Cycle | | Cycle I | | Cycle II | |
|---|---|---|---|---|---|---|
| | Student | % | Student | % | Student | % |
| Pass | 21 | 29,58% | 51 | 71,83% | 63 | 88,73% |
| Fail | 50 | 70,42% | 20 | 28,17% | 8 | 11,27 |
| Total | 71 | 100% | 71 | 100% | 71 | 100% |

(Source: Processed Primary Data, 2019)

Based from the table above, in the first cycle, there is an improvement of 42.25% from passing percentage of 71.83% in the first cycle and 28.58% in the pre-cycle. This result showed that the students more understand to the subject taught by the teacher by using problem based learning assisted with ICT media. In the second cycle there was also an improvement proven by the increasing number of students who passed the test with the percentage of 88.73%. Compared to the first cycle, there is an increasing percentage of 16.9%. Compared to the pre-cycle there is an increasing of percentage of 59.15%. Beside these results, there is an increasing on the score obtained by the students, categorized in the lowest score, highest score and mean score based from pre-cycle, first cycle and second cycle shown in table 2.

Table 2 Score Improvements of 10th grader accounting students of SMK Negeri 1 Boyolali

| Parameter | Pre-Cycle | Cycle 1 | Cycle 2 |
|---|---|---|---|
| Lowest Score | 23 | 53 | 71 |
| Highest Score | 93 | 100 | 100 |
| Mean Score | 64,23 | 78,14 | 89,17 |
| Average Percentage | 29,58% | 71,83% | 88,73% |

(Source : Processed Primary Data, 2019)

Based from the table above, there is an improvement in test score of 10th grader of accounting students of SMK Negeri 1 Boyolali proven by the increasing of the lowest score, highest score and average score of the class, and also the passing percentage. In the pre-cycle, the lowest score obtained by student is 23 with the average score of 64.23 followed by improvements in the first cycle with lowest score of 53 and the average score of 78.14 with 13.91 difference from the pre-cycle and further increased in the second cycle with the lowest score of 71 and the average score of 89.17 (11.03 difference from the first cycle). Compared to the un-treated learning, the problem based learning with ICT media gave a significant effect on the average score with 24.94 difference.

Improvement of cognitive learning outcome were experienced by 10th grader accounting student of SMK Negeri 1 Banyudono using the same method, problem based learning with ICT media. The improvement were shown in Table 3 below.

Table 3 Improvement of Cognitive Learning Outcome of 10th grader accounting students of SMK Negeri 1 Banyudono

| Criteria | Pre-cycle | Cycle I | Cycle II |
|---|---|---|---|

|  | Stude nt | *Percentag e* | Stude nt | *Percentag e* | Stude nt | *Percentage* |
|---|---|---|---|---|---|---|
| Pass | 17 | 23,94% | 46 | 64,79% | 59 | 83,09% |
| Fail | 54 | 76,06% | 25 | 35,21% | 12 | 16,91% |
| Total | 71 | 100% | 71 | 100% | 71 | 100% |

(Source : Processed Primary Data, 2019)

Based from the table above, in the first cycle, there is an improvement of 42.25% from passing percentage of 71.83% in the first cycle and 28.58% in the pre-cycle. This result showed that the students more understand to the subject taught by the teacher by using problem based learning assisted with ICT media. In the second cycle there was also an improvement proven by the increasing number of students who passed the test with the percentage of 88.73%. Compared to the first cycle, there is an increasing percentage of 16.9%. Compared to the pre-cycle there is an increasing of percentage of 59.15%. Beside these results, there is an increasing on the score obtained by the students, categorized in the lowest score, highest score and mean score based from pre-cycle, first cycle and second cycle shown in table 2.

Table 4 Score Improvements of 10th grader accounting students of
SMK Negeri 1 Banyudono

| Parameter | Pre-Cycle | Cycle 1 | Cycle 2 |
|---|---|---|---|
| Lowest Score | 17 | 47 | 68 |
| Highest Score | 84 | 100 | 100 |
| Mean Score | 56,72 | 78,25 | 88,56 |
| Average Percentage | 23,94% | 64,79% | 83,09% |

(Source : Processed Primary Data, 2019)

Based from the table above, there is an improvement in test score of 10th grader of accounting students of SMK Negeri 1 Boyolali proven by the increasing of the lowest score, highest score and average score of the class, and also the passing percentage. In the pre-cycle, the lowest score obtained by student is 17 with the average score of 56.72 followed by improvements in the first cycle with lowest score of 47 and the average score of 78.25 with 21.53 difference from the pre-cycle and further increased in the second cycle with the lowest score of 68 and the average score of 88.56 (18. 3 difference from the first cycle). Compared to the un-treated learning, the problem based learning with ICT media gave a significant effect on the average score with 24.94 difference.

Learning by implementing problem based learning with ICT media could improve students' score in accounting class of SMK 1 Negeri Boyolali and SMK 1 Banyudono. With 75 as passing standard score, by such method the standard could be overpassed. This agrees with researches report by Downing, Ning and Shin (2011: 66) who stated that PBL could improve students' score in much higher and significant result in any subjects and general skills. Blackburn (2017: 171); Chen (2016: 199) also stated that the integration between technology and PBL had a positive impact on students. According to Kock (2007), who performed a research on ICT media, there is relevancy between ICT based learning and reward giving surprise in a learning process which have a positive

impact among students in the case of their memory and study. A statement from Arends and Kilcher (2010: 328) also strengthen the result of this study which stated that such model enhance activeness, curiosity, imagination, interest and motivation, achievement influence, thinking ability and cognitive learning among students. These showed that a research by Barrow (2002: 119) proved that PBL model could help student in developing their problem solving ability, critical thinking and individual learning while obtain knowledge in every subjects. Chen and Chen (2010: 7) stated that problem based learning with ICT media could ease the teaching challenges among teachers and students in a learning processes occurs in the classroom.

**CONCLUSION**

Based from the analysis of the data, it is concluded that the implementation of problem based learning with ICT media could improve the students' cognitive learning outcome in basic-banking subject in SMK Negeri 1 Boyolali and SMK Negeri 1 Banyudono. This could be proved by the increasing number of SMK Negeri 1 Boyolali students who passed the test from only 21 passing student to 51 passing students in the first cycle and increased again in the second cycle with 63 passing students. This also experienced in SMK Negeri 1 Banyudono with only 17 passing student in the beginning to 40 passing students in the first cycle and 56 passing student in second cycle out of 71 students.

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