Ability of Problem Solving Students Based on Information and Communication Technology

Tri Andri Hutapea¹, Pardomuan Nauli Josip Mario Sinambela², Dilinar Adlin³

¹Mathematics Department, Medan State University, Medan Estate 20221, Indonesia (Telp +6281215268219; Email: triandrihutapea@unimed.ac.id)
²Mathematics Department, Medan State University, Indonesia
³Arts Department, Medan State University, Indonesia

Abstract. This study aims to produce product findings from the activity development program for students' problem solving abilities based on information and communication technology. The method used in this research is research and development methods. The stages of program development are survey, planning, validation, and socialization. The research subjects were students of Medan State University. The activity development program for students' problem solving abilities based on information and communication technology has not yet considered the planning, implementation and evaluation of activities. The final product of this research is a valid program about the ability to solve problems based on information and communication technology.

Keywords: Problem solving, information and communication technology

1. Introduction

In the rapid development of technological progress, resulting in everything changes very quickly. One of them is that communication is no longer limited by space and time. Time can no longer be used as an excuse for the low ability to solve student problems. The rapid development of technology and communication provides a good opportunity for the implementation of education and student activities both academic and non-academic activities. The existence of technology actually provides opportunities for improving students' problem solving abilities. The existence of information technology motivates all people, especially educators and educators to be more creative in carrying out activities to improve the ability of the problem without the limitations of space and time.

The change of technological, especially information technology, has influenced the paradigm and mindset of a person both as a student and as an educator. The use of information and communication technology in both academic and non-academic fields is one of the demands that a person must have so that students can develop and be able to adapt and become good problem solvers. Because of that mastery of information and communication technology is an important and major requirement that students must have in improving their problem solving abilities.

This research is a research development whose product is an activity program that aims to improve students' problem solving abilities by utilizing information and communication technology as their foundation.
2. Literature Review

A problem can be overcome if someone has a good concept towards it to overcome it. Problems will have a good and valid solution if it is found that there is a match between the schemata that students have and the problems faced. In this case students are in the adaptation phase, meaning that there are activities that are carried out spontaneously between the brain and motion in finding a rule in overcoming the problem. Problem solving is a process for students to find guidelines between those previously learned to apply in obtaining solutions to new situations [1].

The ability of problem solving is the ability of individuals to use their knowledge and logical thinking to analyze information from a problem, arrange alternative solutions to possible problems, and choose the most effective problem solving. The ability of problem solving consists of five stages, namely: a) identify the problem, b) defining and formulating the problem, c) explore problem solving strategies, d) implementing problem solving strategies, and e) recheck the results obtained and evaluate the effects of the problem solving strategies that have been taken [2] and [3].

The ability of information and communication technology (ICT) referred to in this matter are a) the ability to make ICT become a means of information, b) The ability to make ICT as a medium in processing and using information, c) The ability to make ICT as a basis in literacy, d) The ability to use ICT as a means of increasing creativity, e) The ability to use ICT as a means of collaboration, f) The ability to use ICT as a means of communication [4].

The ability to make ICT as a means of information is meant to be the ability to access information efficiently and effectively, evaluate information critically, process basic information about accessing information. The ability to use ICT as a medium for processing and using information is to understand how information is obtained and understand the purpose of the information. In this case students must be able to interpret the information message obtained into a true and valid news. The paradigm of the students in addressing this information must be positive. The ability to make ICT literacy as the ability to use digital technology, communication facilities and / or networks that are appropriate for accessing, managing, integrating, evaluating and creating information to function properly. The ability to use ICT as a means of increasing creativity is intended as the ability of students to show the originality of the ideas they get. This is shown related to the ability of these students to convey new ideas to others. In this case students must also be able to accept differences in ideas with others. The ability of ICT as a means of collaboration is the ability of students to utilize one application to establish connections with others. The things that might arise are the exchange of information which makes the acquisition of information previously more valid. The ability of ICT as a student communication medium is intended that information and communication technology can be used as a medium in conveying and receiving information. With this capability it is expected that information will be conveyed more quickly and has a valid value.

Based on these stages, the category obtained in measuring the level of problem solving ability of students and the ability of students to use ICT.

| Table 1. Categories of students’ ICT and problem solving competencies |
|---------------------------------------------------------------|
| Values | Categories |
| 80 < value ≤100 | Very good |
| 60 < value ≤80 | Good |
| 40 < value ≤60 | Enough |
| 20 < value ≤40 | Less |
| 0 < value ≤20 | Very Less |
Besides activities related to knowledge, activities need to be done outside of it, so as to lead students to develop general strategies for controlling learning that can be transferred to different contexts. We also underline the need to modify didactic contracts, partly entrusting students with the responsibility of their own learning process, especially in the case of adults who work based on their own learning needs [5].

Reality shows that technological developments, especially in the field of communication and information have had an influence on the world of education. Today's technological revolution, especially computers and the internet has changed the way of thinking and thinking in a practical and efficient way for everyone.

ICT is very supportive in the educational process which has a role to direct in carrying out case-based reasoning activities, simulations, organization of knowledge and multimedia, individual studies through personal channels, tracking and pooling of different source materials, joint discussions and joint project development makes students to work independently side by side in space and time [6].

3. Methods
This development research is a development research that aims to improve academic quality. Research and development are carried out simultaneously and gradually. At each stage to be carried out referring to previous results to produce new things [7].

There are several stages of this research including information gathering, planning, developing preliminary product forms, preliminary field testing, major product revisions, playing field testing, operational product revisions, operational field testing, final product revisions, and dissemination and application. Activity design is a process of developing ICT-based student problem solving as presented in Figure 1.

![Figure 1. Research Design of Problem Solving Competencies Based ICT](image)

4. Results And Discussion
Based on observations obtained by students' problem solving abilities related to the tasks given are presented in Table 2.

| Table 2. ICT Competencies of Student |
|--------------------------------------|
| **Indicators**                        | **Score** | **Categories** |
| Identify the problem                   | 45        | Enough         |
| Defining and formulating the problem   | 40        | Less           |
| Explore problem solving strategies    | 40        | Less           |
| Implement problem-solving strategies  | 38        | Less           |
Recheck the results obtained and evaluate the effects of the problem solving strategies that have been taken. Average 40 Less

Based on Table 2, obtained that identifying the problem is the first step that must be done and obtained a score of 50 and is in the sufficient category. The second indicator and the third indicator are defining and formulating problems and exploring problem solving strategies with the same score. The score obtained by students on this indicator is 40 and is in the less category. Furthermore, indicators in implementing problem solving strategies have a score of 38 and are in the less category. The Indicator rechecks the results obtained and evaluates the effect of the problem solving strategy that has been taken has the lowest score with a large 37 and is in the less category. Overall, it is found that the average problem solving ability of students is still in the lacking category, this is indicated by the large score obtained is 40.

| Table 3. Problem Solving Competencies of Student |
|-----------------------------------------------|
| Indicators                                      | Score | Categories |
| the ability to make ICT as a means of information | 65    | Good       |
| The ability to make ICT as a medium for processing and using information | 62    | Good       |
| The ability to make ICT the basis of problem literacy | 60    | Enough     |
| The ability to use ICT as a means of increasing creativity | 60    | Enough     |
| The ability to use ICT as a means of collaboration | 62    | Good       |
| The ability to use ICT as a means of communication | 65    | Good       |
| Average                                        | 62.33 | Good       |

Based on Table 3 it is found that the indicator of ability to make ICT a means of information in the category of good, this is indicated by a score of 65. The same score is obtained on the indicator of the ability to use ICT as a means of communication. Indicator of the ability to make ICT as a medium in processing and using information is in the good category. This indicator is the same as an indicator of the ability to use ICT as a means of collaboration. This is indicated by the score on these two indicators is 62. While the indicator of the ability to make ICT as a basis in problem literacy and the indicator of the ability to use ICT as a means of increasing creativity is in the sufficient category. The score obtained is 60. Although there are two indicators that are in the category enough but overall the ability of ICT students are in good category with a score obtained of 62.33.

Based on the results of theoretical analysis and observational data analysis results, the researcher designed a program scheme to improve ICT-based problem solving abilities as follows.

Figure 2. Scheme of Problem Solving Competencies Based ICT Program
Based on Figure 2 it is found that the indicators of problem solving and ICT competence are interrelated with one another. This connection pattern certainly needs special attention from study programs, faculties and collaboration between the two, this will certainly bring a new approach or curriculum that will eventually be executed by the university and vice versa.

5. Conclusion
Based on the results of the study it was found that the development of activity programs aimed at improving students' problem solving abilities based on ICT is very likely to be done, this is indicated by the ability of ICT students to be in a good category. Of course the development of ICT that will be carried out is no longer an obstacle because students are already very familiar with the information technology that is developing at this time.

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