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Profile of Biology Teachers' Understanding on Socio-Scientific Issues (SSI) in Bantul Regency Based-on Teaching Experiences and Gender

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ABSTRACT
Aims of this study is to describe high school Biology teachers' understanding on Social-Scientific Issues in Bantul Regency based on teaching experiences and gender. This study is a descriptive-quantitative design study. The method of data collection is using multiple tests on teachers' understanding of *Socio-Scientific Issues* (SSI) implementation in biology instruction. The result showed that teachers' understanding on SSI based on teaching experiences are teachers who teach between 14.5 until 23.5 years have the highest level of understanding, while teachers' understanding on SSI based on gender is female teachers have higher level of understanding than male teachers. Conclusion of this study, teachers' understanding on SSI at "medium" category with percentage

Keywords: *Profile, Teachers, Socio-scientific issues, Teaching experiences, Gender*

1. INTRODUCTION

The implementation of some recent innovation in teaching and learning process is aims to get ready students for their future careers. It is also important to give education students to have 21st century competences and skills that able to responsible decisions to have critical thinking and creative skill, to have effective communication and collaboration with others, aware of cross-cultural and global issues [1]. To be able to realize these educational goals, it is necessary to involve many factors. There are curriculum, teaching materials, learning resources, and teacher.

According to Darling Hammond (2010), Professional teachers must be able to give opportunities for deep-meaningful learning to students to encourage their holistic development. Teachers must also have the ability to work collaboratively with others, looking for opportunities for learning, namely learning activities that can be implemented inside and outside of school). In addition, teachers need to have certain social and personality values in accordance with the teacher's role as a social leader. They can maintain learning in a quality context by upholding a social justice orientation, in this case it is included in the social competencies that teachers must have [2]. Teachers need to be equipped with competencies (for example, knowledge and skills related to professional practice, leadership and collaboration, must have integrity and commitment to education and social changing, etc.) for supporting education goal [3].

Teachers need to understand and master the learning approach that will help future teachers to translate such new views and theories about learning into actual teaching practices in the schools. However, several studies have shown that teachers who have undergone formal education are often meagre impact on teachers' beliefs and behaviour [4]. There are still many teachers who need intensive guidance and support to be able to teach in accordance with education science and develop innovative learning [5].

Teachers who are well educated and trained, and have rich experience in their fields. Teachers should be treated as active learners, for example they should

construct their own understandings about learning-teaching but they may have preconceptions that differ significantly from the views of learning and teaching that they have got in university before, so its effect on teaching-learning process [6].

One of pedagogic competencies that teachers must have is teachers as a learning designer. It means that Teachers must be able to make a learning plan or design learning activities in class. While formal knowledge of learning design (like learning approach that used in learning activities) are important, studies show that teachers as learning designer draw on personal experiences and formal knowledge commonly[7].

Teachers design learning plan in many different contexts based on levels of high school levels education, according Bielaczyc (2013). The design of learning activities can be created by teacher or a team of many teachers that can be written as lesson plan. Therefore, it is important for a teacher to be able to know the approximate learning needs of students, make learning activity designs, and can organize classes well [8].

When designing learning activities, including the learning model and learning approach to be used in learning activities, teacher can get consultation with relevant expertise that can give valuable guidance on either the learning design process or the resulting product. This is also to align learning design with the context and needs of students [9]. So that it can be used as initial information for preparing or designing learning preparation and implementing effective learning.

The implementation of the 2013 Curriculum in learning activities in school classes is largely determined by the quality of educators, especially in understanding learning concepts. The 2013 curriculum has a goal-oriented character and focus on learning activities, so that it can produce an effective and effective education system. From the curriculum character design above, the quality of the teacher should be an important factor in the success of its implementation [10].

Implementation of the 2013 Curriculum needs to be strengthened in order to develop student potential which is manifested in the form of instilling an understanding of teachers about appropriate learning materials and models, as well as philosophical and empirical conceptions of learning that are in line with learning outcomes that have been set in the curriculum. Teachers also need to understand well the learning model which includes approaches, methods, strategies, and techniques that are in tune with needs [11]. So that the selection of the approach or learning model that will be used according to the needs becomes a challenge for the teacher.

Biology learning that has taken place in schools so far has been limited to the process of delivering information (transfer of knowledge), and learning emphasizes the conceptual dimensions rather than the process and context dimensions. In fact, learning biology requires a contextual aspect, considering that the scope of biological problems is closely related to the facts found in real-life which do not only involve knowledge, but also require attitudes and skills to find, respond to and solve existing biological problems. Teaching concepts that relate to real-life contexts is expected to make science (biology) learning more meaningful, relevant and motivating for students [12]. Thus, biology learning should be designed and implemented through an approach or learning model that can meet contextual needs, such as Socio-scientific Issues [13].

The learning approach that contains contextual aspects is Socio-scientific Issues (SSI) which presents problem-based science material in the context of social issues involving aspects of technology, society and moral or ethical components [13], [14] that make it easier for students to understand biology material. Social issues or problems in real life are presented by the teacher by relating the biology material being studied. However, SSI-based learning is still relatively new and has not been widely applied in learning in Indonesia, especially at high school level [13].

Each of the factors that SSI has applied or not applied much in learning is the teachers' understanding of the Socio-Scientific Issues (SSI). Teachers' understanding of Socio-Scientific Issues (SSI) determines the application of SSI in learning, whether SSI has been applied in learning or not. The results of interviews in August 2020 with several high school biology teachers in Bantul Regency stated that there are few of teachers who already know SSI in learning biology in schools, but there are also teachers who do not know SSI-based learning.

Understanding what is known today in the field of education as Bloom's taxonomy. Bloom's taxonomy gives consistent means or as the basis for developing learning program outcome assessment tools (PO), that can be divided into three domains: cognitive domain, psychomotor domain and affective domain, which understanding included in cognitive domain [15]. Cognitive domain usually called "thinking" domain that focuses on intellectual skill. It describes

with how acquires processes and utilizes the knowledge [16].

Understanding is the process of constructing meaning, understanding the meaning or concept, situation, and facts that are known or presented from the content of reading whether it is oral, written, or graphic [17]. The level of understanding dimensions in Bloom's Taxonomy can be translated into 7 levels, namely 1) Interpreting, 2) Exemplifying, 3) Classifying, 4) Summarizing, 5) Concluding, 6) Comparing, and 7) Explain.

The multiple levels of learning in each domain (cognitive domain), in this research is understanding, progress from fundamental surface level learning to more complex and deeper learning. the level of learning will be affected by the learning experience depends on (1) the nature of the experience, (2) the development of the participating students and (3) the intensity and duration of the experience [15].

Teachers interpret an innovation in teaching-learning activities, which is an integration of experiential knowledge, formal knowledge and personal beliefs [18]. The formal knowledge can be seen from teachers' understanding. Understanding strongly impacted instructional design and implementation of learning-teaching activities. Teachers' understanding of learning approaches, strategies and models is also influenced by teaching experiences (length of teaching), age, and gender [19], [20], [21]. So, knowing teachers' understanding of assessment based on their different characteristics, such as years of experience or gender, is necessary.

The teacher experiences is a factor that supports the teaching process of a teacher. The teacher experiences will be able to measure his ability to teach, improves teaching skills. The length of teaching is the period of years work as a teacher at a certain level, type, and formal education unit [22].

Based on the studies and considerations above, the researcher is interested in describing biology teachers' understanding about Socio-scientific Issues based on time teaching and gender. There are three research questions that present in this study: (1) How did how did teachers' understanding on *Socio-Scientific Issues* (SSI) implementation in biology instruction at all? (2) How did how did teachers' understanding on *Socio-Scientific Issues* (SSI) implementation in biology instruction based on teaching experiences? (3) How did how did teachers' understanding on *Socio-Scientific Issues* (SSI) implementation in biology instruction based on gender?

2. RESEARCH METHOD

This is a preliminary research. The method used in this study is descriptive-qualitative method. The population in this study in a hypothetical population, follows the principle of the Daniel's hypothetical population which consists. of all current, existing and future high school biology teachers in Bantul regency. The sampling technique used in this study is the convenience sampling technique, which is the current sample, in this study are 31 biology teachers who teach at Senior High School in Bantul Regency ranging in time teaching from 1 to 34 years. The research instrument was validated through expert judgement in education. The reliability of the instrument was tested with Cronbach-Alpha (KR21). The coefficient reliability of the instrument is 0.754 (0.754>r table), so the instrument is reliable. The score means that instrument can used to make valid conclusion [23]. In each reading understanding test there are 12 multiple choice questions of SSI. The data collection technique used test for SSI understanding to determine teachers' understanding of *Socio-Scientific Issues* (SSI) of Biology teachers, and the research instrument is an online multiple choice test using a Google from on Socio-Scientific Issues. Data were analysed descriptively. The descriptive analysis by calculating teachers' answer score, then calculating percentage of frequency of teachers based on teachers' answer, then categorized based on Table 1 [24]. The greatest percentage will be the conclusion of the biology teachers' understanding of SSI.

Table 1. Rating Category of Teachers' Understanding

Score	Criteria
75 < X	Excellent
58,35 < X ≤ 75	Good
41,65 < X ≤ 58,35	Fair
25 < X ≤ 41,65	Poor
X ≤ 25	Very Poor

3. RESULTS AND DISCUSSION

3.1. Description of Biology Teachers' Understanding

The results of the biology teachers' understanding variable. Teacher understanding data was obtained from the distribution of a research scale consisting of 12 statement items using the form of multiple-choice questions with 5 alternative answers. Data was

analyzed using SPSS Statistic 16 program, there are mean, standard deviation, minimum, and maximum is shown in Table 2.

Table 2. Statistical data of teachers' understanding score

Distribution of Statistical Data	
Mean	38.7742
Mode	42.00
Std. Deviation	14.8123
Minimum	17.00
Maximum	67.00

The results of data analysis show that for the teacher perception variable the highest score is 67.00 and the lowest score is 17.00. From these scores obtained a mean of 38.7742 mode 42.00, and a standard deviation of 13.81234. Referring and adapted based on Table 1 [24] and based on existing data, the result of teachers' understanding on the SSI test is shown in Table 3.

Based on Table 3, it can be seen that percentage of understanding of high school biology teachers in Bantul Regency about SSI can be seen that in the "good" category there are 1 teacher (3%), in the "fair" category 17 teachers (55%), in the "poor" category there are 4 teachers (13%), and in the "very poor" category there were 9 teachers (29%). Based on the average value, which is 38.77, the level of understanding of high school biology teachers in Bantul Regency towards SSI in the "fair" or medium category is 55%.

The findings of this study provide implications for teachers because teachers' understanding play an important role in mediating how educational reforms are implemented in schools and classrooms through teaching-learning activities [25]. Teachers should know that the way they conceive of learning approach the way they utilize and development of learning model and learning activities in their classroom. This study implies that teachers must improve their understanding about learning approach (SSI) to help improve student achievement in biology. They must use other alternative learning approaches (contextual learning approach: SSI) that would engage students in the process of learning.

The following is the frequency distribution of answering questions 'true' and 'wrong' based on seven indicators of understanding (Table 4).

Based on Table 4, it can be seen that the highest percentage is found in indicator no.2, exemplifying cognitive abilities and social issues in SSI, which is 87%, and the lowest percentage is in indicator no 4. summarized the themes of the topics in SSI, which is 3%. It means that Biology teachers in Bantul Regency have the highest level understanding of SSI about regarding cognitive abilities and social issues in SSI on indicator no 2, and teachers have lowest level understanding of SSI or they do not understand SSI related to the theme of the topic in SSI on indicator no 4. Indicator exemplifying got highest percentage, there is 87% compared to other indicators in understanding, giving an example is the easiest indicator.

Based on the results below, it shows that the teachers' understanding of Socio-scientific Issues (SSI) still needs to be improved. This is because teachers' understanding is still very limited and teachers do not master learning theory and teaching-learning principle and teachers have not yet developed self-awareness to develop and improve a more active, creative, and learning models, especially SSI-based learning. Besides, SSI is something that is still new and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching

Table 3. The understanding of high school biology teachers in bantul regency on SSI

Interval	Frequency	Percentage (%)	Category
75 < X	0	0%	Excellent
58,35 < X ≤ 75	1	3%	Good
41,65 < X ≤ 58,35	17	55%	Fair/Medium
25 < X ≤ 41,65	4	13%	Poor
X ≤ 25	9	29%	Very poor

Table 4. Distribution of frequency of teachers' understanding based on indicators

Indicator	Frequency of answer			
	True	Percentage (%)	False	Percentage (%)
Interpreting framework aspects and components in SSI	17	55%	14	45%
Exemplifying cognitive abilities and social issues of SSI	27	87%	4	13%
Classifying the foundation thinking and syntax of SSI	9	29%	22	71%
Summarizing the themes of the topics of SSI	1	3%	30	97%
Conclude the characteristics of social issues of SSI	16	52%	15	48%
Comparing the SSI with other models and the advantages and disadvantages of SSI	21	68%	10	32%
Describing the definition and objectives of SSI learning	25	81%	6	19%

skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies, developed self-awareness to develop and improve a more active, creative, and innovative learning process. Teachers are still not applying the knowledge gained from various kinds of training that have been implemented, and teachers are lacking in developing their teaching skills, related to approaches, strategies,and has not been widely applied in Indonesia, especially at the high school level. So, teachers have not been able to optimally implement the SSI strategy [13].

3.2. Description of Teaching Experiences (Length of Teaching) of Biology Teachers

The results of the teaching experiences variable. The data on the length of teaching variables were obtained from the documentation study technique in the form of the last teaching length data until August 2020 of 31 teachers. Data was analyzed using SPSS Statistic 16 program, there are mean, standard deviation, minimum, and maximum is shown in Table 5.

Then, determine the tendency for length of teaching with the modification of the assessment criteria for the level of length of teaching as follows.

Table 5. Statistical data of teaching experiences

Distribution of Statistical Data	
Mean	19.000
Mode	16.000
Std. Deviation	9.0332
Minimum	1.00
Maximum	33.00

Based on Table 6, it can be seen that the length of teaching for high school Biology teachers in Bantul Regency until August 2020 in the very long category there is 1 teacher (3%), in long category there are 9 teachers (29%), in the medium category there are 15 teachers (48%), in the recent category there are 2 teachers (6%), and in the very recent category there are 4 teachers (13%). Based on the average value, which is 19.00, the length of teaching of high school biology teachers in Bantul Regency is in the "medium" category is 48%.

Table 6. Distribution of tendency on the frequency of teaching experiences

Interval (Years)	Frequency	Percentage (%)	Category
x>32,5	1	3%	Very long
23,5 <x< 32,5	9	29%	Long

14,5 <x< 23,5	15	48%	Medium
5,5 <x< 14,5	2	6%	Recent
x<5,5	4	13%	Very Recent

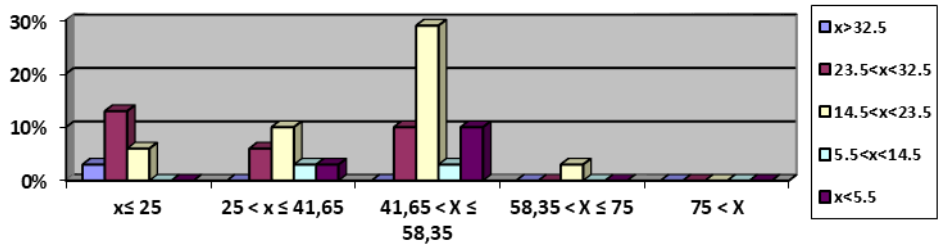

Figure 1 Teachers' Understanding based on Teaching Experiences

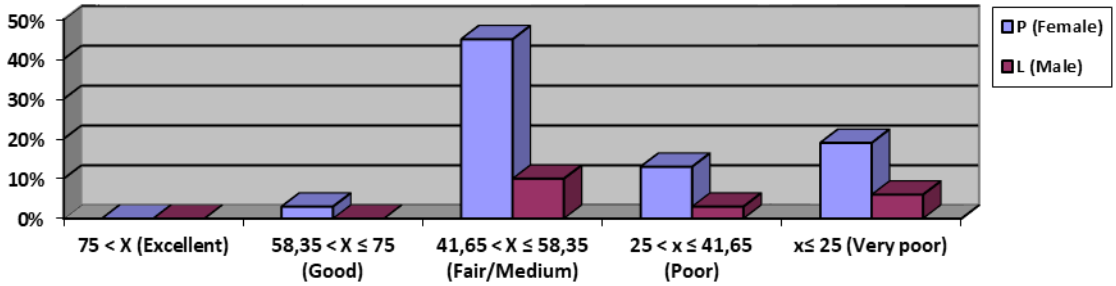

Figure 2 Teachers' Understanding based on Gender

3.3. Description of Biology Teachers' Understanding based on Teaching Experiences

The categories of teachers' understanding of SSI based on teaching experiences can be seen Figure 1.

Based on Figure 1, it can be seen that the highest frequency value is found in teachers with teaching lengths between 14.5 until 23.5 years (14.5< x < 23.5) with understanding values in the 41.65-58.65 interval, which is 29%. This means that Biology teachers who have taught between 14.5 until 23.5 years with a frequency percentage of 29% have highest understanding score in SSI than others. Teachers who have medium category (14.5-23.5 years) have a higher understanding than teachers who have recent teaching experiences (5.5-14.5 years), very recent teaching experiences (<5.5 years), and long teaching experiences (23.5-32.5 years).

The Result of this research shows that, on average and percentage of frequency, Less experienced teachers, there are recent and very recent teaching experiences (5.5-14.5 years, and <5.5 years) tend to be less effective than more experienced teachers (14.5-23.5 years), as a whole evidenced by the performance distributions of teachers with less experience and less than 5.5 years of experience are at the lower frequency percentage of the performance distribution of more experienced teachers.

Teachers show the greatest productivity performance during the first few years on the job, after which their performance tends to level off [26]. It causes teachers who have not been teaching for a few years (14.5-23.5 years) have experiences for developing knowledge and skills related to learning (methods and strategies of learning) than teachers who have been teaching for 23.5-32.5 years, and <32.5 years.

Teacher competence and professionalism (in this case related to understanding of the SSI based learning) can be developed and improved through training. Teachers who have taught the least (14.5-23.5 years) have high spirit to create innovative in learning, besides that they have attended training on SSI learning. Novice teachers (teachers that have 14.5-23.5 years) often had more optimistic and less problematic views than veteran teachers (teachers with 23.5-32.5 years, and <32.5 years teaching) [27].

Novice teachers approached and gained educational innovations easily, such as SSI based-learning. Thus novice teachers will get a lot of additional knowledge, experiences, and skills about their field of work. Teachers will be able to carry out their duties properly if they have extensive knowledge and skills and insight in their field. Teachers can carry out his duties properly if he has adequate knowledge and skills in accordance with the educational background he has taken, both formal and non-formal education.

The more experience teachers accumulated, the less teachers' enthusiasm for adopting new instructional innovations [28]. Particularly, because the SSI approach environment has been more informal in Indonesia, especially in Bantul, novice teachers are energetic in participating in informally convened meetings, workshops, and networking in educational centre related to SSI sub-fields. In the Indonesia context, novice teachers are advocated as a potential resource to sustain SSI based-learning approach.

3.4. Description of Biology Teachers' Understanding based on Gender

The categories of teachers' understanding of SSI based on gender can be seen Figure 2.

Based on Figure 2, it can be seen that the high school Biology teacher with the female gender is in the medium category (value interval 41.65-58.35) with a percentage of 45%. It means that female high school Biology teachers in the Bantul regency have a higher understanding of SSI than male teachers, with a moderate category of 45%. Understanding is influenced by gender [19], [20]. Female teacher earned better than male teachers in understanding. This study related to other studies, shown that women score higher than men for understanding [29].

This is very possible because female are more likely to use open learning strategies than men [30]. This study found the effect of gender to assessment feedback. Female teachers got a larger part (understanding) of the assessment feedback on the task than male teacher [31]. Others have reported that female teachers are rated higher than male teachers [32]. In still other cases, researchers have found that female teachers tend to be rated higher on the rapport domain of teaching, and male teachers tend to be rated higher on the presentation and organization domains [33]. It showed that female teachers are more develops their teaching knowledge in innovation of teaching, SSI as learning approach.

4. CONCLUSION

Based on the results and discussion, it can bes concluded that understanding of high school biology teachers of Socio-Scientific Issues (SSI) in Bantul regency is in the "medium" category with a percentage of 55%. Teachers' understanding is based on length of teaching, teachers who have taught between 14.5 until 23.5 years have the highest level of understanding, while teacher understanding based on gender, female teachers have a higher level of understanding than male teachers.

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