The combination of interactive conceptual learning models and multimedia interactive to minimize misconceptions on the science content

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Abstract. This research was accompanied to minimize the misconception of physical education students at the Muhammadiyah University of Makassar in Integrated Science learning through the combination of interactive conceptual learning models and interactive multimedia (IMM) Macromedia Flash. The research conducted included several stages, namely 1) identifying integrated science material that enables students to experience misconceptions, 2) designing scenarios of learning models and interactive multimedia-based learning media, 3) conducting trials, 4) implementing learning followed by data analysis. Data were analysed quantitatively and qualitatively. Qualitative data in this study are in the form of characteristics of the material selected in the identification stage. From the analysis of the misconceptions, data on misconceptions are obtained. The response of the students and the lectures to the presented learning model is then narrated. Quantitative data in this study are in the form of initial test scores and final test scores. Based on the outcomes of the material analysis in the Integrated Science course that has the potential to cause misconceptions in the impact of acid rain pollution. Form the quantitative analysis. It shows that the percentage score of misconception in the pre-test stage has a high level in each item and has decreased in the post-test stage for each item. Misconceptions analysis was carried out on each item. The largest percentage of misconceptions occurred in question number 8, the percentage of pre-test scores of 81%, after being taught to obtain a post-test score of 18.9%. It shows a decrease in the percentage of misconceptions by 62.1%. It shows that lectures by providing Macromedia Flash learning media simulations can minimize misconceptions.

1. Introduction
Integrated science learning is a science learning approach that participates several fields of scientific study hooked on a single discussion part. Integrated science learning essential also covers the approach, process, produce, submission, and original dimensions. Students are estimated to have a complete science understanding (holistic) to agree with the daily life problem contextually concluded integrated science learning

Considering the importance of the science role, which contains ecology, physics, and chemistry, the science learning process has to handled properly. One essential aspect that needs to be considered is how to mix the material from each discipline. after that, it is taught to students using a fun learning
approach. Science Integrated is expected to improve the quality of Integrated Science courses. Besides that, it is also expected to be able to advance the high equal of skills then the competence of students, which is shown by increasing their learning achievement and reducing misconception. In some studies, misconceptions were found in all fields of science. [1][2]

One of them is in research in the field of chemistry where misconception occurs in all sub-concepts in atomic structure material with the highest percentage in the Rutherford atomic theory sub concept that is equal to 45.45%. Likewise, with the research conducted by Chan and Ismail (2013), Malaysian tenth-grade students still harboured misconceptions in reasoning about variability. A study of Gunes (2011), also showed misconceptions in science learning, the students have shown their misconceptions specifically about bright, chlorophyll, vigour, the structure of chloroplast, ATP synthesis and where the reactions happened. Allowing to outcomes of the study Mehmetlioglu (2014), on behalf of the whole quantity misconception, 6th-year scholars had a fewer number of misapprehensions compared to others 7th-year students had a fewer quantity of zero law misconceptions than the others. Instead, for the section rule misconception, 7th year and 8th-year scholars had further misconceptions than 6th-year students. At the university level, there are several studies examining misconceptions. One of them is qualitative research, and students have a misconception on light material that is taught with conventional learning. [3][4][5][6]

A misconception is one of the causes of a student’s learning difficulties. The teacher has known so far the occurrence of misconceptions in students only through interviews because the evaluation instrument for misconception detection has not been widely developed yet. Test instruments used by the teacher in the form of multiple choices and essays are less able to distinguish between students who know the concept, experience misconceptions, and those who do not know the concept. Although misconceptions are difficult to remove, when it can be identified early, prevention and correction of misconceptions can be done. [7]

The integrated science subject is one of the most important subjects to be provided to students who are still at the basic level. Besides, the content of the integrated science subject has direct relevance and makes an important contribution to the development of other sciences. However, the Integrated Science is still not very attractive at the moment. Especially for junior high school students, because it is considered a difficult and complex subject because it has many mathematical formulas. The abstract nature of matter also causes frequent misconceptions of knowledge, the perception that the integrated science in physics, biology, and chemistry and the application of its integration in the student’s daily life creates a distinct burden among students. This perception creates minimum knowledge of integrated science which leads to the lacking of the ability to assign concepts to integrated science.

Furthermore, the problems experienced by lectures while carrying out the integrated science learning process are the uniformity of the fundamental knowledge possessed by students such as some students are still very lacking in certain materials. In contrast, others have mastered the material greatly.

The integrated science process and other subjects in the Physics Education Study Program FKIP Muhammadiyah University of Makassar have not so much applied a learning model that utilizes modern learning technology. It is caused by the difficulty to determine the right learning model, especially in the subjects that students find difficult to understand. Besides, the preparation of the intended learning model requires special skills so that an effective model can be produced. Under the results of monitoring and experience that almost all lecturers who deliver integrated science courses are conducted in the form of lecturing methods, giving examples of questions and papers.

In line with the change and the innovation in the education system that continues to grow in the 21st century, there are few changes in finding learning resources, and there are more choices for using and utilizing ICT. In this case, interactive multimedia can be used so that students understand utilizing ICT. In this case, interactive multimedia can be used so that student’s understanding becomes better. [8]

There are many learning models offered by education experts to reduce misconceptions. As in Khoiryah’s research (2017), conceptual learning models can correct and minimize. Furthermore, there is also a study conducted by Suniati (2013), who concluded that a decrease in the misconceptions of students who take interactive multimedia-assisted contextual learning is greater than the decrease in the
misconception of students who take conventional learning. Similarly, research conducted by Marnita (2017), concluded that the practice of interactive multimedia (Macromedia Flash) could advance student’s fundamental thinking skills. Other research that supports the use of Interactive Multimedia in learning is research from Khan and Masood (2014), the results showed that Interactive Multimedia with cooperative learning had a positive impact on learning with cellular respiration material.[9][10][11][12] 

Many persons claim that interactive multimedia has the potential to create high-quality learning environments actively engage the learner, thereby promoting deep learning. A study of Humienny and Berta (2018), The application of multimedia in learning has a positive effect. The submission aim is to support students to improve skills effective usage of the geometrical tolerancing symbols and rules. With the use of interactive multimedia, teachers produced a various set of activities across multiple subjects that tested deep conceptual and procedural knowledge. Teachers found the training useful for capturing student’s supposed processes, identifying misconceptions, and engaging students with content. Therefore the authors are interested in integrating interactive conceptual learning models and interactive multimedia with the use of Macromedia Flash. By using this learning model, it is expected that it can help students in appreciative the concepts of learning materials and can reduce the existing misconception.[13][14]

2. Research Method
This investigation is a qualitative-numerical study spending pre-experimental project with a one-group pretest-posttest strategy. The topics in this study were physics students at the University of Muhammadiyah Makassar in the odd semester of 2017 educational year, which consisted of 35 students. Numbers assemblage was carried out before and after the application of interactive conceptual learning and interactive multimedia with Macromedia flash. The research conducted in this study included the identification of material followed by concept analysis in science materials which included theory and practice (virtual laboratories). Integrated by interactive conceptual learning models and interactive multimedia Macromedia flash, then identify the integrated science material that enables students to experience misconceptions. A scenario and interactive conceptual learning model and interactive multimedia with Macromedia flash were then designed on integrated science learning. After the research tool was completed, a trial of interactive multimedia-based learning media was carried out integrated science learning. The next stage is the design of the implementation instrument, followed by the implementation of learning in Integrated Science students. After this stage is complete, it is continued with data analysis and conclusions.

For methods and procedures for collecting data in this study, several techniques were used. Data collection techniques were carried out in the form of initial tests and final tests given to students with instruments in the way of items about the misconception. Also, there were questionnaires and interviews delivered to students and lecturers in the form of surveys for students and the lecturer’s responses to the learning model implemented.

The data which are obtained from the research results are analyzed qualitatively and quantitatively. Qualitative data in this study are in the form of material characteristics selected in the identification phase through concept analysis consisting of label concepts, concept definitions, concept types, concept attributes, and concept hierarchies. From the misconception analysis, data on student misconceptions will be obtained. The answer of students and lecturers to the presented knowledge model is then narrated. Quantitative data in this study are in the method of original examination scores then, final test scores. The numbers in the form of quantitative data are then presented in the form of graphs that illustrate the acquisition of student misconception tests for each item in question.
3. Result and Discussion

3.1. The Outcome of The Integrated Science Material Mapping by The Interactive Conceptual and Interactive Multimedia Learning Model of Macromedia Flash

The Integrated Science subject is a compulsory subject in the expertise course group. This subject is divided into Integrated Science 1 and Integrated Science 2. The content of both courses includes scientific knowledge material related to one another in the context of integration (Physics, Chemistry, and Biology). Integrated Science 1 is given in the first semester of the odd semester while the Integrated Science 2 course is offered in semester 2 of the same year. Integrated Science 2 material is a continuation of Integrated Science 1. The material structure in Integrated Science 1 course is as follows: (1) integration models in science (split, associated, nested, sequenced, shared, webbed, threaded, integrated, unnerved, and networked); (2) the material and its changes, including: material and its characteristics, material classification, and chemical bonds; (3) rating of living things, including aspects of living things, plants and their classification, animals and their classification; (4) living things and their environment, including environmental concepts, ecosystems, food types and animal life cycles, ecological changes, pollution and global warming; (5) energy in the life system; (6) temperature and changes; (7) heat and displacement; (8) electricity and electrical equipment; (9) magnetism and its use in technological products.

3.2. Results of The Concept Analysis on Identified Material

Based on the analysis of the material and the considerations of several Integrated Science lecturers, the content studied is prioritized in Integrated Science 1. The content in Integrated Science 1 is the primary material that students need to master before studying Integrated Science 2. The topic pointed out in this study is environmental pollution. The consideration of choosing this material is that the characteristics of this material are closely related to the most frequent problems and are still a problem in the community in real life.

3.3. The results of The Identification of The Material Contained in The Integrated Science Covering The Theory And Practice (Virtual Laboratory) Allowing Students to Experience Misconception

Environmental pollution material is one of the materials in Integrated Science 1 subject which has the potential to cause misconceptions. Integrated Science based on the study of material characteristics that are predominantly abstract if not accompanied by simulations that have the potential to cause conceptual errors or mistakes.

The sub concept that is focused on this research is the impact of acid rain pollution. The descriptions of the material indicators of the effect of acid rain pollution are: describing the results of air pollution, explaining the concept of the water cycle, explaining the concept of acid rain, and explaining the impact of acid rain on the environment.
3.4. Results of Concept Analysis on Identified Material Causing Misconception

Figure 1. The Concept Analysis of Acid Rain Material: The concept analysis of acid rain material is presented in the method of concept maps to facilitate the introducing of concepts related to acidic rain material which is rather complicated. The presentation of acidic rain material in the form of impression maps is shown in the following concept map chart.

3.5. Conducting The Trial of The Integrated Science Learning Software

The learning media produced are then tested to determine the effectiveness of the use of instructional media in the Integrated Science learning process. The outcomes show that the use of instructional media can help students understand the concepts of science about environmental pollution on the effects of acid rain on life. Also, the use of Macromedia flash media can reduce the occurrence of student misconceptions related to the topic of the impacts of acid rain pollution on life.

The statement above is supported by the acquisition of data presented in graphical form the figure below. The graph shows that the percentage score of misconception in the pre-test stage has a high level in each item. This indicates that lectures with simulations of Macromedia flash media can minimize mistakes.
Figure 2. Percentage Graph of Students’ Misconception Test Score on The Concept of Acid Rain

4. Conclusion
The ends from the results of this revision are: (1) based on eight items tested, there were misconceptions about the eight questions. The most significant percentage of mistakes is 81% in the pre-test decreased to 18.9% in the post-test. (2) the use of Macromedia flash learning media can minimize students’ misconceptions on the material impact of acid rain pollution. (3) Integrated Science learning using Interactive Multimedia (Macromedia flash) can support students to understand the perception of the effect of acid rain pollution.

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