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1 pesan

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Akhmad Sukri:

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Agita Risma Nurhikmawati, S.Hum., MA
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RESEARCH SKILLS PROFILE OF PROSPECTIVE SCIENCE TEACHER VIEWED FROM GENDER

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ABSTRACT

Student research skills are important in the development of scientific research. This study's purpose was to reveal students' research skills as measured by five indicators and ten sub-indicators of different genders. This research is a pre-experiment using a one-shot case study design. The treatment was given to an experimental class of 12 students in the biology education study program at Universitas Samawa, West Nusa Tenggara, Indonesia. The instrument uses a research skills assessment sheet consisting of five indicators and ten sub-indicators. The assessment of each indicator uses a scale of 1 to 4 and then is classified into four criteria, namely $3 < \text{Score} \leq 4$ (very good), $2 < \text{Score } 3$ (good), $1 < \text{Score } 2$ (good enough), and Score 1 (less good). The results showed that the student's ability to develop research questions was in a good category, with a score of 3.79. In addition, students' research abilities on four other indicators, such as I2, I3, I4, and I5, are in a good category, with scores of 2.67 to 2.83. Overall, students' research abilities on all research indicators did not differ significantly between males and females. However, there were differences in the scores for each indicator regarding gender.

Keywords: Research skills, science teacher, gender

1. INTRODUCTION

Research is an objective and systematic activity in solving problems to find the truth [1]. Research is conducted based on curiosity about something [2]. In carrying out research skills are needed [3]. Research skills are skills that students must possess to solve problems faced in real life [4]. Research skills generally include designing, implementing, and reporting research results [5]. Research skills are critical because they function in the development of skills for scientific research [6]. Research skills describe a person's ability to conduct research, which includes observation, compiling research questions, building hypotheses, conducting experiments, collecting and analyzing data, and displaying research results, conclusions, and publications [7]. Each research component is essential in developing the quality of education and learning [8].

Research skills are essential for students. Research skills can build a robust intellectual connection between research and student learning [9] because it relies on scientific reasoning through applying the scientific method [10]. In addition, students must also possess research skills so that preparing theses becomes easy as part of the competence of university graduates [11]. The results of measuring students' research skills, especially in Indonesia, differ. These

differences may be caused by differences in measuring students' research skills. According to Maknun [5], research skills are measured based on three criteria: the skills to design, implement, and report research results. Solihat et al. [12] measure students' research skills into five indicators: proposal preparation, research implementation, research results reporting, use of scientific library sources, and student guidance processes.

The difference in indicators and results measuring students' research skills is a treasure in developing students' scientific skills. The research skill profile of prospective science teacher students, especially in West Nusa Tenggara, Indonesia, has not been widely carried out. In addition, no studies reveal students' research abilities regarding different genders. On the other hand, the measurement of student research requires a complete instrument to measure research skills comprehensively. This study aims to reveal students' research skills measured by five indicators and ten sub-indicators adopted by Willison & Buisman-Pijlman [13] on different genders.

2. RESEARCH METHODS

This research is a pre-experiment using a one-shot case study design [14][15]. The treatment was given to an experimental class of 12 students in the biology education study program at Universitas Samawa, West Nusa Tenggara, Indonesia. The treatment used teaching materials for flora and fauna endemic to West Nusa Tenggara to train students' research skills. The implementation of teaching materials was carried out for six face-to-face meetings; then, at the end of the session, a post-test was given to determine students' research skills profile. The research instrument uses a research skills assessment sheet adopted and modified from Willison & Buisman-Pijlman [13], which consists of five indicators and ten sub-indicators. Research skills indicators and sub-indicators are shown in Table 1.

Table 1. Indicators and sub-indicators of student research skills

No	Indikator	Sub-indikator
1	Developing Research Questions (I1)	a. Formulate the problem b. Formulating a hypothesis
2	Evaluating Information (I2)	c. Identifying variables d. Checking the need for research materials and equipment
3	Research Implementation (I3)	e. Carry out research according to the plan f. Research data collection
4	Interpreting research results (I4)	g. Checking research results in problem-solving
5	Communicating research results in writing (I5)	h. Writing scientific reports i. Knowledge representation j. Systematics of writing and completeness of scientific reports

The assessment of each sub-indicator uses a scale of 1 to 4 with details; for example, the sub-indicator for formulating a problem is given a value of 4 if it can formulate a problem covering three criteria, namely (a) in the form of a question sentence, (b) containing manipulation and response variables, and (c) the formulation of the problem relevant to the topic. A value of 3 is given if it can formulate a problem covering only two criteria, a value of 2 if it can formulate a problem covering only one criterion, and a value of 1 if it does not meet all the specified criteria. The description of this rating scale is different for each sub-indicator. The scoring scores for each indicator and sub-indicator are further classified into four criteria, namely $3 < Score \leq 4$ (very good), $2 < Score 3$ (good), $1 < Score 2$ (good enough), Score 1 (less good) [16]. Overall, data analysis was assisted using the Microsoft Excel program [17].

3. RESULTS AND DISCUSSION

This study reveals the research skills of students. In general, students' research skills on each indicator and sub-indicator are shown in Figures 1 and 2.
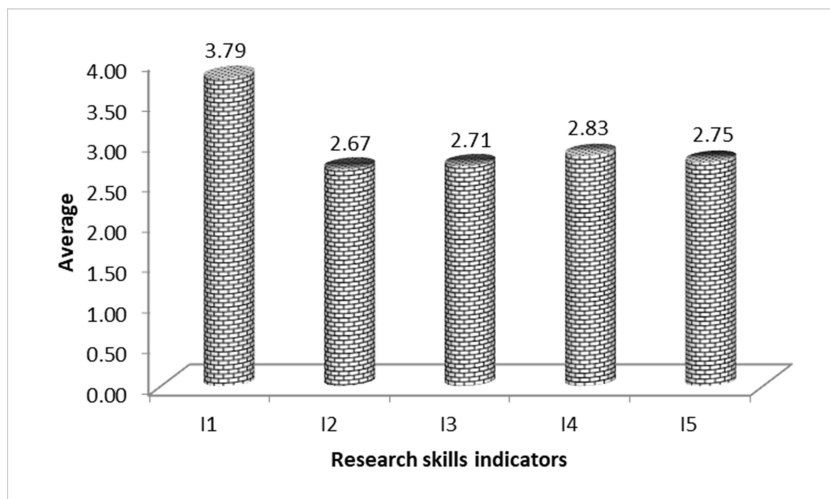

Figure 1. Student research skills on each indicator

Figure 1 shows that students' research skills on indicator I1, namely developing research questions, have the highest average value compared to other indicators, with a value of 3.79. These results prove that students can formulate problems and hypotheses well. These two variables, namely formulating problems and hypotheses, cannot be separated. Formulating hypotheses is a skill in developing research problems. The hypothesis states the solution to a problem: a prediction of the relationship between variables [18]. The results differ from the Aydoğdu [19] report, revealing that prospective science teacher students have difficulty formulating research problems and hypotheses. According to Susetyo & Noermanzah [20], a student's ability to formulate problems is in a good category, and it is not found that students have good abilities. Zuriati [21] also reported the same result, which revealed that 82.30% of students had difficulty formulating research problems.

In addition to indicators of formulating problems and hypotheses, Figure 1 also reveals that students have good skills in evaluating information (I2), carrying out research activities (I3), interpreting research results (I4), and communicating research results (I5). The high ability of students to conduct this research may be caused by the treatment given to students in the form of research-based teaching materials learning. According to Prahmana et al. [3], implementing research-based learning models in learning can foster student research skills. This result is different from the findings of Maknun et al. [5], which found that the research skills of prospective biology teacher students in the Cirebon area were in the poor category, with research design skills reaching 51.3%, research carrying skills 55.21%, and results in reporting skills research by 62.82%. The difference in results may be caused by the absence of treatment given by previous researchers to improve students' research skills. The results obtained by Maknun et al. [5] are an initial description of student research skills.

The descriptive analysis in Figure 2 shows students' research skills in different genders. These results reveal that overall, there is no difference in the research skills of male and female students on the five indicators of research skills. Student research skills on indicator I1, namely developing research questions, have the highest average value compared to other indicators, with scores that are not much different for male and female students. In the three indicators, namely I2, I3, and I5 female students tend to have better skill scores than boys, while in indicator I4, male

students tend to show better scores than girls. But in general, the research skills of male and female students did not show a significant difference and were in a good category. According to Aini [22], there is no difference in the ability of male and female students to solve problems, but women tend to understand problems more quickly than men. This result is also reinforced by Anwar et al. [23], who revealed that women have a higher level of intelligence than men in university learning processes.
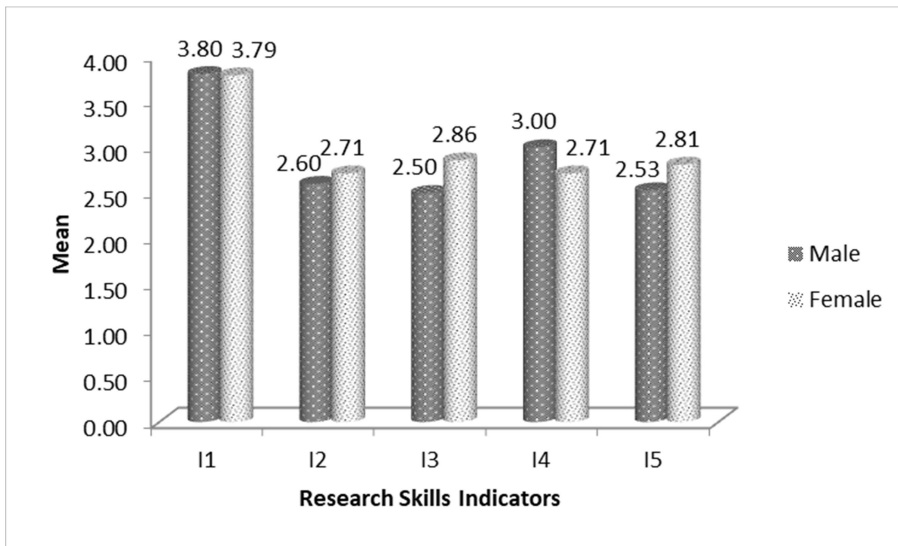

Figure 2. Research skills of students across different genders

To determine the research ability of students in each sub-indicator, a descriptive analysis was carried out, with results shown in Figure 3. The results in Figure 3 show that male and female students have the same ability in sub-indicators a and b, namely formulating problems and hypotheses, with each value being in the very good category. The same trend is also found in indicator c (identifying the variable), which shows that the abilities of men and women tend to be the same. Of the ten sub-indicators of research ability, indicator d (checking the need for research equipment) shows the lowest value compared to other indicators, with values for men and women of 2.00 and 2.29, respectively. The sub-indicator checking the need for research equipment is one of the skills in designing research. According to Maknun et al. [5], student skills in designing research are still relatively low, with a mastery level of 51.30%. This result is also reinforced by the findings of Zain et al. [24], which revealed that students had difficulties designing research, including designing research activities.
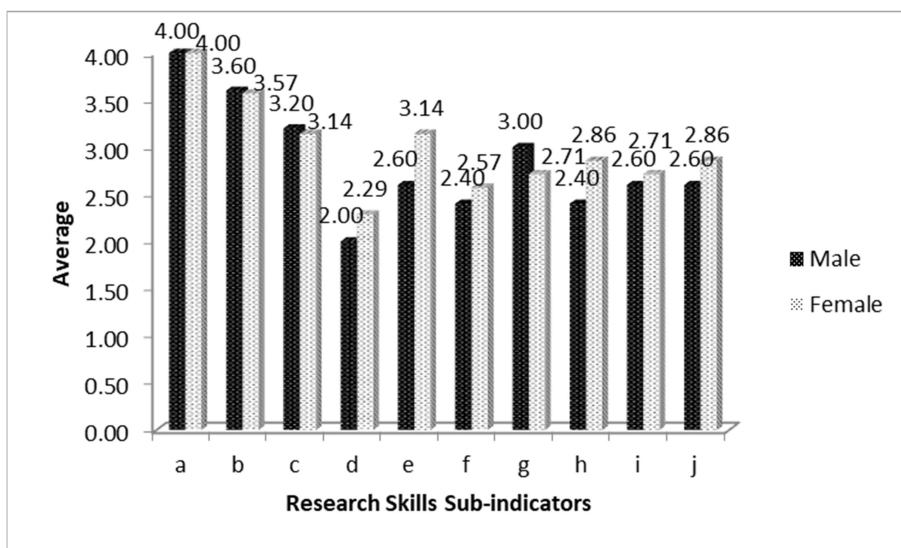
Figure 3. Student research skills for each sub-indicator for different genders

Figure 3 also shows that in the sub-indicator e (carrying out the research as planned), there are significant differences in the mean scores between men and women, with scores of 2.60 and 3.14, respectively. These results indicate that females have better abilities than males in carrying out research as planned. The low Score on the sub-indicator e in male students is in line with the findings of Solihat et al. [12], who reported that most students had difficulties in carrying out research (71.42%) and carrying out research planning (57.14%). On the other hand, on the g indicator (checking the results of research in problem-solving), males tend to have better skills than females. However, in general, the ability on the sub-indicator g between males and females is not significantly different. This result is in line with the findings of Indrawati & Tasni [25], which state that in solving problems, females tend to be careful, hesitant, and structured, while males tend to be quick in taking attitudes, less systematic, and less tidy. This finding also confirms that males' and females' problem-solving abilities are not significantly different.

4. CONCLUSION

This study reveals the research skills of prospective science teacher students in terms of five indicators. The results showed that the student's ability to develop research questions was in a good category, scoring 3.79. In addition, students' research abilities on four other indicators, such as I2, I3, I4, and I5, are in a good category, with scores in the range of 2.67 to 2.83. Overall, students' research abilities on all research indicators did not differ significantly between males and females. However, descriptively there were differences in the scores for each indicator regarding gender. Judging from each sub-indicator, there is no significant difference in research ability between men and women. However, descriptively, there are significant differences in scores between men and women, as in sub-indicator e (carrying out research as planned), which shows that women tend to have better abilities than men. In general, the results of this study reveal that the research skills of male and female students are not significantly different for all indicators and sub-indicators of research skills.

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[ICETECH 2022] Editorial Decision on Paper

3 pesan

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Cc: Hadi Gunawan Sakti <hadigunawansakti_tp@ikipmataram.ac.id>, Muhammad Arief Rizka
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Akhmad Sukri:

Congratulations on the acceptance of your full paper "RESEARCH SKILLS
PROFILE OF PROSPECTIVE SCIENCE TEACHER REVIEWING FROM GENDER" to be
presented at The 3rd International Conference on Education and Technology
2022 and published at Atlantis Press Conference Proceeding. Please find the
enclosed reviewed manuscript and please revise your manuscript according to
the reviewers' comments.

Thank you and looking forward to your participation in this event.

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Reviewer A:

1. Thematic Relevance for the "Call for Papers":
     4- Definitely relevant

2. Quality of Content:
     4- Good work, significant

3. Experiments Result and Preparation:
     4- Good preparation and significant result

4. Quality of presentation:
     4- Well written

5. Conclusion and Future Work:
     4- Significant

6. Significance for theory or practice:
     4- Significant

7. References:
     4- Deep but not recent. The references well cited on the paper.

8. Originality and level of innovativeness:
     4- A pioneer work

9. Overall recommendation:
     4- Probably accept (good quality)

10. General Comment from the paper:
     need to be corrected according to the comments on the script

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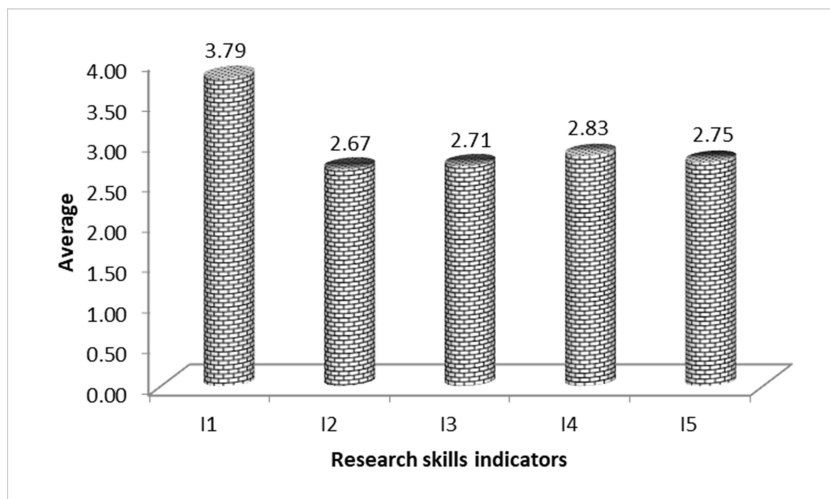

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In addition to indicators of formulating problems and hypotheses, Figure 1 also reveals that students have good skills in evaluating information (I2), carrying out research activities (I3), interpreting research results (I4), and communicating research results (I5). The high ability of students to conduct this research may be caused by the treatment given to students in the form of research-based teaching materials learning. According to Prahmana et al. [3], implementing research-based learning models in learning can foster student research skills. This result is different from the findings of Maknun et al. [5], which found that the research skills of prospective biology teacher students in the Cirebon area were in the poor category, with research design skills reaching 51.3%, research carrying skills 55.21%, and results in reporting skills research by 62.82%. The difference in results may be caused by the absence of treatment given by previous researchers to improve students' research skills. The results obtained by Maknun et al. [5] are an initial description of student research skills.

The descriptive analysis in Figure 2 shows students' research skills in different genders. These results reveal that overall, there is no difference in the research skills of male and female students on the five indicators of research skills. Student research skills on indicator I1, namely developing research questions, have the highest average value compared to other indicators, with scores that are not much different for male and female students. In the three indicators, namely I2, I3, and I5 female students tend to have better skill scores than boys, while in indicator I4, male

students tend to show better scores than girls. But in general, the research skills of male and female students did not show a significant difference and were in a good category. According to Aini [22], there is no difference in the ability of male and female students to solve problems, but women tend to understand problems more quickly than men. This result is also reinforced by Anwar et al. [23], who revealed that women have a higher level of intelligence than men in university learning processes.
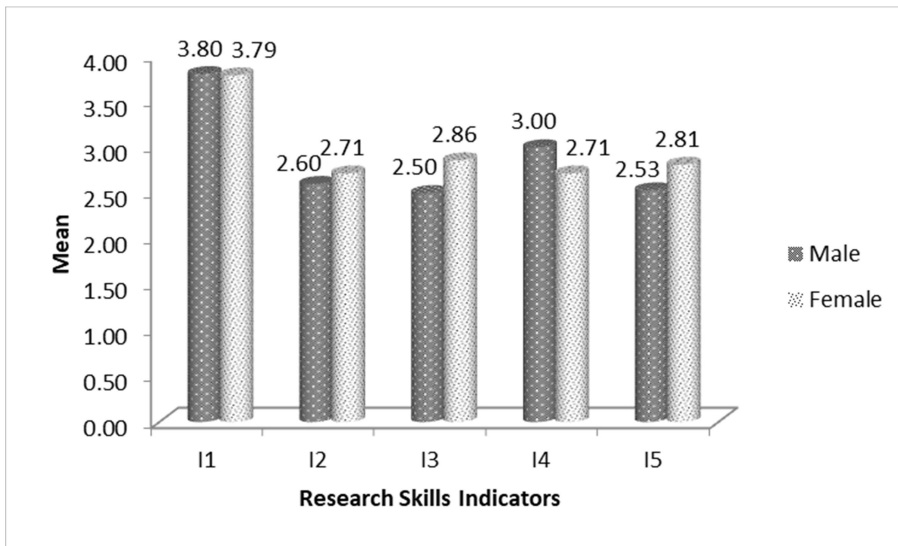

Figure 2. Research skills of students across different genders

To determine the research ability of students in each sub-indicator, a descriptive analysis was carried out, with results shown in Figure 3. The results in Figure 3 show that male and female students have the same ability in sub-indicators a and b, namely formulating problems and hypotheses, with each value being in the very good category. The same trend is also found in indicator c (identifying the variable), which shows that the abilities of men and women tend to be the same. Of the ten sub-indicators of research ability, indicator d (checking the need for research equipment) shows the lowest value compared to other indicators, with values for men and women of 2.00 and 2.29, respectively. The sub-indicator checking the need for research equipment is one of the skills in designing research. According to Maknun et al. [5], student skills in designing research are still relatively low, with a mastery level of 51.30%. This result is also reinforced by the findings of Zain et al. [24], which revealed that students had difficulties designing research, including designing research activities.
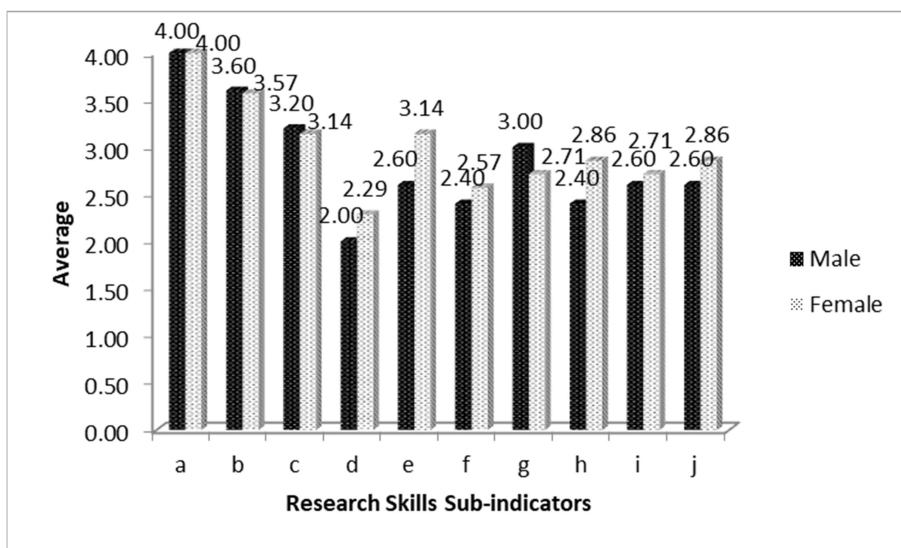
Figure 3. Student research skills for each sub-indicator for different genders

Figure 3 also shows that in the sub-indicator e (carrying out the research as planned), there are significant differences in the mean scores between men and women, with scores of 2.60 and 3.14, respectively. These results indicate that females have better abilities than males in carrying out research as planned. The low Score on the sub-indicator e in male students is in line with the findings of Solihat et al. [12], who reported that most students had difficulties in carrying out research (71.42%) and carrying out research planning (57.14%). On the other hand, on the g indicator (checking the results of research in problem-solving), males tend to have better skills than females. However, in general, the ability on the sub-indicator g between males and females is not significantly different. This result is in line with the findings of Indrawati & Tasni [25], which state that in solving problems, females tend to be careful, hesitant, and structured, while males tend to be quick in taking attitudes, less systematic, and less tidy. This finding also confirms that males' and females' problem-solving abilities are not significantly different.

4. CONCLUSION

This study reveals the research skills of prospective science teacher students in terms of five indicators. The results showed that the student's ability to develop research questions was in a good category, scoring 3.79. In addition, students' research abilities on four other indicators, such as I2, I3, I4, and I5, are in a good category, with scores in the range of 2.67 to 2.83. Overall, students' research abilities on all research indicators did not differ significantly between males and females. However, descriptively there were differences in the scores for each indicator regarding gender. Judging from each sub-indicator, there is no significant difference in research ability between men and women. However, descriptively, there are significant differences in scores between men and women, as in sub-indicator e (carrying out research as planned), which shows that women tend to have better abilities than men. In general, the results of this study reveal that the research skills of male and female students are not significantly different for all indicators and sub-indicators of research skills.

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Research Skills Profile of Prospective Science Teacher Viewed from Gender

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Abstract. Student research skills are important in the development of scientific research. This study's purpose was to reveal students' research skills as measured by five indicators and ten sub-indicators of different genders. This research is a pre-experiment using a one-shot case study design. The treatment was given to an experimental class of 12 students in the biology education study program at Universitas Samawa, West Nusa Tenggara, Indonesia. The instrument uses a research skills assessment sheet consisting of five indicators and ten sub-indicators. The assessment of each indicator uses a scale of 1 to 4 and then is classified into four criteria, namely $3 <$ Score ≤ 4 (very good), $2 <$ Score 3 (good), $1 <$ Score 2 (good enough), and Score 1 (less good). The results showed that the student's ability to develop research questions was in a good category, with a score of 3.79. In addition, students' research abilities on four other indicators, such as I2, I3, I4, and I5, are in a good category, with scores of 2.67 to 2.83. Overall, students' research abilities on all research indicators did not differ significantly between males and females. However, there were differences in the scores for each indicator regarding gender.

Keywords: Research skills · science teacher · gender

1 Introduction

Research is an objective and systematic activity in solving problems to find the truth [1]. Research is conducted based on curiosity about something [2]. In carrying out research skills are needed [3]. Research skills are skills that students must possess to solve problems faced in real life [4]. Research skills generally include designing, implementing, and reporting research results [5]. Research skills are critical because they function in the development of skills for scientific research [6]. Research skills describe a person's

ability to conduct research, which includes observation, compiling research questions, building hypotheses, conducting experiments, collecting and analyzing data, and displaying research results, conclusions, and publications [7]. Each research component is essential in developing the quality of education and learning [8].

Research skills are essential for students. Research skills can build a robust intellectual connection between research and student learning [9] because it relies on scientific reasoning through applying the scientific method [10]. In addition, students must also possess research skills so that preparing theses becomes easy as part of the competence of university graduates [11]. The results of measuring students' research skills, especially in Indonesia, differ. These differences may be caused by differences in measuring students' research skills. According to Maknun [5], research skills are measured based on three criteria: the skills to design, implement, and report research results. Solihat et al. [12] measure students' research skills into five indicators: proposal preparation, research implementation, research results reporting, use of scientific library sources, and student guidance processes.

The difference in indicators and results measuring students' research skills is a treasure in developing students' scientific skills. The research skill profile of prospective science teacher students, especially in West Nusa Tenggara, Indonesia, has not been widely carried out. In addition, no studies reveal students' research abilities regarding different genders. On the other hand, the measurement of student research requires a complete instrument to measure research skills comprehensively. This study aims to reveal students' research skills measured by five indicators and ten sub-indicators adopted by Willison & Buisman-Pijlman [13] on different genders.

2   Research Methods

This research is a pre-experiment using a one-shot case study design [14, 15]. The treatment was given to an experimental class of 12 students in the biology education study program at Universitas Samawa, West Nusa Tenggara, Indonesia. The treatment used teaching materials for flora and fauna endemic to West Nusa Tenggara to train students' research skills. The implementation of teaching materials was carried out for six face-to-face meetings; then, at the end of the session, a post-test was given to determine students' research skills profile. The research instrument uses a research skills assessment sheet adopted and modified from Willison & Buisman-Pijlman [13], which consists of five indicators and ten sub-indicators. Research skills indicators and sub-indicators are shown in Table 1.

The assessment of each sub-indicator uses a scale of 1 to 4 with details; for example, the sub-indicator for formulating a problem is given a value of 4 if it can formulate a problem covering three criteria, namely (a) in the form of a question sentence, (b) containing manipulation and response variables, and (c) the formulation of the problem relevant to the topic. A value of 3 is given if it can formulate a problem covering only two criteria, a value of 2 if it can formulate a problem covering only one criterion, and a value of 1 if it does not meet all the specified criteria. The description of this rating scale is different for each sub-indicator. The scoring scores for each indicator and sub-indicator are further classified into four criteria, namely $3 <$ Score ≤ 4 (very good), $2 <$ Score 3

Table 1. Indicators and sub-indicators of student research skills

No	Indikator	Sub-indikator
1	Developing Research Questions (I1)	a. Formulate the problem b. Formulating a hypothesis
2	Evaluating Information (I2)	c. Identifying variables d. Checking the need for research materials and equipment
3	Research Implementation (I3)	e. Carry out research according to the plan f. Research data collection
4	Interpreting research results (I4)	g. Checking research results in problem-solving
5	Communicating research results in writing (I5)	h. Writing scientific reports i. Knowledge representation j. Systematics of writing and completeness of scientific reports

(good), 1 < Score 2 (good enough), Score 1 (less good) [16]. Overall, data analysis was assisted using the Microsoft Excel program [17].

3 Results and Discussion

This study reveals the research skills of students. In general, students' research skills on each indicator and sub-indicator are shown in Figs. 1 and 2.

Fig. 1. Student research skills on each indicator

Figure 1 shows that students' research skills on indicator I1, namely developing research questions, have the highest average value compared to other indicators, with a value of 3.79. These results prove that students can formulate problems and hypotheses well. These two variables, namely formulating problems and hypotheses, cannot be separated. Formulating hypotheses is a skill in developing research problems. The hypothesis states the solution to a problem: a prediction of the relationship between variables [18]. The results differ from the Aydoğdu [19] report, revealing that prospective science teacher students have difficulty formulating research problems and hypotheses. According to Susetyo & Noermanzah [20], a student's ability to formulate problems is in a good category, and it is not found that students have good abilities. Zuriati [21] also reported the same result, which revealed that 82.30% of students had difficulty formulating research problems.

In addition to indicators of formulating problems and hypotheses, Fig. 1 also reveals that students have good skills in evaluating information (I2), carrying out research activities (I3), interpreting research results (I4), and communicating research results (I5). The high ability of students to conduct this research may be caused by the treatment given to students in the form of research-based teaching materials learning. According to Prahmana et al. [3], implementing research-based learning models in learning can foster student research skills. This result is different from the findings of Maknun et al. [5], which found that the research skills of prospective biology teacher students in the Cirebon area were in the poor category, with research design skills reaching 51.3%, research carrying skills 55.21%, and results in reporting skills research by 62.82%. The difference in results may be caused by the absence of treatment given by previous researchers to improve students' research skills. The results obtained by Maknun et al. [5] are an initial description of student research skills.

The descriptive analysis in Fig. 2 shows students' research skills in different genders. These results reveal that overall, there is no difference in the research skills of male and female students on the five indicators of research skills. Student research skills on indicator I1, namely developing research questions, have the highest average value compared to other indicators, with scores that are not much different for male and female students. In the three indicators, namely I2, I3, and I5 female students tend to have better skill scores than boys, while in indicator I4, male students tend to show better scores than girls. But in general, the research skills of male and female students did not show a significant difference and were in a good category. According to Aini [22], there is no difference in the ability of male and female students to solve problems, but women tend to understand problems more quickly than men. This result is also reinforced by Anwar et al. [23], who revealed that women have a higher level of intelligence than men in university learning processes.

To determine the research ability of students in each sub-indicator, a descriptive analysis was carried out, with results shown in Fig. 3. The results in Fig. 3 show that male and female students have the same ability in sub-indicators a and b, namely formulating problems and hypotheses, with each value being in the very good category. The same trend is also found in indicator c (identifying the variable), which shows that the abilities of men and women tend to be the same. Of the ten sub-indicators of research ability, indicator d (checking the need for research equipment) shows the lowest value
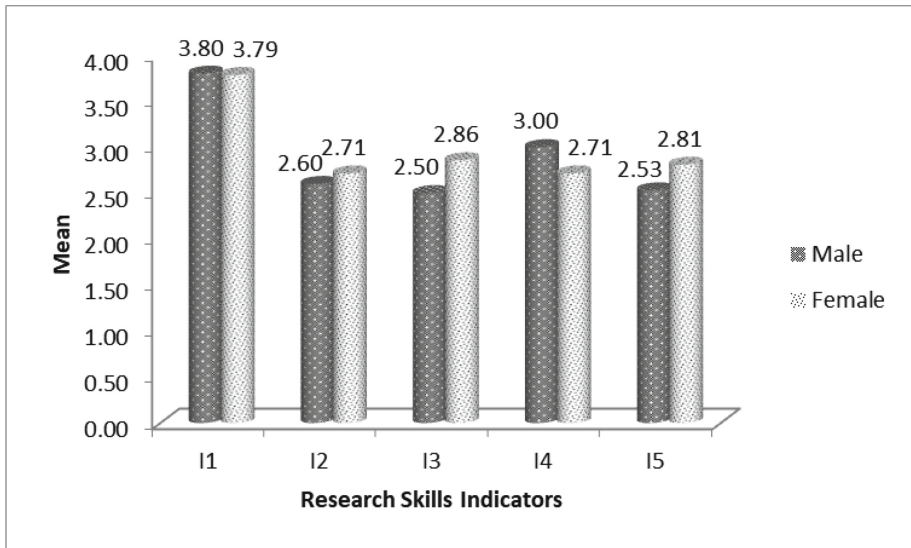
Fig. 2. Research skills of students across different genders

compared to other indicators, with values for men and women of 2.00 and 2.29, respectively. The sub-indicator checking the need for research equipment is one of the skills in designing research. According to Maknun et al. [5], student skills in designing research are still relatively low, with a mastery level of 51.30%. This result is also reinforced by the findings of Zain et al. [24], which revealed that students had difficulties designing research, including designing research activities.

Figure 3 also shows that in the sub-indicator e (carrying out the research as planned), there are significant differences in the mean scores between men and women, with scores of 2.60 and 3.14, respectively. These results indicate that females have better abilities than males in carrying out research as planned. The low Score on the sub-indicator e in male students is in line with the findings of Solihat et al. [12], who reported that most students had difficulties in carrying out research (71.42%) and carrying out research planning (57.14%). On the other hand, on the g indicator (checking the results of research in problem-solving), males tend to have better skills than females. However, in general, the ability on the sub-indicator g between males and females is not significantly different. This result is in line with the findings of Indrawati & Tasni [25], which state that in solving problems, females tend to be careful, hesitant, and structured, while males tend to be quick in taking attitudes, less systematic, and less tidy. This finding also confirms that males' and females' problem-solving abilities are not significantly different.
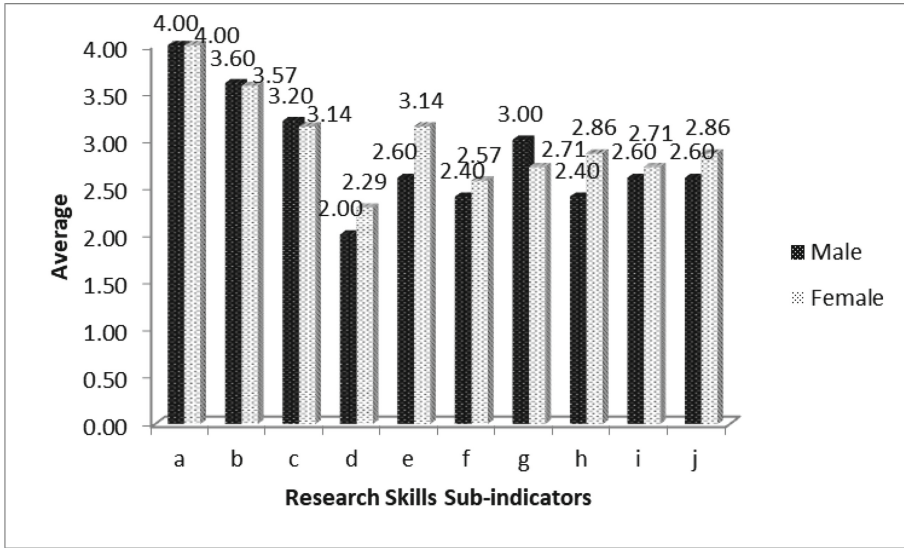
Fig. 3. Student research skills for each sub-indicator for different genders

4 Conclusion

This study reveals the research skills of prospective science teacher students in terms of five indicators. The results showed that the student's ability to develop research questions was in a good category, scoring 3.79. In addition, students' research abilities on four other indicators, such as I2, I3, I4, and I5, are in a good category, with scores in the range of 2.67 to 2.83. Overall, students' research abilities on all research indicators did not differ significantly between males and females. However, descriptively there were differences in the scores for each indicator regarding gender. Judging from each sub-indicator, there is no significant difference in research ability between men and women. However, descriptively, there are significant differences in scores between men and women, as in sub-indicator e (carrying out research as planned), which shows that women tend to have better abilities than men. In general, the results of this study reveal that the research skills of male and female students are not significantly different for all indicators and sub-indicators of research skills.

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