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ARTICLE

Implementation of the Numbered Head Together (NHT) model based on interactive multimedia ispring suite 10 on the subject of work and energy to improve student understanding

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Abstract

With the development of time, educators are required to continuously innovate in the use of models, media, and other learning aspects that support the learning process. This demand is further heightened as students are now required to have 21st-century skills. The aim of this research is to determine the improvement in students' understanding of the topic of Work and Energy by using the Numbered Head Together (NHT) learning model based on interactive multimedia iSpring Suite 10. This study uses a quantitative pre-experimental research method, employing a one-group pretest-posttest design. Sample selection was conducted using purposive sampling, which involves selecting samples based on specific considerations. The sample for this research was a tenth-grade class in one of the high schools in Indonesia. The research instruments used were a 20-item multiple-choice test and a response questionnaire. Based on the test results, the average N-Gain value obtained was 0.41, categorizing it as a moderate improvement according to the N-Gain criteria. Therefore, it can be concluded that there is an improvement in students' understanding of the concepts of work and energy when using the NHT learning model based on interactive multimedia iSpring Suite 10.

Keywords: Numbered Head Together (NHT), student understanding, interactive multimedia

1. Introduction

Natural Science is the field of study that explores the universe and everything within it. However, natural science can only be comprehended through the senses. One branch of IPA is Physics, which studies the physical aspects of the universe and expresses them mathematically for better understanding. Thus, physics learning is inseparable from mastering concepts, applying them to solve physics problems, and working scientifically. However, in reality, physics learning in classrooms tends to neglect problem-solving skills, emphasizing conceptual mastery only (Hoellwarth, Moelter, and Knight 2005; Puspitasari 2019; Rohayah 2022). This results in students having low problem-solving abilities (Rismawati, Aji, and Hudha 2017; Alfika and Mayasari 2018; Puspitasari 2019). In the classroom learning process, various challenges are commonly encountered, including diverse student understanding levels of the taught material. Many students find it difficult to grasp concepts, especially in the subject of physics, which is perceived as challenging. When presented with physics problems, students often struggle to choose the relevant concepts for solving these problems.

Work and energy are considered challenging topics within the realm of physics. They involve understanding the physics concepts of work and energy, the relationship between work and energy, and examples of applying these concepts in daily life. Based on the examination of the content of work and energy, many abstract concepts and complex formulas are found, often related to previously mastered material. This complexity leads to students experiencing difficulties in understanding the material. Students may struggle to solve problems that could be addressed using simple and appropriate concepts. Moreover, students often perceive physics learning as uninteresting, difficult to understand, and boring, contributing to a lack of conceptual understanding. Other contributing factors include a lack of motivation, low interest in learning, students' low activity levels, and the inappropriate use of teaching models and media.

To address these issues, the selection of appropriate teaching models and media is crucial. One such model is cooperative learning, with the Numbered Head Together (NHT) cooperative learning model being a suitable choice. Through the NHT cooperative learning model, students can be more actively involved in studying the material, allowing teachers to assess their understanding of the material taught. Apart from selecting the right teaching model, considering the abstract nature of the physics topic, work and energy, it is essential to use suitable media to facilitate easy understanding and enhance student conceptual understanding. One effective media is interactive learning media.

Interactive learning media can be an effective educational tool (Sugianto et al. 2013; Liana, Ellianawati, and Hardyanto 2019; Puspitasari 2019). Multimedia-based interactive learning media can be a solution for teachers and students to improve the effectiveness and efficiency of education. Interactive learning media ensures effective, efficient, and easily understandable learning for students, supporting their learning and encouraging the development of 21st-century skills (Turiman et al. 2012). Twenty-first century skills are essential for surviving and facing any challenges in the global community environment in the 21st century. These skills include critical thinking and problem-solving, creativity and innovation, collaboration, ICT utilization, and career-oriented orientation. The appropriate selection of teaching models and interactive multimedia-based learning media can significantly impact the improvement of students' conceptual understanding. One such multimedia-based interactive learning tool is iSpring Suite, integrated with Microsoft PowerPoint. This tool can present videos, images, and animations attractively, complemented by interactive quizzes with various question types that can be tailored to the needs and easy to use. Additionally, the resulting product can be in HTML or application form, operable not only through computers/laptops but also through Android smartphones.

Considering these challenges, the researcher is interested in conducting a study by applying the cooperative learning model Numbered Head Together (NHT) based on interactive multimedia using iSpring Suite 10 to observe its impact on improving students' conceptual understanding. Therefore, the researcher chose the title for this thesis: "Implementation of the Numbered Head Together (NHT) Model based on Interactive Multimedia iSpring Suite 10 on the Topic of Work and Energy to Improve Student Understanding.

2. Literature Framework

2.1 Instructional model of Numbered Head Together

Learning is a term closely associated with both the act of learning and teaching. Learning can occur even in the absence of a teacher or formal teaching activities. On the other hand, teaching encompasses everything a teacher does in the classroom based on what the teacher does to ensure that the teaching and learning process in the classroom aligns with the intended goals. Learning is any effort that utilizes and involves the knowledge and profession that teachers possess to achieve curriculum objectives (Octavia 2020). In the learning process, several aspects need attention to support success, one of which is the learning model used.

A learning model is a pattern or plan used as a guide in implementing classroom or tutorial learning (Alvionita 2018; Wiratman et al. 2023). It is a conceptual framework with a systematic procedure for organizing the learning system to achieve specific learning objectives and serves as a guide for instructional designers and educators in planning and implementing learning activities (Sulfiani 2016; Jayul and Irwanto 2020). From these definitions, it can be concluded that a learning model is a systematic design or pattern used to carry out learning activities and shape other components.

There is a wide variety of learning models that can be used according to needs. One such learning model is the Numbered Head Together (NHT) cooperative learning model. The NHT cooperative learning model was developed by Spencer Kagan. This model provides an opportunity for each student to exchange ideas and considerations for the most accurate answers. Additionally, it encourages students to enhance collaboration and cooperation. Moreover, the NHT cooperative learning model has several advantages, considering the process (Suandewi and Wibawa 2017).

Every learning model has its own strengths and weaknesses, including the Numbered Head Together (NHT) cooperative learning model. No learning model can be considered perfect, so educators are expected to optimize each model with its strengths and weaknesses in mind. The advantages of the NHT cooperative learning model include: (a) enabling the creation of collaboration among students; (b) allowing all students to actively participate in learning and be more creative in their studies; and (c) significantly boosting students' learning enthusiasm.

As for the disadvantages of the NHT cooperative learning model, it includes the possibility that a number that has been called may be called again by the teacher, and not all members are called by the teacher. Therefore, an appropriate solution is needed to address these drawbacks. This can be achieved by creating a data sheet containing names, group numbers, individual member numbers, and marking those who have already been called to answer a question from the teacher to ensure that no one is called more than once and to give other students an opportunity.

From the above advantages and disadvantages, it can be concluded that the NHT cooperative learning model may not be suitable for use when the number of students is too large because it may require a longer time. Nevertheless, in the learning process, students not only gain an understanding of the concepts taught but also learn to socialize with other students and express and appreciate each other's opinions.

2.2 Interactive multimedia of Ispring Suite 10

Etymologically, interactive multimedia originates from the Latin word "multi" (a noun), meaning many, varied, and "medium," which signifies something that can be used to convey or deliver something. Additionally, the term "medium," as per the American Heritage Electronic Dictionary, can be interpreted as a tool for distributing and presenting information. According to Akhwan 2002, "multimedia is a medium that combines two or more elements of media consisting of text, graphics, images, photos, audio, video, and animation in an integrated manner." Multimedia is also divided into two categories: linear multimedia and interactive multimedia. Linear multimedia refers to multimedia that lacks any controlling tools and is operated by the user, such as TV and film. Interactive multimedia, on the other hand, is multimedia equipped with controlling tools that can be operated by the user, allowing them to choose the next steps, as seen in applications and games.

Multimedia is a collection of communication and computer-based media systems with a role in creating, storing, delivering, and receiving information in the form of text, audio, video, graphics, and more (Hasanah, Salam, Mahtari, et al. 2019). Multimedia was defined as the combination of two or more communication media such as text, graphics, animation, audio, and video, characterized by computer interactivity in producing an engaging presentation. In the context of learning, multimedia-based learning is an activity that utilizes computers to create and combine text, graphics, audio, moving images like video and animation, with interconnected networks (links) and tools that enable users to navigate, interact, create, and communicate.

Summarizing various definitions provided by experts regarding interactive multimedia, it can be concluded that interactive multimedia is a medium that integrates two or more elements, including text, graphics, images, audio, animation, and video, creating a two-way communication or interaction between the user (human/product user) and the computer (software/application/product in a specific file format). Furthermore, instructional media using interactive multimedia has advantages, such as flexibility, catering to individual learning speeds, rich content, interactivity, communicativeness, ease of modification, and the freedom to develop creativity (Deliany, Hidayat, and Nurhayati 2019).

The structure and components of interactive multimedia are guided by the development of ICT-based teaching materials. ICT-based teaching materials are materials compiled and developed using ICT tools to process, organize, store, and manipulate data to produce quality information. Therefore, to assist in creating interactive multimedia, specific applications are needed, and one example is iSpring Suite 10.

iSpring Suite 10 is a learning medium that utilizes digital technology. iSpring Suite 10 software is a tool with various supporting features in creating presentation-based learning media that includes components like text, animation, video, effects, music, and interactive quiz creation. Additionally, iSpring Suite 10 can be used as a variation in learning tools to enhance educators' motivation and creativity (Nuraini et al., 2019: 64). Integrated with Microsoft PowerPoint, iSpring Suite 10 can make PowerPoint presentations more engaging. With various attractive features, the iSpring Suite 10 application can assist in planning materials and conducting both online and offline learning. Furthermore, iSpring Suite 10 has its strengths and weaknesses. The advantages, as mentioned by Ariyanti et al. 2020in the journal "Education and Development" titled "Interactive Multimedia Based on iSpring Suite," include (a) serving as an engaging medium for students, (b) making it easier to create learning media compared to other tools, allowing even less computer-savvy teachers to use it; and (c) creating quizzes with various types as it integrates with iSpring Quiz Maker, enabling the creation of interactive quizzes for both online and offline use. The disadvantage of iSpring Suite is that it may not be suitable for practical-based learning; thus, it needs to be collaboratively used with other supporting media.

2.3 Conceptual understanding

Understanding comes from the word "understand" and, according to the Big Indonesian Dictionary, it means comprehending, understanding, knowing, and a stream of teachings. In this context, understanding can be interpreted as the process, action, or method of comprehending or grasping something that is being learned. Understanding is an individual's ability to comprehend and grasp something after it has been known and remembered. In other words, understanding involves knowing about something and being able to view it from various perspectives. Understanding represents a cognitive thinking ability one level higher than memory and memorization. A person is considered to understand if they can explain, classify, summarize, predict, and differentiate. Students' understanding is defined as the ability to grasp or comprehend the meaning and significance of material being studied. Meanwhile, understanding falls within the cognitive domain, level 2, after knowledge.

Another definition of students' understanding can be derived from the word "understand," which means responsive, truly understanding, viewpoint, and teachings. Moreover, understanding can be defined as the ability to comprehend the meaning of material being studied, such as interpreting, explaining, or summarizing the studied material.

From the various opinions above, the indicators of understanding are essentially the same, namely that by understanding something, an individual can defend, distinguish, speculate, explain, interpret, estimate, determine, expand, conclude, analyze, provide examples, rewrite, classify, and summarize. These indicators indicate that understanding has a broader meaning than knowledge. If someone has knowledge, it does not necessarily mean they can deeply understand what is being studied. In other words, they may only know without understanding the meaning and significance of what they are learning. On the other hand, understanding means that an individual can not only memorize what is being studied but also has the ability to grasp the meaning and understand the concepts of the subject. The cognitive process profile of concept understanding that is analyzed includes seven stages: interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining (Anderson and Krathwohl 2001).

3. Research Method

3.1 Research design

The research method employed in this study is quantitative research. The research design utilized is a pre-experimental one-group pretest-posttest design. The experimental method involves utilizing a phenomenon known as an exercise. Through this exercise, the cause-and-effect relationship will be observed as an impact of the exercise implementation. In this research, the aim is to determine whether there is an improvement in students' understanding of the taught material, specifically on the topic of work and energy (Darna and Herlina 2018). This is achieved by employing the Numbered Head Together (NHT) learning model based on interactive multimedia iSpring Suite 10, integrated with Microsoft PowerPoint.

3.2 Participants

Participant The research was conducted during the period from March to May, which was adjusted to the schedule of Teaching and Learning Activities at the chosen school for the research. The research took place at one of the Public Senior High Schools in Indonesia. The population for this study consisted of all tenth and eleventh-grade students in the Science Program, totaling 65 individuals. In this research, the researcher employed the purposive sampling technique to select the sample. Purposive sampling is a sampling technique where samples are selected based on specific considerations (Darna and Herlina 2018). This was chosen because the subjects to be studied are students in the tenth grade of Senior High School taking the Science Program, as the material to be tested is derived from this grade. The sample size for this study was 35 individual

3.3 Instruments

The research instruments used in this study consist of questions through comprehension test items and a questionnaire to measure students' responses to the use of the model and learning media conducted by the researcher. This quantitative data is analyzed based on the results of pretests and post-tests, as well as the questionnaire responses from the students who participated in the study. The comprehension test items are used during both pretest and post-test activities to measure the extent of students' improvement in understanding the tested material. Meanwhile, the questionnaire is used to measure students' responses to the implementation of multimedia interactive learning media based on iSpring Suite 10 integrated with Microsoft PowerPoint during the teaching and learning process.

The instruments for this research consist of comprehension test items adapted to the cognitive process profile of understanding according to Anderson and Krathwohl (2001). There are seven stages: interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. The comprehension test instrument comprises 25 multiple-choice questions designed to measure the improvement in students' understanding. The questionnaire instrument consists of 14 questions related to the effectiveness and responses to the use of the model and multimedia interactive learning media.

3.4 Data analysis

In line with the upcoming research, which will employ a quantitative approach, the analysis will be conducted using quantitative data analysis techniques. The researcher will utilize statistical formulas to analyze the quantitative data. This analysis is based on the data obtained from the pre-test and post-test responses in the form of test items conducted before and after the implementation of learning using the NHT (Numbered Head Together) learning model based on interactive multimedia iSpring Suite 10, integrated with Microsoft PowerPoint. For data analysis, the researcher will use either Microsoft Excel 2010 or SPSS Statistics 26.0. The data analysis will include tests for normality, homogeneity, hypothesis testing, N-Gain analysis, and Likert Scale testing (Questionnaire).

4. Result of the research

4.1 Conceptual understanding

Based on the pretest and post-test data, the average pretest score was 37.14, and the average post-test score was 62.50. This indicates an improvement after the treatment compared to before the treatment. After conducting data analysis as mentioned above, the results of the instrument data analysis previously performed are obtained.

Table 1. Score of conceptual understanding

Measurement	Test	
	Pretest	Posttest
Student number	28	28
Ideal Score	100	100
Minimum score	10	20
Maximum score	60	85
Average	37,14	62,50

Based on the research data analysis, the normality test results for the pretest obtained a value of 0.071, which is greater than the significance level = 0.05 (0.071). Therefore, it can be concluded that the sample comes from a population with a normal distribution. Then, for the post-test score calculation on the understanding of the concept of work and energy for tenth-grade IPA 2 students with a value of 0.223, which is greater than the significance level of 0.05 ($0.223 > 0.05$), it can be determined that the sample comes from a population with a normal distribution. For the homogeneity test, the significance value of the pretest and post-test in the Based on Mean column is 0.013, which is smaller than the significance level of 0.05 (0.013). Therefore, it can be concluded that the sample comes from a population that is not homogeneous.

Based on these results, a hypothesis test was then conducted to make the final decision as an answer to the formulated problem regarding the improvement in students' understanding when using the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 on the topic of work and energy. According to the hypothesis test results, the significance value (sig. 2-tailed) is 0.000, which is smaller than the significance level of 0.05 (0.000). Thus, the alternative hypothesis (Ha) is accepted, indicating an improvement in students' understanding of the concept of work and energy when using the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10. To strengthen the evidence of an improvement in students' understanding, an N-Gain test was conducted, resulting in an average N-Gain value of $g = 0.41$. Based on the N-Gain test criteria, this value falls into the moderate category.

4.2 Result of the interview and observation

Based on the Likert Scale questionnaire results, the average percentage obtained is 66.99%, falling into the "agree" category. This indicates that the use of the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 during the learning activities can be an alternative method that enhances students' enthusiasm and understanding. According to the researcher's analysis through direct questions to students regarding the use of the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 during learning activities, it can boost students' learning spirit. This is because the learning process is conducted in groups, students actively participate in learning activities, and it fosters and creates closer social relationships among peers.

The learning process using the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 took place in 2 (two) sessions, aligned with the physics subject's schedule at the research school. In the first stage, students were given an initial test (pretest). Subsequently, the learning process was carried out using the treatment. Afterward, a final test (post-test) was administered to the students, followed by interviews and the completion of response questionnaires. Throughout the learning process, students were provided with an application used as a learning media and a Student Worksheet to be completed following the instructions. During the learning process, students became more active in studying the given material. Peer-to-peer and student-to-teacher interactions became more interactive, and students appeared enthusiastic and motivated during the learning sessions.

5. Discussion

The findings indicate that students have varying understandings of the concept of collisions. There are four categories of visual representations of students' preconceptions: correct collision concepts, collision concepts based on objects, collision concepts based on types, and incorrect collision concepts. The majority of students' visual representations fall into the macroscopic level, rooted in everyday experiences with large objects that can be directly observed. Students who visualize collision concepts correctly demonstrate detailed and meticulous understanding. They are able to connect the concept to events or objects in daily life, often through observation or direct experience with the collision between two moving objects. This aligns with previous research showing that a significant number of students can visualize collision concepts accurately.

In the category of collision concepts based on objects, students use specific objects, such as vehicles, to represent collision concepts. Previous research also suggests that visual representations can help students understand concepts more vividly and meaningfully through the use of objects. In the category of collision concepts based on types, two types of collisions identified by students are elastic and inelastic collisions. Many students find it easier to visualize elastic collisions compared to inelastic collisions. Previous research has also revealed students' difficulties in visualizing both types of collisions. The last category is incorrect collision concepts, where students cannot accurately depict the concept of collisions. Their visual representations lack relevant connections to the concept of collisions. This aligns with previous research indicating that many students have misconceptions and difficulties applying collision concepts in complex real-world situations.

Overall, students' preconceptions about collisions tend to be at the macroscopic level before they acquire a more abstract and detailed understanding through experiences and learning. Further efforts are needed to advance students' understanding to a deeper level. Teachers can provide activities and examples at more detailed levels, such as the mesoscopic and microscopic levels, using simulations or enlarged photos to help students understand molecular-level interactions. Moreover, students' biases about collisions are still limited, as indicated by incorrect visual representations. There are still many misconceptions among students about collision concepts, especially at the macroscopic level.

6. Conclusion

Based on the results outlined above, the research on the impact of implementing the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 on the understanding of concepts in the subject of work and energy can be concluded. The application of the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 significantly enhances students' understanding of concepts in the subject of work and energy in high schools. By obtaining a significance value (sig. 2-tailed) of 0.000, which is smaller than the significance level of 0.05 (0.000), Ha is accepted, and H0 is rejected. This indicates an improvement in students' understanding of the concepts of work and energy when using the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10.

The increase in understanding is supported by the calculation of the N-Gain value. Based on the N-Gain calculation, a gain value of 0.41 is obtained, categorizing the improvement as moderate. The increase in students' understanding of the work and energy material after the treatment is considered moderate. However, the use of the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 can be considered an alternative to help improve students' understanding, especially in the subject of physics. Additionally, based on the calculation of student responses to the questionnaire regarding the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10, an average percentage of 66.99% is obtained, falling into the agree category. This implies that the use of the Numbered Heads Together (NHT) learning model based on interactive multimedia iSpring Suite 10 during learning activities can be an alternative for both the learning model and media, enhancing students' enthusiasm and understanding during learning activities.

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