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The Effectiveness of Simulation Methods on Prospective Teachers' Professionalism in Science Learning

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abstract

Professionalism in teaching is needed in the Curriculum 2013. As many as 54% of the 68 students stated not yet familiar with the scientific approach. The average value of didactic concept mastery is 55 under the minimum completion criteria. The objectives of this research are to (1) test the effectiveness of the application of simulation methods on the professionalism of prospective teachers; and (2) analyze student responses. The research design is Posttest Only with Non-Equivalent Control Group Design. Data of the simulation method was analyzed by a descriptive method. One sample t-test is used to know the achievement of the average mastery of pedagogic competence. The Independent t-test was addressed to know whether the average value of professional competence of the experimental class is higher than the control class. The response was analyzed by *Likert* scale. The result of the research shows that: (1) the simulation method of science learning on the professionalism of prospective teachers in IAIN Kudus is effective; and (2) Student response to the positive simulation method is 79,00% from 31 students.

1. Introduction

Professional teachers are expected to be present as a response to the implementation of the 2013 Curriculum. Teachers with professional behavior are a necessity as an effort to improve the quality of education (Darma, 2017). Professional teachers are teachers who have four competencies at once namely professional, pedagogic, social, and personality. Teacher professionalism in teaching is a knowledge transfer skill carried out by the teacher to students at certain times and places (Azhar, 2013). The development of pedagogical competence can be done by emphasizing aspects of learning management, development of professional competencies covering aspects of improving skills and perspectives of knowledge; elements of the development of personality competencies include mental, spiritual, and the formation of professional ethics that provide changes in teacher attitudes in managing to learn; while social competence includes emotional intelligence, and the development of the role of teachers in professional organizations (Sutrisno & Aisyah, 2012).

The number of professional teachers indicated by the existence of educational certificates from 2007 to 2017, the total number of certified teachers has reached 1,471,812 people, and teachers who have not been certified are around 656,150 people (Budi, 2017). The number of teachers in 2015 is approximately 2.7 million, and 60 percent have not graduated, especially SD / MI teachers (Surapranata, 2015). The data should be immediately responded quickly by both higher education institutions under the auspices of the Ministry of Research, Technology and Higher Education and the Ministry of Religious Affairs to be able to create professional teacher candidates who are ready to be deployed in schools. The need for prospective professional teachers must be supported by adequate education. Education is an instrument to equip prospective teachers in shaping teacher professionalism. Professional graduates can be achieved with a quality learning process, namely potential teacher-centered learning (Suderadjat, 2005). So quality education can produce professional-minded teachers. Similar to Yunus (2016), quality education is education that can produce graduates who have competencies, both professional (academic) and vocational (pedagogic) competences, which are based on personality and social competences.

Today's homeroom teachers are required to master all fields of science, including Natural Sciences. Therefore, the government needs to provide creative space for prospective teachers to express themselves as early adult humans. According to Sujarwo (2013), old adults are humans who have a self-concept, so that they are more mature in carrying out their duties and responsibilities. Hence, the lecturers need to provide provisions in the form of trust, knowledge, and skills to prospective teachers during the learning instruction. This was confirmed by Putri (2016) who stated that not a few people who work in an institution that is not by educational qualifications. Phenomena also occur in the world of education, for example, science teachers are asked to teach subjects outside of their expertise. If that happens, then the learning that occurs will not be professional, and the results will not be optimal. So, professionalism of teachers greatly influences the output of education. This was reported by Prayudi et al. (2013), there is a close and significant relationship between students' perceptions of teacher professionalism in managing classes with learning achievement. Sutarno et al. (2011), also reported that professional competence affects students' learning motivation by 61.20%.

The distribution of questionnaires to 68 prospective teachers of the Special Cross-class Madrasah Ibtidaiyah (PGMI) Teacher Education (LK) A and LK-B study program was

obtained by 54% of prospective teachers stating that they did not fully recognize the characteristics of the Scientific Approach. The government has been conducting socialization related to the scientific approach only to teachers in schools. This results in a lack of understanding of the implementation of the 2013 Curriculum obtained by prospective teachers on campus. Prospective teachers should know the scientific approach in Curriculum 2013 which consists of observing, asking, trying, reasoning or associating, and communicating (Salim, 2014). This approach will lead students to have competency in knowledge, attitudes, and skills. Dewi and Mukminan (2016), revealed that teachers should ideally be able to develop science learning with a scientific approach in the classroom. Mastery of model selection and strategy is part of the teacher's professional attitude. The thing that must be received by prospective teachers is the scientific approach, not to eliminate absolute truths against empirical truths. Moreover, they are prospective teachers who graduated from the State Islamic College (Salim, 2014).

Skills in managing learning indicate the existence of pedagogic competence in the prospective teacher. According to Trianto (2014), the implementation of the 2013 Curriculum must have the availability of reliable human resources with all the strategic competence. Pedagogic competence. According to Yunus (2016), academic skill, namely the ability to manage learning which includes the understanding of students, designing, and implementing education and development of students to actualize the various potentials possessed.

Monitoring of science teaching by lecturers in the PGMI-LKA and PGMI-LKB classes obtained means values of 55 under the KKM. A value of 55 is changed equivalently to the amount of C (Lecturer Team, 2015). Mastery of material on science education theory is part of professional competence. According to Ghufron (2008), professional expertise is the ability to master learning material widely and genuinely which makes it possible to guide students to meet established graduate competency standards.

Alternative learning methods that are quite effective for improving the professionalism of prospective teachers are using simulation methods with syntax orientation, participation, simulation, and confirmation. This method encourages prospective teachers to gain hands-on experience in implementing science learning activities with real learning steps to obtain science and skills knowledge (Nurhasanah, 2016). Other opinions are not much different. The simulation method is a way of presenting learning experiences using artificial situations to understand certain concepts, principles, or skills (Majid, 2013). The simulation method is a

way of presenting learning experiences using artificial conditions to understand certain concepts, principles, or skills (Mulati, Kuswati, & Rejeki, 2014). The method of simulation of the cybernetics learning theory section that is expected by prospective teachers to easily and quickly master professional and pedagogical competencies in teaching. According to Huda (2014), there are steps or procedures in applying simulation methods in the classroom, namely: orientation, participation training, simulation implementation, and interviews.

Previous research related to the use of simulation methods provided many benefits. Simulation is a picture of reality that is physical or abstract (Atamimi, Sanmustari, & Retnowati, 2002). This simulation is a game that is played by one or more players, who compete in achieving results, based on a series of agreed rules. Simulation methods can be used for: (1) Producing a positive attitude towards a topic; (2) obtain active involvement; (3) provide experiences similar to the real world; (4) Demonstrating the relevance of knowledge; (5) and experiment in safe situations. In the simulation space and time are provided to one participant or one small group of participants to (1) Obtain feedback and clarify misconception; (2) Encouraging and developing introverted participants; and (3) Develop and encourage reasoning on a topic in more depth.

The results of the next study showed that there was a significant effect between the application of the simulation method and student learning outcomes in science subjects about artificial vegetative reproduction after it was seen that it was smaller than or 0.374 <0.832> 0.478 (Falahuddin & Agustin, 2013). The advantages of the simulation method are that it does not require substantial costs, students' interest in learning increases and teachers can assess learning interactions in groups. It is necessary to apply a simulation model in learning to write drama texts to high school class XI students who have a characteristic auditory learning style so that learning to write drama texts can be useful (Krisbiono, Supriyanto, & Rustono, 2015).

The results of the study show that the simulation method assisted by electron configuration and installation media can improve student activity from being excellent, the students' social skills from the good become very good and increase the teacher's activity from being quite good. This also affects the learning outcomes of MAN 2 Paringin XI grade students, whose initial level of mastery of students in the initial test was only 34.40% to 81.65% (Magdalena, 2017). Simulation methods can show better knowledge retention (NorMa, Emllla, & Wilopo, 2005).

Based on the characteristics of the problem and the solutions offered, the application of the simulation method is expected to be effective against teacher professionalism in the Science Learning at IAIN Kudus. Professionalism in this study is only measured from aspects of professional and pedagogical competence. This study aims: (1) to explain the procedure for implementing the science learning simulation method at the LK-A PGMI IAIn Kudus; (2) test the effectiveness of the application of the simulation method to the professionalism of teacher candidates in science learning at IAIN Kudus in the Academic Year of 2017/2018; and (3) analyze the responses of prospective teachers to the use of simulation methods after lectures.

2. Method

2.1 Research Design

The design applied is Posttest Only for Non-Equivalent Control Group Design (Sugiyono, 2010). The independent variable in this study is the use of simulation methods. The dependent variables in this study were pedagogical, professional, and teacher candidate responses. The technique used to obtain the data already mentioned is by observation (educational competence), tests (professional expertise), and questionnaires (teacher candidate responses).

2.2 Population and Sample

The population in this study were prospective teachers of the Cross-sectional PGMI class study program (LK) IAIN Kudus semester 5 in the academic year of the 2017/2018 consisting of 68 people. The sample used PGMI-LKA class (31 people) as an experiment and PGMI-LKB class (37 people) as a control. Random sampling is applied because both types are declared homogeneous with a sig value> 0.05.

2.3 Types of Data and Technique of Data Collection

Data retrieval along with the implementation of the simulation method. Implementation Procedure of the simulation method in the Science Learning. The four steps are explained as follows.

Stage 1 Orientation

a) The lecturer presents the learning contract at the beginning of the course of science learning and the materials for one semester which use a simulation method;

b) The Lecturer provides the syllabus for science materials in MI, especially class IV to class VI in Curriculum 2013 for prospective teachers;
c) Each prospective teacher gets a different Basic Competency;
d) Basic Competency that has been distributed to prospective teachers is asked to be developed into a Lesson Plan that will be simulated in science learning;
e) The Lecturer distributes assessment sheets between friends to assess the prospective teachers' pedagogical competence.

Stage 2 Participation Practice

a) The Lecturer makes scenarios (rules, roles, procedures, scores, types of decisions to be chosen, and goals);
b) The Lecturer carries out practice in a short period.

Stage 3 Simulation Process

a) Prospective teachers carry out learning simulations with the essential competencies that have been distributed in the beginning for approximately 30 minutes. Every time there is face to face there are four practitioners in learning science materials in Islamic Primary School/MI;
b) The simulation consists of three main stages, namely opening (five minutes), core (10 minutes), and closing (5 minutes);
c) Prospective teachers who are not in practice seem to be the audience for prospective teachers who are simulating science learning;
d) Besides, the audience becomes the evaluator for prospective teachers. As for those assessed are pedagogic competencies with assessment techniques among friends.

Stage 4 Confirmation

a) Prospective teachers conclude their difficulties and views;
b) The lecturer provides an opportunity for the audience to submit comments regarding the course of the science learning simulation conducted by prospective teachers;
c) Prospective teachers receive feedback and evaluation from the lecturer;
d) The Lecturer and prospective teachers conclude events and perceptions.

The data of this study are professional competencies, pedagogical competencies, and prospective teacher responses. Professional competence in this study relates to the mastery of lecturing materials in the form of science learning. Professional competence is taken using the Final Semester Exam. Pedagogical competence is related to the ability of prospective teachers in managing to learn. Observation technique to retrieve pedagogic competency data. Questionnaire technique to get prospective teacher responses after science learning. Questionnaires are arranged in the form of questions.

2.4 Statistical Analysis

The data on professionalism in this study is limited into two indicators, namely pedagogic competence, and professional competence. Observed pedagogical competencies are (1) the ability of prospective teachers to deliver learning objectives; (2) teaching styles of prospective teachers; (3)) the involvement of prospective teachers with the audience; (4) teacher enthusiasm in explaining; and (5) variations in learning media. Professional competence emphasizes the mastery of science learning concepts. The sample t-test is applied to find out whether the average value of the experimental class professional competencies is higher than the control class (Yulius, 2010). The mean difference test of one sample was used to determine the achievement of the average mastery pedagogic competence of the experimental class teacher by comparing the Minimum Completion Criteria used was 76. Teacher candidate responses were obtained by a *Likert* scale which was then scanned and made very negative to very positive criteria. Criteria for the percentage of student response scoring: Range 0% -20% = very negative; range 21% -40% = negative; range 41% -60% = quite positive; range 61% -80% = positive; and the range 81% -100% = very positive.

3. Result and Discussion

The results of the study consisted of teacher professionalism in the form of pedagogic competence, professional competence, and teacher candidate responses. The results of the study were revealed comprehensively.

3. 1 Pedagogic Competence

Pedagogic competence consists of five factors, namely: (1) achievement of learning objectives; (2) teaching styles of prospective PGMI teachers; (3) the involvement of

prospective teachers with the audience; (4) teacher enthusiasm in explaining; and (5) variations in learning media. The results of calculations with SPSS 15 are presented in Table 1 below.

Table 1 Analysis on the mean of one sample of Experiment Class

Minimum Completion Criteria = 76					
	t count	**df**	**Sig. (2-tailed)**	**t tab**	**Mean**
Pedagogic Competence	9,300	30	,000	2,000	80,00

Hypothesis

H_o : $\bar{x} = \mu$ (The mean score of pedagogic competence equals the minimum completion criteria)
H_a : $\bar{x} \neq \mu$ (The mean score of pedagogic competence does not equal to the minimum completion criteria)

The calculation results in Table 1, obtained a score of t count> t table (9,300> 2,000), then Ho is rejected, meaning that there is a significant difference between the average value of prospective teachers and the minimum completion criteria (76). The result of t count is positive; this means that the average value of the experimental class pedagogical competence is higher than the KKM value (80.00> 76.00). The result was obtained because the use of simulations provides a broad opportunity for prospective teachers to practice conveying learning objectives directly, applying different teaching styles and teaching media, interacting with audiences and expressing themselves in explaining the material specified. In addition to being given the opportunity to teach, prospective teachers can learn from the input of other prospective teachers who first practice learning material.

3. 2 Professional Competence

Professional competencies were analyzed by testing two unrelated samples. The purpose of this test is to see whether the professional competency of the experimental class is higher than the control class. The output can be seen in Table 2 below.

Table 2 The Result of Different Test for both means

Class	**N**	**Mean**	**t count**	**t table**
Esperiment Class	31	78,20	1,30	1,99
Control Class	37	75,70		

Ho: There is no difference between the mean score of the post-test of experiment and control class

Ha: There is a difference between the mean score of the post-test of experiment and control class

Based on Table 2, the value of t count is obtained by a positive value (1.30), which means that the value of the professional competency of the experimental class is higher than the control class (78.20> 75.70). So the use of simulation methods is effective in improving the professional competence of prospective teachers. The result was obtained due to the simulation method providing a real experience for prospective teachers so that learning material is easy to understand. Real experience in learning theory occupies the highest place as contextual teaching media.

3. 3 Prospective Teacher Responses

At the end of the meeting, questionnaires were distributed to 31 prospective teachers. The calculation results show the percentage of prospective teacher responses is 79.00%. The full percentage can be seen in Figure 1 below.

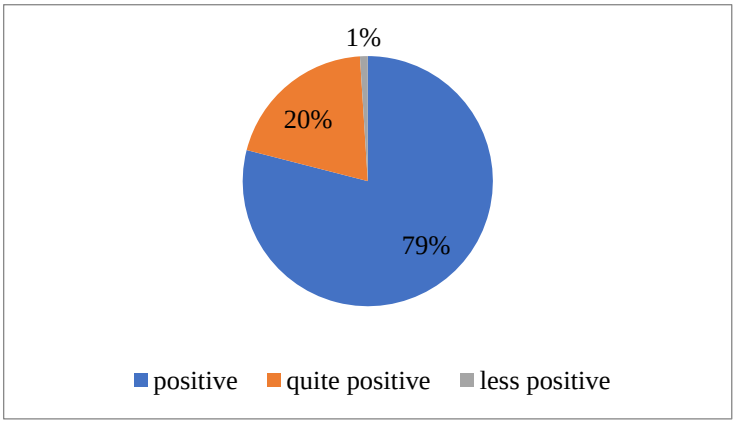

Figure 1 Prospective Teacher Responses

Based on Figure 1, it can be concluded that the use of the simulation method received a positive response of (79.00%) in the science learning subject at IAIN Kudus. In general, prospective teachers are motivated by the simulation method in the science learning course.

3. 4 Discussion

Science learning is taught in the fifth semester of Madrasah Ibtidaiyah Teacher Education Program. The expected competencies are: (1) prospective teachers can describe various kinds of understanding of strategies and methods of science learning; (2) prospective teachers are able to analyze various kinds of understanding of strategies and learning methods to choose

from in learning instruction; and (3) prospective teachers are skilled in applying various strategies and learning methods that are in accordance with the characteristics of science.

Science learning requires that prospective teachers understand how the science concept can be transferred to the audience with mature learning planning. The method that can stimulate professionalism in teaching is a simulation method. Practicing simulation methods will be more effective in increasing overall understanding (Saputri & Azam, 2015). Understanding the concepts of pedagogic science or teaching science is needed, so that prospective teachers fully master when in class.

Lecturers provide freedom to prospective teachers to determine the selection of learning methods. The success of teachers in learning instruction is highly dependent on lesson planning. Lesson planning is the stage associated with the learning instruction, implementing a quality learning process, and evaluating the learning outcomes (Palupi, 2013). Expertise in lesson planning is expected to be able to achieve the learning goals. The skill of lesson planning is part of the teacher's pedagogical competence. One element or component of lesson planning and learning strategies is the learning method. This is in accordance with the results of previous studies that the lesson plan was composed of 9 components namely 1) subject identity, 2) formulation of indicators, 3) formulation of learning objectives, 4) selection of teaching materials, 5) selection of learning resources, 6) selection of learning media , 7) selection of learning methods, 8) designing learning scenarios and 9) designing authentic assessments of the Ministry of Education and Culture (Chusni et al., 2017). These components refer to the standard process of primary and secondary education in the preparation of lesson plans.

Many methods can be chosen when simulating science learning in class. The method that is often used by teachers in science learning is experimentation and demonstration. Data retrieval was carried out on 28 August - 8 December 2017. The conclusion was that the use of the simulation method for the professionalism of prospective PGMI teachers, especially LK-A is effective.

In general, the implementation of the method is successful in science learning in order to realize teacher professionalism. However, some obstacles were found, for example, time management, the occurrence of prospective teachers who were permitted to study because of illness or family affairs. However, until the science learning lecture ends, all prospective teachers can get performances with the models of exchanging days.

3.4.1 Pedagogic Competence

The measured pedagogic competencies include (1) the ability of prospective teachers to deliver learning objectives; (2) teaching styles of prospective teachers; (3) the involvement of prospective teachers with the audience; (4) enthusiasm of prospective teachers in explaining; and (5) variations in learning media. There are still many indicators of pedagogical competence, but due to the limitations of this study, for that only five items were the focus of observation during science learning using the simulation method.

3.4.1.1 Delivering Learning Objectives

Regarding delivering learning objectives, the prospective teacher has conveyed the moment of perception of learning. Instructional or learning objectives are part of the main element of learning strategy planning. When the goal has been set, the teacher will be able to determine what strategy is right for the intended purpose. Submission of goals is an implementation of a very important theory conveyed at the beginning of learning because it is a description of behavior that is expected to be achieved by the audience after learning takes place.

3.4.1.2 Teaching Style

With the simulation method, it is very beneficial for lecturers to conduct an evaluation process on the teacher's style that is not appropriate when teaching. For example, the position of the arm is inserted into the pants pocket; the view does not focus on the audience, talking to the audience, writing while talking, covering the beam of the projector lamp and so on. Thus, simulation methods can enrich knowledge especially ethics and teaching attitudes so that teachers can minimize errors in teaching styles that should not be necessary. Mulati et al. (2014) argued that simulation methods could enrich knowledge, attitudes, skills, and experiences that are not directly needed in dealing with various problems.

3.4.1.3 The Involvement of Prospective Teachers with the Audience

Pedagogical competencies further demand how teachers in the class can be actively involved in the classroom. Moreover, the 2013 Curriculum paradigm in Islamic primary School/MI directs active learning in students and teachers acting as facilitators. The ability to interact with students is part of the art of teaching that must be trained. One of the advantages

of the simulation method is to increase the learning activeness by involving prospective teachers in studying situations that are almost the same as the actual events (Nurlaili & Kharizmi, 2016).

3.4.1.4 Teacher Enthusiasm in Teaching

The use of simulation methods is one method that can generate enthusiasm or motivation to teach. This is by the opinion of Nurlaili and Kharizmi (2016); (Kisman et al., 2014), the simulation method can provide learning and teaching motivation. If you see the teacher enthusiastically, of course, it will spread to students so that the provision of motivation can improve the learning outcomes. Motivation is very important to encourage people to act like a driver or motor that releases energy. Motivation, in this case, is the driving motor of every activity that will be carried out (Rahman & Elshap, 2018).

Enthusiastic teachers will strive for interesting learning. One of the practitioners who was considered attractive during the science learning simulation was when the prospective teacher applied the Number Hand Together (NHT) method. This learning can bring the classroom atmosphere alive so that the pedagogical competence of the teacher can be realized (Widoyoko, 2015). NHT learning can also improve audience learning outcomes (Nurmala, 2016).

3.4.1.5 Learning Media

Learning media is a tool for delivering learning content. The selection of the right media by the learning objectives will help students understand the learning material. The benefits of ICT (Information and Communication Technology) based learning media include (1) Attracting students' attention, (2) Learning becomes fun, (3) Learning becomes easier, (4) Providing more knowledge to students, and (5) Facilitating communication (Sari, 2015). During the simulation, the average prospective teacher competes in using interesting learning media. One of the media used is internet media. Moreover, Curriculum 2013 has a learning principle that must be integrated with the internet. Therefore, it is not wrong for the last step of the scientific approach to communicate or form a network.

Audience with the guidance of prospective teachers must be directed to be able to present, dialogue and conclude on the material that has been learned from observing until the last step

which is communicating (Salim, 2014). The simulation method is one way to provide convenience in communicating the learning goals (Mahtarami, 2006).

3.4.2 Professional Competence

Professional competence is the ability to master the learning material widely and deeply which includes: concepts, structures, and scientific, technological, artistic methods that are coherent with teaching materials, teaching materials that are in the school curriculum (Syukur, 2015). Some efforts that can be made in increasing teacher professionalism are: 1) reading books about education, 2) reading and writing scientific papers, 3) following the actual news from the news media, 4) participating in training, 5) participating in the teacher consortium, 6) conducting Class Action Research (CAR), and 6) actively participate in professional organizations (Nursalim, 2017). The teaching training using the simulation method is expected to improve the professional competence of prospective teachers. The results of the study show an effective simulation method for professional competence.

This success is reinforced by Kusnianingsih's research study (2015), that the application of simulation methods can improve audience learning outcomes. By applying the simulation method of prospective teachers who actively participate as well as prospective teachers whose active observers can develop imagination, form group cohesiveness. Besides, prospective teachers are not ashamed and hesitant to develop their potential. Increased learning outcomes can be proven by improving the quality of the cognitive domain of the test before the action of 65.59 increased to 70.48. The next study explained that using simulation methods made audience knowledge comprehensive by 84% (Saputri & Azam, 2015). There was an increase in audience learning outcomes in the experimental class 1 which was given learning using the simulation method of 90.00% (Yunata & Soesanto, 2014).

Audience learning achievement with a simulation method is higher than the demonstration method on basic competencies in copying documents (Fauzia, 2013). This is indicated by an increase in the magnitude of the gain and the mean of posttest class using the simulation method on audience learning achievement, especially in the psychomotor audience. The use of simulation methods provides a descriptive and dynamic grouping description of all planned designs. (Rukli, 2011). For this reason, researchers recommend simulation methods should be carried out in an educational environment to improve the learning achievement of prospective teachers.

3.4.3 Prospective Teacher Responses

The success of the simulation method is strengthened by the response of prospective teachers. The results obtained were 79.00% which stated a positive response. Presented by prospective teachers, there are several prospective teachers who are teaching for the first time. They claimed this was the first experience in teaching even though the one taught was his friend. At least this can be a training ground for honing pedagogical competence and professionalism in prospective teachers. As much as 20% is quite positive, and 1% states less positive. This is because there are several prospective teachers who have served in several schools, so perhaps the teaching simulation is an experience that is usually experienced by them.

The implementation of the simulation method still found many obstacles. Especially it takes quite a long time. The indiscipline of lecturers and prospective teachers in teaching lectures at the beginning of time greatly affects the success of learning. Discipline is very important in realizing better andragogy education. The prospective PGMI LK-A teacher, although non-regular, should have a great sense of responsibility towards lectures (Rahman & Elshap, 2018). Although most of them already have jobs in school, sometimes they make work or a reason not to arrive on time during class time even though simulations require considerable time so that learning is more effective and efficient.

4. Conclusion

Simulation methods in science learning proved effective against the professionalism of prospective teachers at IAIN Kudus. The response of prospective teachers to the use of a positive simulation method (79.00%) in preparing teachers with the spirit of professionalism at IAIN Kudus. This research is expected to be continued to test the effectiveness of the simulation method on the social competence and personality of the prospective teacher. The rush of special cross-class teacher candidates with regular classes is much different because special classes have been preoccupied with work outside of lectures. Therefore, it is necessary to emphasize the discipline of time from the beginning of the lecture, with the hope that the learning system with the simulation method can run effectively and efficiently.

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The Potential of Local Wisdom on Traditional Fishing *(Tangkul)* Gear in Lake Sipin Jambi City as a Science Learning Source

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This study aims to explore and identify the concept of science contained in "Tangkul" and mapping basic competence of science in Junior High School. The study was descriptive qualitative research. The research subjects were the Sipin Lake community and science education experts. The data collection instruments used were observation sheets, interview guides, and documentation. Data were analyzed descriptively using the Miles and Huberman analysis model (data collection, reduction, display, and verification). The validity test of the data used is the triangulation technique. Tangkul is a traditional fishing gear in Lake Sipin form of trap nets were hung using bamboo. The working mechanism of Tangkul uses the principle of a simple aircraft, namely a net as a load, a pole as support, bamboo as a power arm and a load arm. At the time of lifting the nets, the fishermen draw power with muscle force smaller than the load. The mapped basic competency is in class VIII, i.e., basic competency 3.3 Explain the concept of effort, simple plane, and its application in everyday life including muscle work on the structure of the human skeleton.

1. Introduction

According to Fajrini (2014), local wisdom is a view of life and science as well as various life strategies that are tangible activities carried out by local communities in answering various problems in meeting the needs. Furthermore, Khusniati (2014) argued that local wisdom could be understood as a human effort by using his mind to act and behave towards an event that occurs in a certain space. Anggraini and Kusniarti (2015) mention that local wisdom functions to shape people to be wiser in living their lives. Meanwhile, Ardan (2016) defines local wisdom as something contained among other traditional knowledge as a Savior of the environment has been widely researched and examined by experts. From their research, it can be seen that there should be a bridge to connect between the traditional knowledge with modern scientific and look for ways to integrate it within the system of formal learning at students who understand and will never forget the values of the local culture its own. Based on some definitions of local wisdom above, it can be concluded that local wisdom is the way

people live their lives wisely. The community uses the natural environment as a source of life independently as a result of local customary knowledge or policies. Various forms of wisdom become a unity in the lifestyle of the community.

One of the potential areas of Jambi City which has local wisdom is Lake Sipin. Lake Sipin is located in the Danau Sipin sub-district which is a division of the Telanaipura sub-district. Lake Sipin is a natural resource that can provide benefits to the community and the Jambi City government. The wisdom of Danau Sipin community can be seen from the use of traditional transportation like traditional boats, traditional fishing gear (*Tangkul*), utilization of lakes as cage cultivation, surrounding communities living in traditional stilt houses, *batik* activities and other potential natural resources such as typical fishes namely Lamb and Bad Fish. Communities around Lake Sipin live wisely with the surrounding environment with various patterns of life.

The biodiversity found in Lake Sipin is a supply of river fish which is quite a lot to be consumed by the surrounding community. Hence, the community uses this potential as a family economic resource, namely by fishing and freshwater fish farming activities carried out around Lake Sipin. Capture fisheries activities are fishing activities using traditional tools while fish farming activities are carried out in floating net cages. One of the fishing tools used is *Tangkul* (a fishing trap type that is hung using bamboo).

Based on the background above, the focus of this study is that traditional fishing gear (*Tangkul ikan*) from observations in schools, especially in Jambi City, is known that there are not many learning activities that integrate local wisdom. Learning science and the potential of local wisdom has not been well documented so that it can be used as a source of learning science. Science learning will be more meaningful if it is connected with daily life or local wisdom of the local community.

This is by relevant research conducted by Warpala et al. (2010), the results show that teaching materials that orient science based on local wisdom can improve students' understanding of concepts and scientific performance. Saputra et al. (2016) learning local wisdom can be earning local wisdom can increase environmental awareness. Satriawan and Rosmiati (2016) state that teaching materials are contextually based with local wisdom can improve mastery of physical concepts. Marhayani (2016) states that local wisdom can develop character. Further explanation is given by Parmin et al. (2015) who concluded that the use of local wisdom in learning also ensures that the science of learning not only understands

concepts but also strengthens Indonesia's identity with various cultures. Multicultural education in Indonesia is more appropriately seen as an approach, namely an educational approach that seeks that regional cultural values (ethnicity) and religion in Indonesia can be understood, appreciated, and utilized for educational purposes (Amirin, 2012).

Society in carrying out activities cannot be separated from the elements of culture and the value of science in it. Disclosure of local community ideas that are local can strengthen the essence of meaningful learning, and encourage every student in the school to be wise, and full of wisdom so that they can solve their problems in daily life (Azizahwati & Yasin, 2017). The scientific values contained in the local wisdom objects of the community have the potential as a source of science learning based on the Science Environment Technology Society (SETS) approach. The SETS approach provides an understanding of the links between science, environment, technology, and society and is a vehicle for training students' sensitivity to environmental impact as a result of the development of science and technology (Yuniastuti, 2015). According to Khasanah (2015), science education is a vehicle for studying oneself and the environment and its application in everyday life. In accordance with the Content Standards (Kemdikbud, 2014), it is expected that at the SMP / MTs level, there will be an emphasis on mutual learning (science, environment, technology, and society) integrated directed at learning experiences to design and create works through the application of science concepts and work competencies scientifically wisely. Through learning based on the SETS approach, students can integrate local wisdom with learning activities.

The integration of local wisdom in learning will be by the environment that exists and experienced by students. Thus, students will be motivated in learning. According to Ameyaw (2011), students have difficulty in making connections between science concepts integrated with local wisdom in teaching materials that have been prepared. It is noted that less than 20% of integrated teaching materials are prepared for students. Integrating local wisdom does not reduce the understanding of science concepts.

On the contrary, it can add meaning to the concept. Students can study science by using more objects found in the environment and selecting objects tailored to their needs and understanding of concepts and learning styles. This study aims to explore and identify in depth the potential of local wisdom in traditional fishing gear *(Tangkul)* as well as to reach the basic competence of science mapping in the middle school level. The results of the mapping can then be used as a source of learning science.

2. Methods

This research is explorative qualitative research. This is aimed at exploring and identifying the potential of local wisdom of *Tangkul* fishing gear. The research subjects were the Danau Sipin community and science education experts. The sampling technique is purposive sampling, namely sampling techniques based on consideration. The criteria for the research subject were the lake sipin community who know the history, customs and local culture, and community profession as fishermen using *Tangkul* fishing gear. Meanwhile, the criteria for science education experts are that someone who has a background in science education and works professionally in the field of science education.

The research instruments are in the form of observation sheets, interview guides, and documentation. Observation sheet indicators include material, shape, and driving force of *Tangkul*. The interview guide lists questions from the Lake Sipin community and education experts. Indicators that were asked of the community were the origin of Lake Sipin, the existence of *Tangkul* fishing gear in Sipin Lake and the use of *Tangkul* fishing gear. The indicator asked by science experts is the science concept found in the working mechanism of *Tangkul* fishing. While the documentation in the form of pictures and videos related to the lake area and the use of *Tangkul* fishing, the documentation can be developed as a learning resource.

Data were analyzed descriptively qualitatively by Mills and Humberman model which consisted of several stages, namely data collection, data reduction, data display and conclusion drawing / verification. Reduction activities in this research are carried out after the researcher enters the field (location of penetration), where the records of the initial observations that have been obtained are grouped and then coded according to the research requirements. Display data in this study is to find the relationship between various data from observations with science concepts. The initial conclusions put forward are still temporary and will increase if no strong evidence is found that supports the next stage of data collection. But if the conclusions raised at the initial stage are supported by valid and consistent evidence when the researcher returns to the field to collect data, then the conclusions put forward are credible conclusions. The validity test of the data used is the credibility test. The data credibility test is done by triangulation of techniques, namely data collection by observation, interviews, and documentation on the same data source.

3. Results And Discussion

Lake Sipin is one of the lakes in Jambi City. The existence of Lake Sipin in the center of Jambi City has an important role for the surrounding community. Therefore, the community exploits this potential as a family economic resource, namely fish farming, and capture fisheries carried out around Lake Sipin. Capture fisheries are fishing activities using traditional tools. Traditional fishing gear is a form of local wisdom that comes from the knowledge of the community in facilitating fishing activities that have been going on for generations.

Local wisdom according to Asriati (2012), is a local idea that is wise, full of wisdom, good value, embedded and followed by community members. Local wisdom according to Leo (2015), is the order of life values inherited from one generation to another in the form of religion, culture or customs that are commonly spoken in the social system of society. The presence of local wisdom in the community is a result of the process of adaptation to a normally inhabited environment where interactions often occur from one generation to another over a very long period. According to Suastra (2013), local wisdom can be understood as a human effort by using his mind (cognition) to act and behave towards something, object, or event that occurs in a particular space. Ibrahim (2014) states that integrating local wisdom in educational and learning activities is very potential to bring innovation. Integration of local wisdom into education can be done in various forms and objectives, including (a) local affairs as a model, which can be an example to be imitated and practiced in daily life; (b) local wisdom as content / content of lessons that can act as examples taught; (c) local wisdom as an inspiration, which raises new ideas in learning.

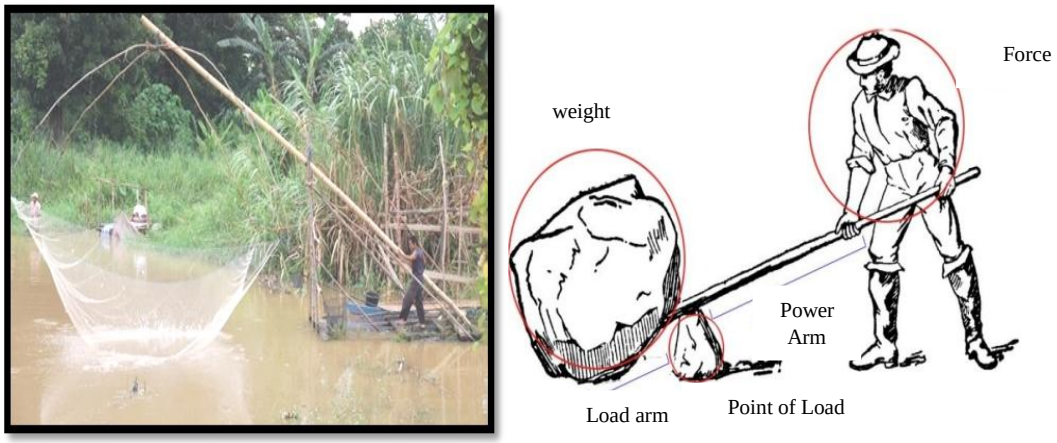
One of the wise behaviors of the people living in the Danau Sipin area is community activities in fishing by using local understanding wisely in maintaining the lake environment. Fishing activities in the community are using net traps which are hung using bamboo or better known as *Tangkul* fishing gear. This fishing activity (with *Tangkul*) has been carried out for generations by the community. *Tangkul* fish has a scientific concept that can be seen from its mechanism of action.

3.1 Science Concept on the Local Wisdom of *Tangkul* Fishing

According to Dahliani et al. (2015), local wisdom has two main elements, namely humans with a mindset and nature with its climate. Local wisdom is the uniqueness of local knowledge and understanding of certain cultures or communities (Indrawasih, 2017). According to Hasbiah (2015), local wisdom is reflected in daily life; it will be reflected in the knowledge and practice of people who use and maintain the environment. Local wisdom according to Mungmachon (2012), is a basic knowledge obtained from the balance of life with nature. Based on the interview results of one of the speakers who is a fisherman in the Danau Sipin area, said that the existence of *Tangkul* itself was long around two centuries ago. Catching fish using *Tangkul* is an activity that has been carried out for generations. *Tangkul* fishing gear made of waring with a mesh size of 1 mm, size 2.5 x 2.5 m. Bamboo stalks or handles 3 cm in diameter 2-3 m in length-bamboo branches (frames) of 1.5 cm in diameter (4 pieces).

The length of the stretch is from one to another is 50-75 cm, connecting the skeleton of the branch with two pieces of stalks made of bamboo with a diameter of 1.55 cm in length 15 cm tied with a rope at the end of the bamboo stalk. So that the bamboo handle can rotate in any direction when it is lifted. *Tangkul* fishing equipment is operated in an open place to facilitate installation and can also be on the banks of the river, carried out by two people. One person raises *Tangkul*, and the other one is tasked with dragging or collecting seeds that enter into *Tangkul* (Abidin, 2009).

Tangkul fishing can be found in several locations in Lake Sipin. In fishing activities using community, *Tangkul* fishing equipment use the principle of simple machine. Simple machines are tools that can help humans make an effort. The following figure shows the concept of a simple machine in *Tangkul*.



Source: Personal Documentation

(a)

Source: *http://www.sainsseru.com/2017/12/materi-terlengkap-pesawat-sederhana.html#more*

(b)

Figure 1. (a) *Tangkul* Fishing, and (b) The Concept of Simple Machine in *Tangkul* Fishing

Tangkul uses mechanical principles. The nets are developed which then connected with ropes and bamboo. The fulcrum is in the middle, the net is a load, and the fisherman holds the power point. In figure 1, there is a simple mechanic concept found in *Tangkul* fishing. A simple type of mechanic that belongs to the working mechanism of *Tangkul* is a simple type I of mechanic (the type of lever). According to Puspita and Rohima (2009), a simple machine is tools that can help humans make an effort. The lever is a rod that can be rotated around the fulcrum, the lever functions as a force magnifying device so that the advantage of using a lever is the force produced is greater than the force released. Then it can be formulated as follows:

$$KM = \frac{w}{F} = \frac{l_k}{l_b}$$

Notes:

KM = Mechanical Benefit, *w* = Wight, *F* = Force, L_k = =power arm, dan L_b = load arm.

The principle of *Tangkul* work is a lever, where the *Tangkul* is lowered then raised. It is related to the human skeleton, so there is a thing called straight and attractive movement of the flexor and extensor for movement in his hand. The mechanism of action of the muscles is the work of the principal muscles of contraction and relaxation, when interesting he has contractions when straightened he relaxes. Muscles are a network consisting of muscle cells. Muscle cells combine to form muscle fibers. Muscle fibers are wrapped by a muscle

membrane (sarcolemma). These muscle fibers combine to form a collection of muscle fibers called muscle bundles. The combination of muscle bundles is called muscle or flesh. The muscle is wrapped by a muscular sheath (fascia). Muscles can contract by expanding and deflating. As a result, the muscles can move the skeleton. Therefore muscle is called active motion.

According to (Gusti, 2014), the muscles which are active instruments have three characteristics, namely as follows.

1) Contractibility, namely the ability of muscles to make changes to be shorter than the original size.
2) Extensibility, namely the ability of the muscle to relax or extend from its original size. This characteristic is the opposite of contractibility. Motion that arises is the opposite of motion caused by the contraction of the muscles in question.
3) Elasticity, namely the ability of the muscle to be able to return to its original size after contracting or extensively. When the muscle returns to its original size, the muscle is called a state of relaxation.

Muscle work cannot be done with just one type. This causes the work of the muscles to be differentiated into synergistic and antagonistic.

1) *Synergic* is the work of the muscles whose contractions cause unidirectional movements. For example muscles in the forearm, and cubits.
2) *Antagonists* are muscles that contract the opposite effect. Example:
   a. Extensor (straightening) and flexor (bending)
   b. Abductor (away from the body) and adductor (approaching the body)
   c. Depressor (down) and the elevator (upwards)
   d. Supinator and pronator (face down)

In the activity of catching fish, it is necessary to carry out additional training if there are many fish catches. This heating is done so that the muscles are not surprised to minimize the occurrence of cramps in the muscles when it pulls the fish tank.

3.1 The Mapping of Basic Competency which is Integrated with Local Wisdom of *Tangkul* Fishing

The concept of a simple machine in *Tangkul* fishing can be seen from the working mechanism of the *Tangkul* itself. In addition to the concept of a simple machine in *Tangkul* fishing, there is a concept of a human motion system. This can be seen from the activities of the community in operating *Tangkul* fishing. This tool is operated by pulling the end of the bamboo so that the load (fish caught) contained in the trap net can be lifted. In this activity flexor and extensor, movements occur, namely straight and interesting movements for movement in his hand. Based on the results of the analysis of the science concept, it can be mapped basic competencies for science subjects in junior high schools that can be integrated with the local wisdom of *Tangkul* fishing. The mapping results are shown in Figure 2.

Ridwan (2007) argues that local wisdom can be understood as a human effort using his mind (cognition) to act and behave towards something, object or event that occurs in a particular space. *Tangkul* is one form of local wisdom that is in Lake Sipin from the results of people's thinking and passed down from generation to generation. The results of people's thinking in creating traditional fishing gear (*Tangkul* fishing) is a wise action in preserving the environment. Based on the results of this study, it can be seen that there are scientific concepts in *Tangkul* fishing, namely the concept of simple machine and motion systems in humans. This *Tangkul* fishing can be used as a source of learning science by making *Tangkul* fishing as a context to explore scientific content. Students can learn about simple machine concepts through the first-hand experience of simple machine applications on fish tanks. Jufrida et al. (2018) state that local wisdom that has a scientific concept is used as a source of learning science. The same thing expressed by Al Musafir et al. (2016), local wisdom can be a source of learning geography. Local wisdom is a part of the environment around students so that it can be used as a learning resource.

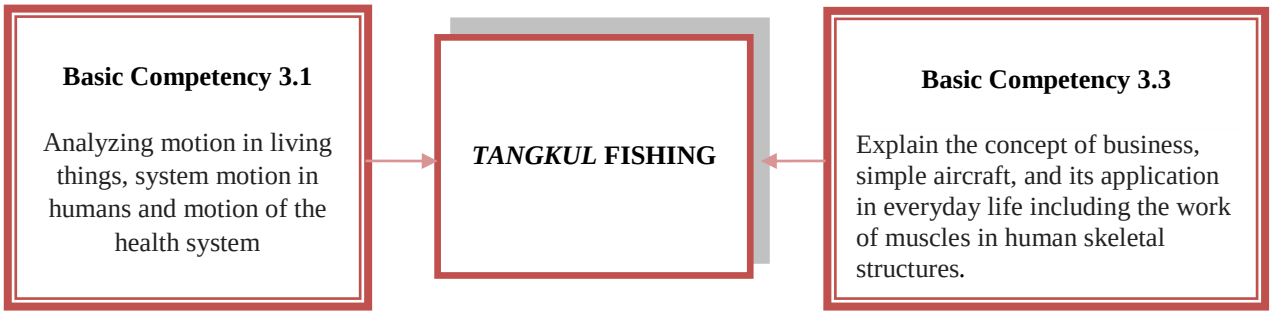


Figure 2. The Mapping of Basic Competency of Science

According to Al Bahij et al. (2018), the surrounding of the natural environment can be utilized as a teaching media in science learning so that it can foster creativity; students are more active in learning outside the classroom because it is more fun. Students can see directly using real media in the school environment. The environment can be used as a natural laboratory in science learning so students will get information based on direct experience and can learn from things that are concrete so that students will more easily understand the material being studied (Utaminingsih, 2015).

Lamasai et al. (2015) explain that the use of the surrounding natural environment as a learning resource can be achieved by conducting activities by bringing students to the environment, such as observation and practice in the field. The use of the environment as a learning resource provides opportunities for students to actively explore information about everything that is around them and then is connected with learning in schools (Ikhsan et al., 2017). Haryati (2016) concluded that utilizing the school environment as a learning resource makes students active and directly involved in the learning process. Ifrianti and Emilia (2016) argued that the use of the surrounding environment as a learning media could improve student learning activities and outcomes. Future science learning needs to be sought so that there is a balance between the knowledge of science itself and the planting of scientific attitudes, as well as the values of local wisdom that exist and develop in the community. Therefore, the socio-cultural environment of students needs to get serious attention in developing science education in schools because it contains original science that can be useful for their lives. Thus, science education will truly benefit the students themselves and the wider community (Suastra, 2010). This is by the opinion of Subali et al. (2015) that the implementation of local wisdom-based science learning not only has a positive impact on students but also can improve learning achievement.

4. Conclusion

Based on the results obtained, it can be concluded that the scientific concepts identified in *Tangkul* fishing are physics and biology. In the field of physics, there is a simple machine concept that can be viewed from the mechanism of *Tangkul*. Whereas in the field of biology, there is the concept of muscle style in operating the *Tangkul* fishing gear. The results of the basic competency mapping identified on the object of local wisdom in *Tangkul* fishing are the basic competency of 3.3 Explaining the concept of business, simple machine, and its