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Prior Knowledge Mapping on Teacher Candidates for Reproductive System Material in UNSRI

Safira Permata Dewi[1]✉, Djunaidah Zen[1], Maefa Eka Haryani[2]

[1] Lecturer of Biology Education FKIP, Sriwijaya University
[2] Lecturer of Chemistry Education FKIP, Sriwijaya University

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Abstract

This study aimed to map Prior knowledge that is owned by science teacher candidate from FKIP's (Fakultas Keguruan dan Ilmu Pendidikan) undergraduate students Unsri. The sample in this study was science teacher candidates from undergraduate students in the Chemical Education Study Program of FKIP Unsri (n = 71). The instrument used in this study was a multiple choice question in the form of a three-tier test. Questions were developed based on learning objectives and the results of previous research studies on similar topics. The results of this study indicate that there is a tendency for FKIP Unsri science teacher students to have misconceptions and high lack of knowledge still. Questions that showed a high misconception are found in the topic of menstruation and pregnancy. A high percentage of lack of knowledge is shown in the topic of gametogenesis. While understanding the most top concepts can be seen in the topic of the reproductive organs. The findings of this study can be used as an illustration to determine the planning steps for learning activities so that they can help minimize misconceptions that occur after the learning process takes place.

✉ Correspondence:
Jl. Raya Palembang Prabumulih KM 32, Ogan Ilir
Email: sapphire2687@gmail.com

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INTRODUCTION

The process of learning and teaching enacted in the classroom requires an improvement in the concepts and attitudes of students who have gone through this stage. The teacher is tasked with optimizing all activities that occur in the classroom so that learning takes place into meaningful learning for students. According to Hailikari, *et al*. 2008 and Ameyaw, 2016) one way that can be done to optimize the learning process that occurs in the classroom is by conducting diagnostic tests. Diagnostic tests are beneficial for knowing the prior knowledge of students before learning takes place. Another benefit of this diagnostic test is that it can provide an overview to the teacher to determine learning strategies, learning methods and considerations of any concepts that are important to emphasize (Hailikari *et al.,* 2008; Ameyaw, 2016)

Presently there are many forms of diagnostic tests that have been developed by experts. One type of known diagnostic test is three-tier-test. A diagnostic test with a three-tier test usually uses MCQs. The specialty of this form of the question is that it can dig deeper into students' misconceptions (Gurel & Aryilmaz, 2015). This test can also provide a diagnosis of the prior knowledge category of students because it can distinguish whether students experience misconceptions or lack of knowledge (Schaffer, 2013; Kirbulut & Geban, 2014; Gurel & Eryilmaz, 2015). This information is vital for determining which concepts need to be addressed or which ideas are sufficiently informed in passing. Thus, it is expected that after the learning process has been completed, all the misconceptions that occur to students are overcome and students who are still categorized as lack of knowledge can better understand the concepts taught better.

Science subjects have a broad scope because they consist of physics, chemistry and biology. The extent of this coverage requires that teachers have a good understanding of all three fields. However, the time allocated to teach these subjects to junior high school students makes this subject one of the difficult issues to explain if the teacher has not yet mapped the conceptions of students. In principle, to study Natural Sciences will be easier to do by linking various phenomenons that occur around students. The event that is very close to students is their own body. One of them is the reproductive system.

The results of the literature review regarding previous studies have been carried out. Research conducted by Andrej & Rebeka (2017), Ramadhani, *et al.* (2016), and Chaniarosi (2014) indicate that various concepts in the material of the human reproductive system still show a tendency for misconceptions and lack of knowledge for both students and teachers. The understanding of individuals related to reproductive system material show errors in the concept of understanding, according to Hasanah (2016) reproductive health problems in adolescents are caused by many factors, one of which is the development of information and developing technology so that everyone can access the various data needed without knowing the truth of the information. In addition, the many misleading myths that emerge in a society that relate to individual understanding related to human reproduction also exacerbates personal understanding (Anas, 2010).

This research was conducted to obtain an overview of prior knowledge mapping of an undergraduate science teacher candidate in the Unsri FKIP on human reproductive system material through the provision of questions in the form of a three-tier test. The results of this study are used to take effective steps when designing learning activities carried out in the General Biology course including the determination of strategies, methods to arrive at the

selection of concepts that must be emphasized in the learning process. The final result expected from this study is that the learning process can take place more effectively and can eliminate the misconceptions that occur in prospective science teachers.

RESEARCH METHOD

Research Method And Subject

The research conducted is survey research which aims to get a complete picture of the conception of science teachers candidate in the FKIP Unsri. The population of this study was entirely undergraduate science teachers candidate students who were taking courses in General Biology at the Unsri FKIP. The sample of this study amounted to 71 students who are prospective science teachers in the subject of General Biology in the Chemical Education Study Program. In this study, no special treatment was applied to the research sample.

Research Instrument

Mapping the concept of undergraduate science teacher candidate is done by giving multiple choice tests. This multiple choice test is in the form of a three-tier test. The three-tier test problem used is a development result question that has been validated by experts, tested for reliability, distractor function and difficulty level of the question. The questions given amount to 20 items. Each issue consists of three levels, namely questions, reasons, and levels of confidence.

The first level contains questions related to the concept. The defense that is developed is a question that has been adjusted to the expected learning objectives, the study of the material from the primary textbook used and pay attention to the cognitive level of the sample. Each multiple choice question prepared five alternative answers. The second level, namely the disclosure of the reason for the answer to the question at the first level. Disclosure of this reason in the form of multiple choices with eight alternative answer choices. The third level, namely the level of confidence. At this level the respondent's level of confidence is asked when giving answers from the first and second levels. The level of confidence is also in the form of choices, namely "sure" and "unsure". Next is the discussion topic for each question item.

Table 1 Question item topic

No.	Topic	Number of Questions
1.	Reproduction, sexual reproduction, asexual reproduction	1, 2, 17,
2.	Fertilization, ovulation, pregnancy	3, 10, 13, 18, 19
3.	Gametogenesis	6, 7, 8, 14,
4.	Male reproductive organ	4, 5,
5.	Menstruation, reproductive cycle	11, 12, 20
6.	Reproductive hormone	9, 15,
7.	Contraceptive tool	16

Mapping the conceptions of undergraduate science teachers candidate in the FKIP Unsri is divided into three categories, namely understanding concepts, lack of knowledge, and misconceptions. After the test is done, the first step is to correct each item for the first and second levels based on the answer key that was provided previously. The next stage is to analyze the respondents' understanding categories by referring to Table 2. below.

Table 2 Respondent's Understanding Category Analysis

First tier	Second tier	Third tier	Category
True	True	Sure	Understands the concept
True	Wrong	Sure	Misconception
Wrong	True	Sure	Misconception
Wrong	Wrong	Sure	Misconception
True	True	Unsure	Lack of knowledge
True	Wrong	Unsure	Lack of knowledge
Wrong	True	Unsure	Lack of knowledge
Wrong	Wrong	Unsure	Lack of knowledge

Data analysis was continued with the calculation of the percentage of respondents' understanding categories for each item, both in the category of understanding concepts, lack of knowledge and misconceptions. The percentage calculation of respondents' understanding categories uses the following formula.

$$\text{Misconception Percentage} = \frac{Number\ misconception\ item}{question\ total} x\ 100\%$$

$$\text{Lack of knowledge Percentage} = \frac{Number\ lack\ of\ knowledge}{question\ total} x100\%$$

$$\text{Understanding Percentage} = \frac{Number\ of\ understanding\ concept}{question\ total}\ x\ 100\%$$

RESULTS AND DISCUSSION

Well-prepared tables and or figures must be of a significant feature of this section because they convey the major observations to readers. Any information provided in tables and figures should no longer be repeated in the text, but the text should focus on the importance of the principal findings of the study. In general, journal papers will contain three-seven figures and tables. Same data can not be presented in the form of tables and figures. The results of the study are discussed to address the problem formulated, objectives and research hypotheses. It is highly suggested that discussion is focused on the why and how the research findings can happen and to extend to which the research findings can be applied to other relevant problems.

An overview of prior knowledge of students is critical to study before the learning process begins. This mapping will help the teacher to be able to arrange various steps in planning the learning to be carried out and how deeply the concepts will be taught. These concepts determine the learning method and the learning strategy that will be carried out. Tests for knowing prior knowledge have been developed by various experts. One form of test that can be used is in the form of a three-tier test with multiple choice questions.

The three-tier test questions aim to find out a deeper understanding of students. This type of test not only explores students 'knowledge and understanding but also explores the students' reasons and confidence levels when answering the tests given. The results of this test then categorize students into three groups, namely understanding the concepts, lack of knowledge and misconceptions.

The questions that are used to capture prior knowledge are prospective students of the Science Faculty FKIP Unsri before going through the stages of expert validation in terms of constructs, contents and languages.

The results of prior knowledge mapping of undergraduate science teacher candidate FKIP Unsri students focused on human reproductive system material. This material not only

has a broad and in-depth study of concepts, but also there are still many possibilities for experiencing high misconceptions (Andrej & Rebeka, 2017; Ramadhani, *et al*. (2016), and Chaniarosi (2014) due to the still high public trust in myths that develops (Anas, 2010). Mapping prior knowledge for human reproductive system material is presented in Table 3 below.

Table 3 Prior Knowledge Mapping

No. of Questions	Topic	Misconception	Lack of knowledge	Understand the Concept
1	Reproduction	61,97	26,76	11,27
2	Sexual Reproduction	47,89	40,84	11,27
3	Fertilization	59,15	32,39	8,46
4	Reproductive Organ	49,29	22,54	28,17
5	Reproductive Organ	33,8	49,3	16,9
6	Gametogenesis	35,21	63,38	1,41
7	Gametogenesis	49,3	26,76	23,94
8	Gametogenesis	30,99	69,01	0
9	Reproductive Organ	66,2	29,58	4,22
10	Ovulation	46,48	53,52	0
11	Menstruation	52,11	46,48	1,41
12	Menstruation	81,69	18,31	0
13	Pregnancy	52,11	47,89	0
14	Pregnancy	59,15	40,85	0
15	Reproductive Hormone	47,89	52,11	0
16	Contraceptive Tool	49,3	49,3	1,4
17	Asexual Reproduction	71,83	28,17	0
18	Fertilization	63,38	32,39	4,23
19	Pregnancy	74,65	22,53	2,82
20	Reproductive Cycle	69,01	29,58	1,41

Table 1 shows the results of mapping the understanding of undergraduate science teacher candidate in the FKIP Unsri. The topic for each question developed refers to the learning objectives and the results of the literature study from previous research on the conception of human reproductive system material. The results of this study indicate a tendency for undergraduate science teacher candidate in FKIP Unsri who still experience misconceptions and lack of knowledge. Even though the reproductive system material is not new material, because previously they have obtained this material from the education level of Elementary and Middle School. In addition, if viewed from cognitive development, undergraduate science teacher candidates have reached the formal category or hypothetical deductive operations. According to Piaget in Barrouillet (2015), at this cognitive level, a person has been able to reason hypotheses, form new operations, logical reasoning, classify, connect various variables.

Prior knowledge mapping of undergraduate science teacher candidate FKIP Unsri students showed that all categories of conceptual understanding emerged in almost all the questions tested. Some six questions only consist of two achievement groups, namely

misconception and lack of knowledge. This fact shows that none of the six questions of the undergraduate science teacher candidates have demonstrated understanding of the concept (Figure 1.)

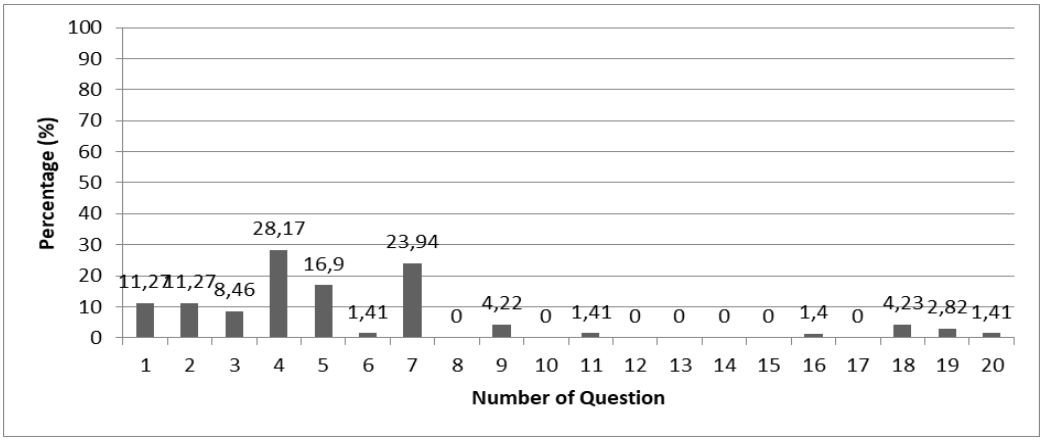

Figure 1 Percentage of Natural Science teachers' achievement in concept understanding category

Figure 1 explains that the percentage level of achievement of the concept of understanding the category of undergraduate science teacher candidate still tends to be low. The minimum percentage of performance is 0% on questions number 8.12, 13, 14, 15, and 17. While the highest percentage is seen in question number 4 as much as 28.17%, this group categorization is seen from the respondent's answer for each level. Students of prospective science teachers must answer correctly to the questions at the first level, the second level, and show the level of confidence "sure" at the third level.

Item number 4 with the topic "reproductive organs" is a question item that has a high level of understanding compared to other items. This question focuses on exploring prospective natural science teacher students' understanding of about the structure and function of human reproductive organs, especially men. The topic regarding the structure of male reproductive organs has indeed been studied at the elementary, middle and high school levels. The existence of repetition with a level into different material will result in understanding the concept of someone showing improvement. Davey & Field (2014) explains that repetition of the concepts learned helps understanding concepts of settling on one's long-term memory and facilitating the learning process because it does not require a great effort to understand the concept being repeated. This opinion is also supported by the research conducted by Kang (2016) which states that learning will run more effectively and efficiently if the concept is studied repeatedly.

The results of prior knowledge mapping for the misconception category show a different picture with the conceptual understanding category. The percentage of each item that was tested for the category of misconception was very high. Figure 2 shows the percentage of misconceptions for each item in question.

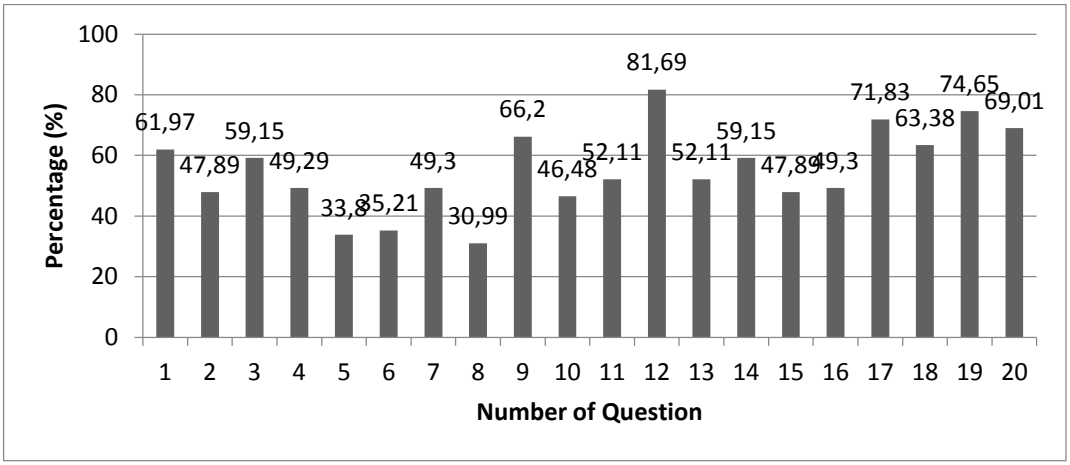

Figure 2 Percentage of misconception for each tested question item

The categorization of misconceptions identified through first tier and second tier show different results and the level of confidence is "sure" or each first tier and second tier shows the wrong answer but in the third tier shows the level of confidence "sure". The highest percentage of misconception can be seen from items number 12 and 19. Problem number 12 is a question with the topic of menstruation, and question number 19 is the topic of pregnancy. Both of these topics do indeed show high misconceptions in previous studies (Andrej & Rebeka (2017); Ramadhani, *et al*. (2016); and Chaniarosi (2014)).

Question number 12 asks about the causes of menopause in women. The percentage of answers for choices "A" (35.21%) and "C" (32.39%) are almost the same for this question. Although the choice of the "C" answer is the right choice, the respondent still incorrectly gave the reason for the answer. The conception understood by the students of FKIP Science teacher Unsri about the causes of menopause in women is that the reserves of the ovum have run out so that there are no more eggs that can be ovulated. Hall (2015) explained this phenomenon that when menopause occurs, the ovaries show a sensitivity response that is very weak in reproductive hormones so that the follicle cannot develop properly.

The weak understanding of the concepts of undergraduate science teacher candidates in FKIP Unsri is also shown in question number 8 (Figure 3). The topic tested in this problem is gametogenesis that occurs in the ovum (oogenesis). This topic is also one of the topics identified as having a low understanding of concepts from previous research (Andrej & Rebeka (2017); Ramadhani, *et al*. (2016); and Chaniarosi (2014)). Understanding the concepts that are held by prospective science students on this concept is the polar body formed by the results of the next oogenesis event which will come out together with menstrual blood through the vagina. Urry *et. al.* (2017) explains that the polar body that is formed as a result of ovum formation (oogenesis) will then regenerate in the body.

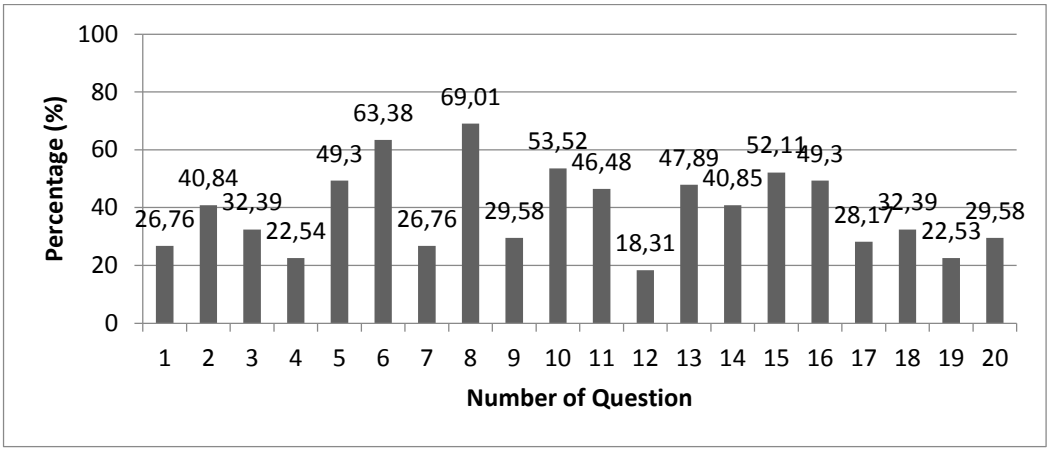

Figure 3 Achievement percentage on category lack of knowledge

One of the items tested shows the tendency of respondents to choose the same answer. This event can be seen in question number 14. In question number 14 this is indeed not a question item that has a percentage of misconceptions, lack of knowledge or high understanding of concepts, but in this question number shows that 81.69% of respondents choose the option "B, embryo get nutrients from the placenta since the first week of pregnancy "for questions about pregnancy. Though conceptually, during the early stages of pregnancy nutrition for the embryo originates from the endometrium because the placenta has not yet been formed (Urry, *et. al.*, 2017; Hall, 2015). The results of this study indicate that understanding concepts in this concept must be straightened out when the learning process is carried out.

The results of the research that have been conducted show that the prior knowledge is still low for FKIP science teacher candidates for Unsri on human reproductive system material and there is a high percentage of misconceptions and lack of knowledge. Andrej & Rebeka (2017) explain this phenomenon is due to the difficulties experienced by students in understanding the reproductive system material concepts concerning the many terms used and must be understood by students even though the various topics raised in this study are fundamental concepts that students must understand. Although basically, all the topics tested are topics that are very familiar to respondents because they have been studied at the previous level of education. This prior knowledge mapping can then be based on the lecturers' consideration for choosing strategies, learning models and arranging learning experience plans that will be given to undergraduate science teacher candidate in Unsri's FKIP so that they can eliminate misconceptions.

This study only provides an overview of prior knowledge of prospective students of the Natural Sciences Faculty FKIP Unsri from the Chemistry Education Study Program. This constraint happens because of the limited time in conducting the observation.

CONCLUSION

The results of the research conducted on the students of the FKIP Science Teacher candidate Unsri (n = 71) regarding prior knowledge in the material concept of the human reproductive system showed that the respondents' understanding of the material is still low. This low level of understanding is accompanied by a high tendency towards misconception and lack of knowledge. The highest understanding of concepts is shown in the questions with the

topic of male reproductive organs, while for the category of misconceptions and lack of knowledge occur in the topic of menstruation, pregnancy, and gametogenesis.

A high understanding of the concept in the sub-concept of male reproductive organs can occur because this sub-concept is always repeated at the previous level of education. Menstrual topics, pregnancy, and gametogenesis have indeed been found in previous studies. The difficulty of understanding the concept in this material is due to the many terms used in this material.

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