
Analysis Science Process Skills, Arnguing Ability and Digital Literacy of MAN 5 Batanghari Students Based on Gender Differences

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Abstract. Science process skills are skills that students must have in processing the scientific knowledge they have acquired. Both knowledge gained from the environment and digital media with literacy skills. So the ability to argue scientifically is needed to be able to convey information obtained scientifically so that it can solve problems in everyday life. Therefore, this study aims to analyze students' science process skills, argumentation skills, and digital literacy. The method used in this study is the explanatory mix method. The population in this study were students of MAN 5 Batanghari, while the sampling technique in this study used purposive sampling, namely students of class X IPA with a total of 35 students. The data collection instruments in this study were in the form of interview sheets, digital literacy questionnaires, and essay questions. Data analysis in this study used descriptive statistical methods. Gender-based SPS for students with dominant results (always good) is female. Then the ability to argue is also more in the female gender. Meanwhile, digital literacy that has the maximum value is male students.

Keywords: SPS, Arnguing, Digital Literacy, Gender Differences.

Introduction

According to Kurniawan et al. (2019) one of the lessons taught in the education curriculum is science learning. Learning science in physics is very beneficial for students to develop their scientific abilities and skills. Learning physics is very important to learn because it is the most basic learning and cannot be separated from mastering concepts, their application in solving physics problems, and working scientifically (Darmaji et al., 2019; Aji et al., 2017). Physics learning is also not only concerned with intelligence, as according to (Apriliyani et al., 2015; Setyandaru et al., 2017) good education is not solely aimed at honing students' intelligence, but it will be more meaningful if it is involved in improving thinking skills. student. One of the thinking skills that must be mastered by students is higher order thinking skills (HOTS).

HOTS is the ability of students to think more deeply. According to Chotimah et al. (2020) HOTS is a student's thinking process at a higher cognitive level that is developed from various cognitive learning concepts and methods such as problem solving, teaching, and assessment methods. Students must be able to think with good reasons to be able to follow developments in the developing world of education (Astalini et al., 2019). Then these HOTS will be active in students when students face unfamiliar problems,

uncertainties, statements and dilemmas (Saido et al., 2015). These HOTS skills/abilities include problem solving skills, critical thinking skills, creative thinking skills, argumentation skills, and decision making skills (Setiawati et al., 2019). Meanwhile, according to Singh et al. (2018) higher order thinking skills include critical, logical, reflective, metacognitive, and creative thinking. On the ability to argue put forward by Setiawati, on logical and critical thinking which involves the ability to express opinions scientifically, to support it requires in-depth process skills in the scientific field or are called science process skills.

Science process skills (SPS) are scientific skills that are important for students to have in the physics learning process. SPS has a strong influence on education because SPS allows students to develop higher mental processes (Wirda et al., 2015). However, teachers do not realize the importance of teaching these science process skills (Af'idayani et al., 2018). The need for individuals who are scientifically literate and proficient in the use of SPS makes it imperative that effective strategies for teaching these skills are developed (Strawitz, 1993). Skills that must be possessed include measuring, observing, classifying, concluding, predicting, asking questions, making hypotheses, conducting experiments and formulating models (Darmaji et al., 2019). Through process skills, the concepts students acquire will be more meaningful because students discover scientific concepts, principles, laws, and theories themselves (Darmaji et al., 2020). SPS can be done by conducting experiments or also called practicum. With learning practices students can build concepts by connecting results with previously owned theories and can solve science problems (Lestari & Diana, 2018). Entering the 5.0 revolution, digital literacy is needed to increase students' knowledge about SPS.

The concept of digital literacy has become very important for everyone around the world (Reddy et al., 2020). Therefore, in the context of the development and expansion of an increasingly digital society, competence in the scope of digital literacy in student education is very important, but often seen as something taken for granted (Tejedor et al., 2020). According to Mauludi (2020) digital literacy is a skill that does not only involve the ability to use information and communication technology tools, but also social skills, learning abilities, and critical, creative, and inspirational attitudes as digital competencies. Increasing digital literacy skills is obtained by familiarizing students with searching, processing, analyzing, and interpreting information and data obtained during face-to-face or online learning (Octavia & Hardinata, 2021). According to Harjono, (2018) digital literacy refers to knowledge of how communication technology impacts the meaning that follows, and the ability to analyze and evaluate the knowledge available in web networks. Having good digital literacy can help students' learning processes run smoothly and more easily.

Problems that occur in student SPS are similar to research by Maheasy et al., (2019) which states that 76% of SPS class XI IPA students at SMA Bandung are in the low category, where students are still lacking in skills. making hypotheses, determining variables, and theory. In addition to science process skills, the opinion skills of MAN 1 Gorontalo students in Setiono et al., 2021's study were low, because in arguing most students only commented and did not provide evidence and justification for the claims they made. And here are a number of studies that have considered the extent to which argumentation skills are transferable across contexts, though often these focus on transfers between familiar and unfamiliar contexts within a given subject area (Guilfoyle et al., 2021). Meanwhile, based on research conducted by Rahayu et al., (2019) regarding the digital literacy of students at SMKN 1 Gamaliel Madiun, it is still lacking, because many students bring mobile phones or androids to school but are less integrated in learning. However, based on several previous studies, no one has researched to measure SPS, argumentation skills and digital literacy skills simultaneously or all at once.

Based on the problems experienced by students in previous research, an evaluation instrument is needed to measure and improve SPS, argumentation abilities, and digital literacy of MAN 5 Batanghari students. This study aims to analyze SPS, argumentation abilities, and students' digital literacy in physics learning.

Methods

The method used in this study is the explanatory mix method. As according to Rachmawati et al., (2018) mixed methods are research approaches that combine or link qualitative and quantitative forms. The qualitative and quantitative methods used in research are to obtain more valid or verifiable data (Ulandari et al., 2019). Ulandari et al., (2017) mentioned several advantages of mixed methods including: (1) the possibility of asking complex research questions, (2) the data obtained is richer and more comprehensive, (3) the research results will have high credibility due to triangulation. The type or research design used is the explanatory method. Explanatory research aims to explain the position of the variables studied and what effect one variable has on other variables (Rikusita et al., 2020). The data collection instrument used for quantitative data in this study used questionnaires and essay questions, while for qualitative data interview sheets were used.

The population in this study were students at MAN 5 Batanghari. While taking samples in this study using purposive sampling technique. Purposive sampling is a non-random sampling method in which researchers ascertain certain identities that are in accordance with research objectives so that they are expected to be able to respond to research objectives (Lenaini, 2021). The considerations made in this purposive sampling technique can vary and depend on the needs of the research to be carried out (Maharani & Bernard, 2018). The sample used in this study was students of class X MIPA MAN 5 Batanghari, totaling 35 students.

The data collection instrument in this study was in the form of test questions about argumentation abilities according to Faiqoh et al., (2018). Based on the components of the Toulmin argumentation pattern (TAP) which consists of data, claims, warrants, support, and rebuttal. Students fill in five arguments for each question number. Then the participant response questionnaire, observation sheet and interview sheet. Student response questionnaires are used to determine student responses to digital literacy. Where for the assessment and categorization according to Sugiyono (2012) are as follows:

Table 1. Category Evaluation.

Score Range	Category evaluation
$75 \leq n \leq 100$	Very good
$50 \leq n \leq 75$	Well
$25 \leq n \leq 50$	Enough
$n \leq 25$	Low

(Sugiyono, 2012)

The interview used in this research is a structured interview. Structured interviews were used as a data collection procedure in the form of prepared questionnaires to be given to informants to obtain information (Nugroho et al., 2019). The analysis in this

study uses descriptive statistical analysis methods. According to Sholikhah (2016) descriptive statistics are statistics that have the task of organizing and analyzing data, figures, in order to provide an orderly, brief, and clear picture of a phenomenon, event or situation, so that a certain definition or meaning can be obtained. In the analysis of descriptive statistical data, the data obtained through questionnaires in this study were analyzed using quantitative descriptive statistics for each skill or ability test, namely SPS, argumentation skills, and digital literacy. Then from the data that has been collected look for the frequency distribution. According to Darmaji et al. (2020) that descriptive statistical analysis is carried out by finding the mean, median, minimum value and maximum value to get an overview of the characteristics of the data. As for qualitative data analysis in the form of interviews which were analyzed using Miles and Huberman's analysis. The activities carried out in Miles and Huberman's analysis are reduction, data, display, data, and verification of conclusions (Huda, 2020) which can then support quantitative data.

Results and Discussion

The following is a table of students' questionnaire results on SPS, HOTS in argumentation and digital literacy skills.

Table 2. Student Questionnaire Results (Males) at MAN 5 Batanghari

	Range Score	Category evaluation	Total	Average	Median	Min	Max	Evaluation (%)
SPS	25.0-0	Low	0	85	85	80	90	0
	50.0-25.0	Enough	0					0
	50.0-75.0	Well	3					23
	75.0-100	Very good	10					77
Total			13					100
Argumentation	25.0-0	Low	0	57	60	35	68	0
	50.0-25.0	Enough	2					15,4
	50.0-75.0	Well	6					46,1
	75.0-100	Very good	5					38,5
Total			13					100
Digital Literacy	25.0-0	Low	0	72	68	60	93	0
	50.0-25.0	Enough	7					53,8
	50.0-75.0	Well	5					38,5
	75.0-100	Very good	1					7,7
Total			13					100

The following Table 2 shows the results of the questionnaire for female students on SPS, HOTS in arguments and abilities digital literacy.

Table 3. Student Questionnaire Results (Females) at MAN 5 Batanghari Batanghari

	Range Score	Category evaluation	Total	Average	Median	Min	Max	Evaluation (%)
SPS	25.0-0	Low	0	85	85	80	90	0
	50.0-25.0	Enough	0					0
	50.0-75.0	Well	4					18,2
	75.0-100	Very good	18					81.8
Total			22					100
Argumentation	25.0-0	Low	0	64	65	50	76	0
	50.0-25.0	Enough	7					31.8
	50.0-75.0	Well	15					68,2
	75.0-100	Very good	0					0
Total			22					100
Digital Literacy	25.0-0	Low	0	73	75	53	82	0
	50.0-25.0	Enough	6					27,3
	50.0-75.0	Well	16					72,7
	75.0-100	Very good	0					0
Total			22					100

Based on the results of a questionnaire about SPS, argumentative abilities, and digital literacy skills of students at MAN 5 Batanghari, the number of participants with male education was 13 people and participants with female education were 22 people. The average score obtained by male and female SPS participants was 85. For the ability to argue, the average score obtained by female students was greater, namely with a value of 64 and as for the ability to argue, male students were smaller, namely, with a value of 57. Students' digital literacy boys and girls get almost the same average score, namely for male students get a score of 72 and for female students get a score of 73. The difference in the average result can be caused by the number of male students being less than the total female students.

Table 4. Results of student interviews with students participating in SPS, HOTS argumentation, and digital literacy students (male/female) at MAN 5 Batanghari.

Question	Answer	
	Man	Woman
Have you done any physics exercises before, and if so, what material did you study?	Ever, Regarding Newton's Laws with to do or push tables, namely the style of holding simple activities	Never, the teacher only gives examples of activities related to physics, such as a push table.
In your opinion, is it important to do exercises such as exercises on Newton's Gravity material?	Important, because with practical activities we can become more knowledgeable about physics.	This is important, because it is a fun and enjoyable exercise for learning physics.
How important are the	Urgent.	Yes, the important thing is

steps for making a practicum test?		the training goes well.
Do you understand the questions given and can you solve them?	Don't understand. because I am confused too much information that is newly obtained and not understood like there are claims, data, theories etc in every thing.	Understand a little, there are some questions that are easy to understand and very difficult to understand.
Is there a mistake you made while solving the given problem? _	Exist. I didn't enter the formula when working on the problem.	Exist. Do not understand the method of using existing formulas.
did you check the done answers and are sure of the ones that worked?	Yes. No.	Yes, A little convincing a few things.
What types of digital media do you prefer to study, and what digital media do you know?	Mobile. Cellphones and computers/laptops.	Mobile/mobile, tab, internet.
Are there assignments to look for using digital media?	Ever, a lot.	Yes I have. Physics questions are also widely searched using the internet to find out the answers.
Are the tasks you are working on anywhere taken from the internet? Or just as reference support for your answer?	Yes, because I didn't find the answer in the book and I took all the answers on the internet because I didn't know the answer.	Part of me took answers from the internet to add my opinion.

Table 5. Results of the Physics teacher's interview with students participating in SPS, HOTS argumentation, and digital literacy students (male/female) MAN 5 Batanghari.

Question	Answer
Does MAN 5 have laboratories and practicum equipment?	Not yet, there is no training tool for physics exercises.
Practicums greatly influence students' science process skills, and have these skills ever been measured or noticed at this school?	Science process skills in this school have never been measured due to a lack of attention to skills.
How is the physics learning process carried out in this school?	The physics learning process is carried out by explaining physics theory and then providing examples of questions and exercises of the same type, and no exercises are carried out, only examples of activities.
How do you, as a physics teacher, apply HOTS learning in class? Are there any obstacles in the implementation of HOTS learning?	Not once did they apply HOTS because the students' abilities were felt to be inadequate or the students' lack of ability to understand high-level questions.
Have you received training on HOTS?	The teacher is there, but that was a long time ago and until now there has never been any training or the like about HOTS

	learning for students.
How are students' (HOTS) in thinking about learning physics?	During the learning process, students are counted as graduates who are active in learning by answering and responding to teacher questions. However, students' knowledge is also limited to one meeting and does not understand the previous theory, so they are not sufficiently able to convey theories in the form of data or theories about learning properly.
How can a teacher develop digital literacy?	Digital literacy is difficult to develop because of the lack of facilities and infrastructure. And learning is usually done only occasionally using a projector.
What factors hinder teachers in digital literacy in schools?	Facility and infrastructure factors.
How are the digital literacy participants studying at MAN 5 Batanghari?	Digital literacy here feels lacking, students are also not allowed to bring cellphones to school because they are often misused.

This research was conducted with the aim of finding out how science process skills, argumentation skills and digital literacy skills of students at MAN 5 Batanghari are based on gender differences between men and women. The study of science process skills, argumentation skills and digital literacy is very important to face the era of society 5.0 and needs special attention. Based on the results of the data obtained from the questionnaire given to students about science process skills, argumentation skills and digital literacy, it can be seen that differences in student scores based on gender with descriptive statistics starting from the mean, median, minimum score, maximum score and the total percentage obtained. For students of class X MAN 5 Batanghari majoring in MIPA there are 35 students with 13 male students and 22 female students. The average SPS score for boys is 85, the same as the average score for girls. The median score is 85 and also the minimum score for male and female students is 80 and the maximum score is 90. While the largest percentage is the same, namely in the very good category. In student argumentation skills, the average score obtained by male students is 57 while female students are 64, which means that female students score higher in arguing. For the median difference between 60 and 65, the total minimum score of male students is at 35 which is smaller than the total minimum score of female students, namely 50. Similarly, the maximum score obtained by female students is 76 while male students are 65, then the largest percentage of male students is in the sufficient category while female students are in the good category. This shows that the ability to think is higher in the female sex. Then for digital literacy skills the average score for men and women is almost the same, namely 72 and 73. Then for the median value for men is 68 and for women is 65, the minimum score obtained is greater for male students, namely 60 and women 50. Then for the acquisition of a higher maximum score for men 93 while women only 82.

Process skills are skills that students must have where through process skills there will be interactions between concepts, principles and theories that have been discovered or developed (Irmi et al., 2019). Process skills include thinking skills and acting skills (Widayanto, 2009). Science process skills are needed by students in the learning process with the aim that students are able to understand concepts and solve physics problems (Anisah et al., 2018). Physics is a lesson based on experimental observation so that learning is more appropriate when conducting an experiment or experiment to see

student SPS (Salamah & Mursal, 2017). SPS can be obtained and developed both theoretically and practically through training involving science (Akinbobola et al., 2010). From the results of the research that has been done, the SPS data for male and female students obtained the same results. This shows that the processing skills of male and female students can be said to be evenly distributed, no one is more prominent than male or female students. The similarity in processing skills between male and female students can be due to the fact that they enjoy the same facilities and amenities from their schools, so that what male students receive is the same as that received by female students. With these science process skills students can improve their learning achievement because a quality learning process can support student achievement because it can increase SPS and student motivation in carrying out learning (Zainuddin et al., 2022). Then next argumentation ability, namely the ability to investigate a statement by providing information in the form of data, facts and reasons or supports which can later reject or accept a statement. Arguments are intended to examine the relationship between evidence and theoretical ideas (Hasmudiah, 2015). The ability to think is an important aspect of education, because it is the basis for critical and logical thinking. Critical because it involves statements/reasons and is logical in requiring supporting data, facts and theories. Based on the results of research conducted at MAN 5 Batanghari, it shows that female students are superior in argumentation skills compared to male students. Female students get an average score of 64 for their argumentative ability while male students get an average score of 57. According to Atqiya et al., (2020) female students' scientific arguments are better than male students, both in terms of claims, evidence, and reasoning. A number of studies also state that there may be differences in opinion skills due to cognitive abilities, attitudes, creativity and ways of thinking of students, and these differences will affect the ability of boys and girls to express opinions (Farida et al., 2018). This is because during class learning, female students concentrate better than male students who usually have concentration that is easily lost (Pratama and Subali, 2016). The biggest category is female students in the good category while male students are in the moderate category. These differences can occur, among others, in the opinion of Mardasari, (2020) that differences can be differences caused by nature between men and women not starting from biological differences, but due to acculturation or socialization processes or commonly called social construction. The argumentation skills of female students are better, this can be due to the ability or habits of women in socializing by chatting or talking more than men. This can be seen in terms of verbal argumentation.

Men actually have better analytical skills than women, but not many think that this is a form of argumentation and is in the form of written arguments. In physics learning it is said to argue logically if each answer or statement given is supported or strengthened by something in the form of data or facts. Where the existing evidence must be used to assist other parties in understanding the truth of the statement given. Then next is digital literacy, namely the ability to use technology and information from digital devices effectively and efficiently in various contexts. The concept of digital literacy is based on an understanding of literacy, namely a training in reading, writing and literature that raises communication competence (Pietrass, 2007). Digital literacy is seen as an educational-based reference development that pays attention to practical changes to the target (Zaenudin et al., 2020). Literacy involves a series of learning that enables individuals to achieve their goals. Based on the results of the research that has been done, the results show that the digital literacy level of female students is higher than that of male students even though it is only slightly different. Male students get an average score of 72 while female students get an average score of 73. This is in line with the opinion expressed by Ririen & Daryanes, (2022) where the digital literacy ratio of female students is higher for male students' digital literacy skills. The factors that influence these

differences are probably the differences in the needs and activities of each individual. As stated by Gunes & Bachivan (2018) that daily needs and interests may affect an individual's digital literacy skills.

For the results of interviews with students regarding SPS, the average student answer has never been to carry out a physics experiment at school properly. However, simpler activities exemplified by the teacher are clarifying theories such as Newton's laws or forces. Students actually want to practice, but due to lack of facilities and infrastructure, students have never even practiced physics material. Then for the ability to argue in learning physics students are still lacking, because in the argumentation ability test there are claims, data, support, rebuttals from the theory of each given problem, which requires high-order thinking skills. Claims supported by reasons include data, support needed to represent more complex arguments. In addition, arguments are in the form of refutations that refute a statement to encourage the process of justification and elaboration of evidence (Simon, 2008). The argumentation patterns of claims, data, objections and theories are Toulmin's argumentation patterns. Suartha et al. (2020) The choice of Toulmin's argumentation pattern in the learning process in this study is because Toulmin's argumentation pattern is the most complete argumentation pattern. Then for digital literacy skills students only know that digital literacy uses digital media tools such as cellphones, laptops/computers and tablets and the internet. In utilizing digital media, they often search for school assignments on the internet by copying and pasting answers that should only be used as references, not all plagiarism.

In an interview conducted by the physics teacher at MAN 5 Batanghari, the teacher said that students were lacking in SPS physics subjects because there were no laboratories at school and practicum equipment. Even though with practicum students learn using a scientific approach where the learning process is more student-centered so that they are more active in understanding what is learned based on what is found in the field (Rahmatillah et al., 2017). The students' science process skills have not gone well so that these skills have never been measured to see the extent of students' process skills. The teacher's problem also lies in the practicum assessment process where the teacher experiences difficulties in carrying out the psychomotor assessment process in practicum both in terms of time efficiency and the objectivity of the assessment process (Munandar & Junita, 2022). Learning that takes place is usually only in the form of explanation of material, giving examples of questions and practice questions so that it does not develop students' scientific process skills. Students are quite active in answering and responding to teacher questions and comments, but very few provide reasons for the answers that accompany them scientifically or based on data and theory. This is because the high-level thinking skills of Indonesian students are low (Ichsan & Rahmayanti in Widarta & Artika, 2021). Whereas based on the knowledge dimension, HOTS-level questions can measure metacognitive abilities, namely the ability to associate several different concepts, interpret, solve, choose a solution strategy, find new methods, argue and make decisions which is one of the important aspects of learning (Oskar & Ofianto in Kurnia et al. al., 2022). Meanwhile, students' and even teachers' digital literacy skills can be said to be low, due to a lack of facilities and infrastructure. Students are prohibited from carrying cellphones because to avoid misuse, and also in teaching teachers only learn manually by explaining.

Based on the results of interviews and questionnaire data that have been obtained, it can be seen how the science process skills, argumentation skills, and digital literacy skills of students at MAN 5 Batanghari. SPS of students according to gender is almost the same and the category is always better for female gender, this is because female students are more focused on doing something and paying attention to something. However, the results obtained are also not optimal because the facilities and infrastructure for carrying out exams or practice are still lacking, the absence of

laboratories and equipment causes students not to know how the physics process is in their activities so that students are not optimal in their activities. Then for the argumentation abilities of female students in the good category, this is because female students are more likely to convey something or speak more seriously so that it is easier to express something in an answer. But it cannot be said that the students' thinking skills are good, but overall the students' thinking skills are very low because argumentation is one of the higher-order thinking skills that must be answered. The average student only comments on the questions and does not include the underlying data or theory. The digital literacy of male students is superior to that of female students. This is because men are usually more skilled at operating digital media. Digital literacy skills in schools are actually limited because of the facilities and infrastructure for both students and teachers. Students are not allowed to bring their own cellphones or androids to school because they avoid misusing them for learning.

This study is expected to be a reference in improving SPS, argumentation skills, and digital literacy for students. As for examples of problems experienced in previous learning on SPS students were in the low category, where students were still lacking in aspects of making hypotheses, determining variables, and materials. In addition to SPS, students' argumentation abilities were low, because in arguing most students only commented and did not provide evidence and justification for the claims they made. For digital literacy, many students bring cellphones or Android to school but are not sufficiently integrated into learning. By having good digital literacy skills, students can easily obtain information or knowledge using digital media which of course needs to be sorted first, with information or knowledge obtained with their literacy skills, students argue for each answer or statement given in learning by prove it with facts. However, based on several previous studies, no one has researched to measure SPS, argumentation skills and digital literacy skills simultaneously or simultaneously for these three skills/abilities based on gender differences. As research conducted by Musa et al. (2022) only concerns the implementation of digital literacy in the 21st century in shaping student character.

Conclusion

Based on the explanation above, SPS, argumentation abilities, and signal literacy of male students are generally slightly lower than female students. It can be seen that most of the SPS owned by female and male students are included in the very good category. For the ability to argue female students are included in the good category while male students are included in the sufficient category. This is because female students convey something more often or speak more often so that it is easier to express answers, even though they have not been equipped with the underlying data or theory. For digital literacy skills, male students are in the sufficient category and female educating participants are in the good category. Based on the analysis carried out, it can be concluded that there are several differences in science process skills, argumentation abilities and digital literacy abilities of students at MAN 5 Batanghari.

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