

A Metacognition Analysis of Male and Female Pre-Service Teachers in Making PowerPoint (PPT) as a Learning Media

Naufal Ishartono, Suliadi Sufahani

Abstract: PowerPoint as one of software provided by Microsoft Office has been proven to enable people as a medium to communicate their ideas to others, including for the professional teachers. Therefore, the skill of developing PowerPoint as a learning media must be well-owned by pre-service teachers. However, this skill can be different between individuals, one of which is from a gender factor. Therefore, this study aims to describe the analysis of the metacognition of male and female pre-service teachers in making PowerPoint (PPT) as a learning media. This research is a qualitative descriptive study using test and interview methods in data collection. The results of this study were found to be similarities and differences between male and female pre-service teachers in term of developing PowerPoint as a learning media. The similarities are that the male and female respondent groups have the same flow of developing PowerPoint as a learning media. While the differences of the two respondents' groups are 1) on the aspects they chose as considerations in developing PowerPoint, 2) how to evaluate the development process, and 3) the selection of colors used in designing PowerPoint that has been developed.

Index Terms: Learning Media, Metacognition, PowerPoint, Qualitative Descriptive Study.

I. INTRODUCTION

Mastery of mathematics as a basis for science to be able to think logically, critically and systematically has become a necessity that every person must have in facing the current global challenges, including the people of Indonesia. At present, the level of mastery of mathematics for Indonesian people, especially at the student level, still requires a lot of improvements. As the results of the latest PISA (Program of International Student Assessment) report and TIMSS (Trend in Mathematics and Science Study) show that the mathematical literacy rate for Indonesian students is 63rd out of 69 PISA participating countries and 36th position from 49 TIMSS participating countries. The results of this report must be taken seriously by all practitioners and educational institutions in order to increase the level of mathematics literacy of Indonesian students. The

Department of Mathematics Education of Universitas Muhammadiyah Surakarta (UMS) as a study program that produces prospective mathematics teachers has a great enthusiasm in responding to the results of the latest PISA and TIMSS reports, namely by educating students to become professional mathematics teacher candidates through the provision of courses that strengthen and enrich the skills of its students. One of the skills that must be possessed by students as pre-service mathematics teachers is the skill in developing effective learning media. One of the courses held by the Mathematics Education Department of UMS is the Computer-Based Mathematics Learning Media course held in the even semester for third-year students. As stated in SLP (Semester Learning Plan) that the subject of Computer-Based Mathematics Learning Media aims to educate students to learn to build learning media by utilizing the advancement of information, computer and technology (ICT). Basically, learning media is the media used to channel learning messages to students. Oemar Hamalik (1989) says that learning media are tools, methods, and techniques used in order to more effectively communicate and interact between teachers and students in the process of education and teaching in schools. So that ICT-based mathematics learning media is a tool used to convey information related to mathematical material using ICT. One of the materials taught in the course is how to use PowerPoint (PPT) software as an effective medium to teach mathematics. PowerPoint (PPT) is one of the software from Microsoft Office that aims to facilitate users in creating, collaborating and presenting ideas dynamically and visually (<https://www.microsoft.com/id-id/>). The reason for choosing PPT software as a learning media that is primarily taught in this course is because this software is still commonly used by teachers as a learning media in class, an effective media in increasing students' understanding of the material being taught (Lari, 2014; Mahmoudzadeh, 2014; Zedan, Yakub, Bin, Yusoff, & Bin, 2015) PowerPoint can help teachers streamline learning time where the teacher does not need to spend time writing material on the board while explaining the material taught in front of the class. In addition, in terms of visuals, PPT provides an attractive appearance for students so that the learning conditions do not become boring because this software is able to display animations, images, and videos which of course can attract students' attention. Holzl (1997) stated, "PPT is a user-friendly package that can be used for the creation of visually clear, dynamic and attention capturing presentations".

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In addition, PPT is very easy for users to combine multimedia and presentations even for those who are not so proficient with ICTs that they are able to make an interesting and easy to understand presentation (Szeto & Chen, 2014).

Of course, to develop PowerPoint-based mathematics learning media, students are required to be able to make good planning in order to produce a valid PPT (in terms of material and media) and effective by paying attention to many aspects of the development of good learning media. Arsyad (2013) states that in developing good learning media, it is necessary to pay attention to the following criteria: 1) in accordance with the objectives of learning, 2) simple and easy to use, 3) according to the level of students' abilities, and 4) meeting technical requirements to become a good learning media. Of course, in using PPT as a mathematics learning media, it should not be far from the basic goals of learning media, namely 1) clarifying information or teaching messages, 2) emphasizing important parts, 3) giving variations in teaching, 4) clarifying the teaching structure, and 5) motivating students to learn. Some aspects that need to be considered in developing PPT are (Lenaerts, 2016): 1) visual hierarchy, 2) slide layout design, 3) typography, 4) color, and 5) details. Because the PPT developed as a medium for learning mathematics, one more aspect that needs to be considered is the validity aspect of the material. This planning ability, especially in planning the completion of a task or problem, is a metacognition skill which is very closely related to high-level thinking skills which include active control of cognitive processes (Usman, Hala, & Pagarra, 2017). Metacognition is an activity about thinking how to think. According to Vrieling, Bastiaens, & Stijnen (2012) states that metacognition skills consist of skills in planning, implementing, and evaluating. So that by having good metacognition skills, students are able to make plans based on the things needed, can implement what has been planned, then be able to do an evaluation by monitoring the process so that there is a valid PPT-based mathematics learning media. The indicators of metacognition are as follows:

Tabel 1. Metacognition skills indicator.

No.	Metacognition skills	Indicators
1.	Developing Plan	<ul style="list-style-type: none"> • Able to determine the information that is needed to know • Able to connect information obtained with information that already has • Able to set goals • Able to determine the steps of development
2.	Implementation of The Plan	<ul style="list-style-type: none"> • Able to use information that has been owned as development material • Able to carry out development steps correctly according to plan • Able to formatively evaluate each step of the development carried out • Able to compare the suitability of implementation with plans that have been owned • Able to set results
3.	Product	<ul style="list-style-type: none"> • Able to check the suitability of

Evaluationd	results with goals
	<ul style="list-style-type: none"> • Able to analyze the lack and advantages of the steps of development that have been done • Able to evaluate the achievement of goals • Able to conclude the steps for developing good and correct PPT-based mathematics learning media

The steps and strategies used in developing PPT-based mathematics learning media are not the same between one student and another student. One possible cause is gender differences. The results of a study conducted by Zhang & Qin (2018) found that gender differences affect metacognition skills, especially in choosing strategies in a plan. While the results of (Iswahyudi, 2012) study found that there were differences in the implementation of metacognition between male and female students. Based on the description, this study aims to describe the metacognitive skills of prospective mathematics teachers in developing PPT-based mathematics learning media in terms of gender differences. More specifically is on how students make a plan, implement the plans that have been made, and evaluate the results of the development of the PPT they have developed. The results of this study can provide an overview of how the male and female pre-service teacher's metacognition flow in developing PowerPoint as a learning media.

II. METHODS

This type of research is descriptive research with a qualitative approach, namely the type of research that aims to understand human experience in a humanistic and interpretative approach (Jackson, Drummond, & Camara, 2007). This study will describe in depth the student metacognition skills of Mathematics Education Study Program FKIP UMS in developing PPT-based mathematics learning media in terms of gender differences. The research subjects were six students consisting of 3 male students and 3 female students from the Mathematics Education Study Program FKIP UMS in semester 6 of the 2017/2018 school year who took the subject of Computer-Based Mathematics Learning Media where it was chosen by purposive sampling method. The subject selection technique in this study was based on the scores obtained by students from this course where the six people were students who had high scores (above 80) on the task of developing PPT-based mathematics learning media on Computer-Based Mathematics Learning Media courses.

Data collection in this study used two methods which are test and interview method. The test method provided is in the form of a written description, where students are given instructions to develop PPT-based mathematics learning media on a particular topic, then are asked to write down all the plans that will be carried out in the development of the media starting from the planning, implementation, and evaluation stages. After that, students are asked to develop PPT related to the plans that have been written.



Next the interview method is used to explore the flow of student respondents' thinking in developing their PPT as a medium of mathematics learning. In order to obtain the validity of the data, the data source triangulation is carried out by comparing and looking for connections between data from each respondent based on the results of the three methods of data collection that are applied namely the test method and the interview method.

III. FINDINGS AND DISCUSSION

A. Findings

The subjects in this study were six students that was divided into two group of respondents consist of three male students with initials TP, KK, and KD and three female students' initials DPN, IDN, and RN from the Department of Mathematics Education of Universitas Muhammadiyah Surakarta, each of which had a relatively high score that is above 85 in the course of Computer-Based Mathematics Learning Media. The following are the results of the two data collection methods which are tests and interviews of the six research objects:

1) Test Method

In this method, the six respondents were given a metacognition skills test instrument that asked respondents to write down everything they thought related to planning, implementation, and evaluation in developing PPT-based mathematics learning media with the topic of Linear System of Two Variables (LSTV) at the junior high school level. The following are the results of data collection using the test method from the two groups of respondents:

i) Stage of Planning

In the process of developing learning media, the planning stage is a very important stage as a determinant of the quality of a learning media, including the PPT-based learning media. The following is a summary of the flow and aspects considered in the planning made by the male respondents and the female respondents:

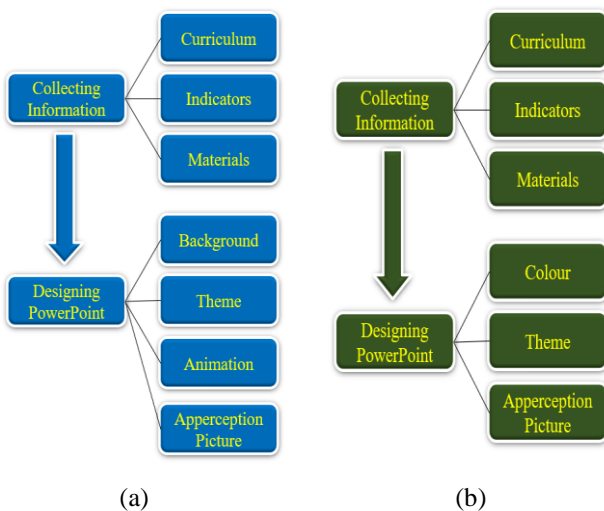


Fig. 1 The flow and aspects considered in the planning made by (a) male respondents and (b) female respondents.

Based on Fig. 1, the two student groups placed the information collection stage as the first stage and the PPT design at the second stage in their planning activities. In the first stage, the two groups considered the aspects of the curriculum, the content of the material, and the indicators as material for developing PPT. But in the second stage, namely at the PPT design stage, the two groups had different aspects of consideration. In the group of male respondents, there are four things that are taken into consideration in developing PPT in terms of design, namely themes, background, animation and apperception images. Whereas in the female-respondents group, it did not place the background and animation aspects as a consideration in developing PPT but instead placed aspects of color, themes and apperception images.

The similarity of aspects considered in the collecting information stage is very understandable because the students have learned how to make PPTs in the Computer-Based Mathematics Learning Media course they have taken. New differences arise at the stage of designing PPT because this stage is a more personal step. From Figure 1, it can be seen that color is not something that needs to be considered for the male respondent group. On the other hand, for the female respondent group, the color aspect is important to consider, but not with the animation aspect.

ii) Implementation Stage

The implementation stage is the stage where the aspects that have been chosen for consideration can be realized at this stage. The following is a summary of the planned activities carried out in the implementation phase by the male and female respondents:

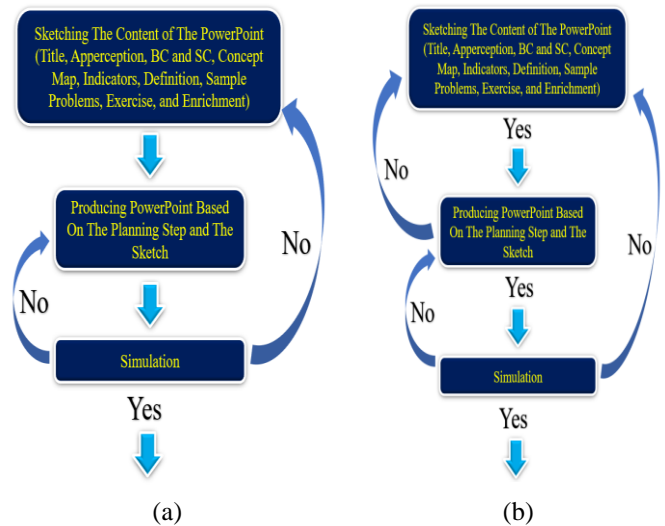


Fig. 2 Summary of planned activities carried out in the implementation phase by groups (a) male respondents and (b) female respondent.

iii) Evaluation Stage

The evaluation phase is the final stage of the development of the PPT which is intended to find out the possible shortcomings in the PPT that have been developed.



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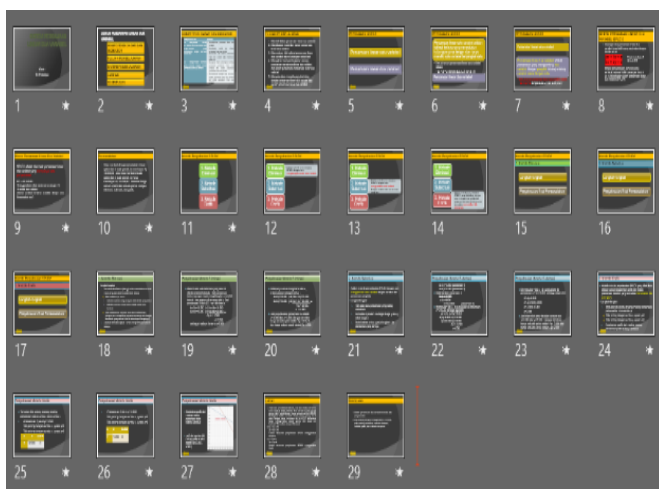
The following is a summary of the planning evaluation stages planned by the two groups of respondents:

Table 2. Summary of plan for evaluation activities by both groups of respondents.

Groups of Male Respondents	Group of Female Respondents
<ul style="list-style-type: none"> • Tested in small classes • Ask for friends' opinions • Consult with senior teachers / lecturers 	<ul style="list-style-type: none"> • Tested in small classes • Asking for opinions from friends • Consult the senior teacher / lecturer

iv) Developing Stage

This stage is done after they have finished drafting the PPT development plan. The following is an example of PPT development results from one member of the male respondent group, namely TP and one member of the female respondent group, DPN:



(a)



(b)

Fig. 3 Examples of PowerPoint slides as a result of development by one member of the group of respondents (a) male and (b) female.

2) Interview Method

The interview method is used to deepen the knowledge of researchers about the mindset of the respondents related to planning and implementation, as well as the realization of the results of planning activities that have been made. At this stage, the researcher interviewed two groups of students at different times. The three members in each group of respondents were interviewed simultaneously to see how

strongly they gave affirmations to each opinion that emerged from each member of the respondent group. If the answer from one member is approved by the other member, then the statement can be registered as one of the summary results of the interview. Likewise, if all members answer the same, then the answer will also be registered in one of the summary interviews.

The things that were asked of the male respondent group can be seen in the table below:

Table 3. Elaboration related to activities planning that has been made by male respondent groups at the interview phase.

Topic of Questions	The Respondents' Explanation and Its Discussion
The determination of the development flow	<p>Summary of answer They chose the path as shown in Figure 1, Figure 2 and Table 2 because the development flow was the development flow that had been taught during the lecture process of Computer Based Mathematics Learning Media.</p> <p>Discussion: During the lecture process of Computer-Based Mathematics Learning Media, students have been taught to be able to develop PowerPoint as a learning media using the flow of metacognition namely 1) plan development which consists of gathering information related to the material to be taught, student psychology, and PowerPoint requirements as a good learning media, 2) implementation of the plan which includes the activity of sketching PowerPoint according to the information obtained, implementing the results of sketches, and simulating the PPT that has been developed, and 3) product evaluation where students can test it on small classes, ask colleagues, or consult the teacher / senior lecturer.</p>

Excluding the aspect of students' psychology	<p>Summary of answer: In depth, the reasons for not considering children's psychology were because the respondents did not know what kind of children they would teach.</p> <p>Discussion: In developing PPT as all learning media, it still has to consider child psychology, even though in general. On the topic of LSTV, the target of students being taught is junior high school students, where they are still in the transition period from children to adolescents, so the PPT design can visually adjust to the psychology level of middle school age children.</p>
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Excluding the aspect of the color psychology	<p>Summary of answer: The reason for not considering color aspects in the development of PPT as a learning media is because they don't know if there is color psychology. Color considerations according to them are included in the background aspect. So that the background selection represents color. Moreover, they stated that color is not important to them because the most important thing for them is the content and quality of the material being taught.</p> <p>Discussion: Color selection greatly affects the comfort of students in viewing PPT slides presented in front of the class. For example, cold colors like black and dark blue are very suitable for use during the day. Or colors like pink, purple and orange are perfect for attracting female students. So, color psychology should be taken into consideration in the development of learning media, especially PPT.</p>
Revision during the development process	<p>Summary of answer: They explained that they would rather do an evaluation after PowerPoint was developed. According to them, this is because all their ideas have been poured out first, and after that they eliminate the points or parts that are not important or not related to the purpose of making learning media.</p> <p>Discussion: Evaluation is an important aspect in the development of learning products. This is intended so that what they have developed remains on the track. In this case, summative evaluation will be a little more risky when an error occurs from the start because they have to improve in full.</p>

Whereas, the aspects asked at the interview stage to the female respondent group can be seen in the following table:

Table 4. Elaboration related to planning activities that have been made by a group of female respondents at the interview phase.

Topic of Questions	Respondents' Explanation and Its Discussion
The determination of the development flow	<p>Summary of Answers: Similar to the answers given by the male respondent group, the reason for the group of female respondents to have the development planning model as seen in Figure 1, Figure 2 and Table 2 is because that model is what they learned in a computer-based mathematics learning media lecture.</p> <p>Discussion: To be able to develop PowerPoint as a learning media, students can use the flow of metacognition namely 1) plan development which consists of gathering information related to the material to be taught, student psychology, and PowerPoint requirements as a good learning media, 2) implementation of the plan which includes the activity of sketching PowerPoint according to the information obtained, implementing the results of sketches, and simulating the PPT that has been</p>

	<p>developed, and 3) product evaluation where students can test it on small classes, ask colleagues, or consult with senior teachers / lecturers.</p>
Excluding the aspect of students' psychology	<p>Summary of Answer: The same as the answers given by the male respondents group that the fundamental reason for the group of female respondents not considering the psychological aspects of children is because they do not know what the characteristics of the students they are going to teach, so that they exclude these aspects.</p> <p>Discussion: Student psychology is a very important aspect to consider by mathematics pre-service teachers. Because by recognizing the characteristics of students will help them to be able to develop learning media that are more targeted to improve the understanding of their students.</p>
Excluding the aspect of background	<p>Summary of answer: According to them, the definition of background is thematic images that are used as background in PPT. The reason they gave related to excluding the aspect of background is because there is a possibility that students have different characters, it will be more neutral if they focus on neutral-neutral colors only.</p> <p>Discussion: Due to differences in understanding related to background, they did not choose the background aspect as their consideration. Even though in essence, they are interrelated. The background of PPT can also be designed in only one color, or included in another image as the background.</p>
Excluding the aspect of animation	<p>Summary of answer: In general, the reason they gave was because they were not very familiar with the technicalities of making animation. So they feel that the animation aspect is not something that is important to them.</p> <p>Discussion: The animation menu provided in the PPT is basically to confirm, emphasize, and dramatize the points to be delivered. Therefore, the aspect of animation should be one aspect that can be considered in developing the media of learning.</p>
Revision during the development process	<p>Summary of answer: According to them, they prefer to evaluate their learning materials regularly. This is to ensure that what they have developed is in accordance with what they have planned and in accordance with the objectives of the learning media they have made. In addition, they argue that this will minimize the possibility of errors that arise at each step of development.</p> <p>Discussion: Formative evaluation is very good to do, but it will require more time in the development process.</p>



B. Discussion

Based on what is presented in Table 1., the metacognition skills are divided into three processes, namely developing, implementation of the plan, and product evaluation. In the developing plan process, the two groups of respondents have developed a plan well where both of them find out what they have to know before developing PowerPoint as a learning media such as analysing the curriculum related to the material to be taught, and analysing aspects what can be used as a consideration in developing the intended PowerPoint as in Figure 1. However, in the plan development process, the two groups did not write information related to child psychology as an aspect of consideration in developing PowerPoint. In Table 3 and Table 4, the two groups gave almost similar reasons, namely that the two groups of respondents did not know who and what characteristics of the students they were going to teach. This means that basically the two groups of respondents still see that the psychological aspects of children remain one of the aspects that need to be considered in developing PowerPoint as a learning media. In theory, aspects of child psychology are important to use as a consideration in developing a learning media. This is so that the developed learning media can be in accordance with the character of the students being taught, so that they can receive information or knowledge that is delivered properly and validly.

In the implementation of the planning process, both groups have met the indicators of metacognition skills according to Table 1, part of the implementation of the planning process. The two groups both started activities in this process by sketching PowerPoint designs referring to the plan development stage they had done. Next, PowerPoint is developed in accordance with the results of the sketches that they already have, and ends with a PowerPoint simulation that they have developed. The difference is only in the process of evaluating activities that groups of male respondents tend to evaluate activities in a summative manner at this stage, ie evaluation is only done when it has entered the simulation phase or the final stage in the implementation of this activity. If the simulation results are not as expected, evaluation can be done at the development stage or even at the sketch stage. While the female respondent groups tended to do a formative evaluation, namely at each step evaluated first.

In the product evaluation process, the two groups of respondents chose to evaluate their products in the same way, namely by testing in small classes, asking opinions from friends, and consulting with senior teachers or lecturers. In Table 2., it appears that the evaluation of the phases of the two groups is the same.

The discovery of similar processes between the two groups of respondents in the planning flow of PPT development as a learning media is because the flow is in accordance with what they get in the learning process in the lectures of Computer-Based Mathematics Learning Media according to those described in Table 3 and Table 4.

From a gender perspective, it can be seen some differences that are seen based on the results of the use of

test methods and interview methods to the two groups of respondents.

Table 5. Differences in metacognition of male and female respondent groups in developing SLTV learning media.

Difference Aspects	Point of Difference
Planning Aspect	<ul style="list-style-type: none"> The male respondent group did not see color selection as a good aspect to consider, whereas female respondents felt that the color aspect was an important aspect to consider.
Evaluation Aspect	<ul style="list-style-type: none"> The male respondents tended to evaluate the process of making learning media summative, while the female respondents tended to use formative evaluations.
Aspect of Color Selection Tendencies	<ul style="list-style-type: none"> The male respondents tended to use dark and firm colors, while the female respondents tended to use bright colors.

IV. CONCLUSION

Based on the results of the discussion, it can be concluded that in terms of being a prospective educator, the two groups of respondents had considered active aspects in developing PowerPoint as a learning media, namely aspects of information related to curriculum and information related to students' psychology although for this aspect both groups do not write in the plan because they do not know how the characteristics of the students they teach. This is confirmed from the results of interviews of researchers with the two groups of respondents. On the other hand, from gender differences, the two groups of respondents have similarities, namely in the development of the PowerPoint development path. What distinguishes the two groups of respondents is 1) on the aspects they chose as considerations in developing PowerPoint, 2) how to evaluate the development process, and 3) the selection of colors used in designing PowerPoint that has been developed.

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