Development of audio-visual learning media integrating character education in chemistry learning to facilitate conceptual change and character strengthening of high school students

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Development of audio-visual learning media integrating character education in chemistry learning to facilitate conceptual change and character strengthening of high school students

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Abstract. Audiovisual media is a set of tools that can project moving images and sound. This study aims to produce audio-visual learning media that integrates character education in chemistry learning to facilitate conceptual change and strengthen student character. This research is development research which includes three stages, namely preliminary studies, development, and validation, as well as testing and implementation to produce valid, practical, and effective audio-visual learning media. The validation was carried out by three experts through Focus Group Discussion. The audio-visual media and learning tools developed were tested on state senior high school students 1 Kabila Gorontalo. The research data technique used observation and three-level diagnostic tests. The data analysis used a qualitative descriptive technique. The results obtained are audio-visual learning media developed with validity with very valid categories, practicality with very high categories, and effective in shifting students' conceptions from misconceptions and not seeing concepts to understanding concepts with high N-Gain. category, which is 0.83. This study concludes that the audiovisual learning media and learning tools developed are of good quality.

1. Introduction

Indonesia is one of the countries in the world that can be said to be lagging, especially in terms of the development of Science and Technology. Science and technology is a very important aspect of the 21st century because it can improve the quality of human resources (HR). However, the Global Competitiveness Index data shows that Indonesia is ranked low about the development of science and technology. One of the solutions to improve human resources in Indonesia is through education, especially in terms of Academic Qualifications and Teacher Competencies. Simanjuntak argues that teachers as facilitators make it easy for students to instill concepts that are demanded by the curriculum, one of which is the use of learning media in the learning process [1].

Learning media is anything that can be used to transmit messages from sender to recipient so that it can stimulate students' thoughts, feelings, concerns, and interests in such a way that the learning process occurs. In learning activities, each teacher uses different learning media to be able to carry out effective learning [2]. Over time, various types of instructional media have been developed to assist teachers in

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implementing effective learning, and also help explain and instill a concept of knowledge easily. One of the learning media is audiovisual media [3].

Audiovisual media is a set of tools that can project moving images and sound [4]. These learning media can be used to enhance students' learning experiences through stimulation of the auditory senses (audio) and sense of sight (visual), because these media can help students to gain real, lively, and vital learning experiences [5]. The application of media containing interactive animation is expected to be able to eliminate students' laziness in learning. A survey proves that a student who learns by using animation will not easily forget about the material he is learning. The application of audio-visual media has various benefits, one of which is based on the opinion of Shabiralyani et al. [6] stated that audio-visual learning media can eliminate student saturation to increase motivation, activity, and conceptual understanding of the material being studied. Also, audio-visual learning media can reduce student misconceptions about chemical concepts and increase student motivation to learn chemistry [7–9].

Based on their understanding of a concept, students can be grouped into three types of understanding, namely knowing the concept (TK), not knowing the concept (TTK), and misconception (MK) [10]. The misconception is a phenomenon in learning that is most interesting to research. From various previous research results, it was obtained evidence of student misconceptions on various chemical concepts, including (1) Found some students experienced misconceptions on the subject of salt hydrolysis [11], (2) Found that some students experienced misconceptions on the subject matter of Chemical Equilibrium [12], (3) Study that some chemical concepts are often a misconception by students, including concepts related to chemical bonds, acids, and bases, stoichiometry, chemical equilibrium [13]. In addition, several researchers found that misconceptions have occurred in several chemical concepts such as acid-base [14–17], atomic structure [18], evaporation [19], reaction rate [20],, colligative properties [21], and chemical equilibrium [13]. One way to reduce misconceptions in students is the use of appropriate learning media and can reduce misconceptions that occur in students, one of which is audiovisual media. The research found that the use of animation learning media can reduce student misconceptions [9]. Visual elaboration of chemical concepts through computer animation can help students interpret chemical phenomena and develop a better understanding of these chemical concepts. By presenting a visual representation of the phenomena that occur at the macroscopic level it can make it easier for students to understand chemical processes. For this reason, audio-visual learning media is needed to be able to overcome the problem of misconceptions in students.

Based on initial surveys and interviews with school principals, teachers, and related agencies, it was found that there was a tendency for the minimal use of audio-visual learning media in chemistry learning. This happens because there are no audiovisual media available that can be used to rectify chemical misconceptions that occur in students. So, it is important to develop an audio-visual learning media in chemistry learning in high school, by integrating character education. This is because character education is very important in building a country. To maximize the implementation of character education, the Indonesian Ministry of Education and Culture has implemented several strategies to strengthen its implementation. The strategy, among others, is to strengthen guidelines for the implementation of character education. Then, accommodate institutions that have implemented character education even with different names, and strengthen existing activities in schools. Therefore, the long-term goal of developing instructional media is to improve the quality of education and the quality of education in Indonesia, particularly the Tomini Bay area. Meanwhile, the specific objective is the availability of audiovisual learning media that integrates character education in chemistry learning to facilitate conceptual change and strengthen the character of high school students in the Tomini Bay area.

2. Methods

This research is included in the type of research and development, where through this research, audio-visual learning media integrated with character education in chemistry learning will be developed as an effort to facilitate conceptual change and strengthen the character of high school students in Gorontalo Province. The development model used in this study was adapted from Borg & Gall, namely the

development of a model that is carried out through repetitive activities ranging from designing the model to implementation. There are ten development research steps according to Borg & Gall, namely: 1) Research and information collection, 2) planning, 3) Develop preliminary forms of the product (initial product development), 4) preliminary field testing (initial field test), 5) main product revision, 6) main field testing, 7) operational product revision, 8) operational field testing, 9) final product revision, 10) dissemination and implementation [22]. In this study, an adaptation was made to the ten steps as modified by Sukmadinata which consists of three main stages, namely preliminary studies, development and validation, and testing/ implementation [23]. The stages of this research are:

2.1. Preliminary study stage

The preliminary study stage is the initial stage carried out to collect various information related to the product to be developed. The purpose of this stage is to define and define the requirements needed in the preparation of audio-visual learning media that integrates character education in chemistry learning as an effort to facilitate conceptual change and strengthen the character of high school students in the Tomini Bay area.

2.2. Development and validation stage

This stage aims to develop audio-visual learning media that integrates character education in chemistry learning as an effort to strengthen the character of high school students in the Tomini Bay area. This stage aims to develop audio-visual learning media integrated character education in chemistry learning as an effort to strengthen the character of high school students in the Tomini Bay area.

2.3. Testing and implementation stage

This stage aims to test the practicality and effectiveness of the learning media developed so that empirical evidence is obtained about the practicality and effectiveness of the learning media being developed. The design used is a one-group pretest-posttest design in which some steps indicate a sequence of research activities, namely:

O1	X	O2
Pretest	Treatment	Posttest

The types of activities carried out in this study are:

2.3.1. Initial survey and coordination (preliminary stage). At this stage, the research team will conduct an initial survey and coordination in several senior high schools in cities/districts in the Tomini Bay Area to determine and define the requirements needed in the preparation of audio-visual learning media integrating character education in chemistry learning for facilitating conceptual change and strengthening the character of high school students in the Tomini Bay Area, so that the learning media to be developed are following the needs and requirements.

2.3.2. Compilation of instructional media that integrates character education (development stage). At this stage, the research team prepared an audio-visual learning media that integrated character education in chemistry learning as an effort to strengthen the character of high school students in the Tomini Bay area based on the results obtained at the definition stage. The audio-visual learning media design was made with the presentation of chemical bonding material contained in the learning video, then supported by the presence of audio related to the explanation of the chemical bonding material presented in the video. The explanation related to the presentation of the material is an audio aspect developed in this media, while the presentation of the chemical bonding material that is displayed in the video is a visual aspect developed in this media. So that the learning media developed in this study is in the form of audio-visual learning videos related to chemical bonding material that integrates character education.

2.3.3. Expert validation (development stage). At this stage, the validation of audio-visual learning media that integrates character education in chemistry learning will be carried out as an effort to strengthen the character of high school students in the Tomini Bay area through focus group discussions involving chemistry learning experts, instructional media experts, and users of audio-visual learning media with integrated education. character. Then make revisions based on the results of expert validation.

2.3.4. Learning media trial (testing and implementation stage). The validated learning media trials were carried out at senior high schools in the Tomini Bay area.

3. Results and discussion

3.1. Results of the validity of audiovisual learning media

Expert assessment of audio-visual learning media was carried out by four experts who assessed learning media for Chemical Bonding material. Expert judgment uses a validation sheet which before being used to assess audio-visual learning media, the validation sheet is first validated by three other experts. Based on the statement of agreement, the validator commented "agreed" to the validation sheet that had been compiled for use in assessing audiovisual learning media. The results of expert assessments of learning media are listed in Table 1.

Table 1. Results of expert validation analysis of audio-visual learning media.

No.	Assessment Aspects	Average Media Ratings and its Validity Category	
1	Audio visual learning media facilitates the achievement of learning objectives and integrates character education	4,0	Very Valid
2	Presentation of material / concept systematically, logically and straightforwardly	4,0	Very Valid
3	Image conformity with concept	3,8	Very Valid
4	Conformity of concepts in audio-visual learning media with the concepts put forward by experts	4,0	Very Valid
5	The correctness and accuracy of the terms used	4,0	Very Valid
6	The clarity of the sentences used.	4,0	Very Valid

Based on the expert's assessment of the audiovisual learning media, all aspects of the assessment of learning media have a very valid category. Based on these results, the audiovisual learning media is said to be of high quality and suitable for use as a learning medium in the chemistry learning process, especially in chemical bonding material. The learning device developed is said to be of quality if it meets three criteria, namely validity, practicality, and effectiveness [24].

3.2. Results of observation of student activities

Student activities were observed by the observer every 3 minutes during the learning activities. The results of the observations on the eight types of student activities are presented in Figure 1.

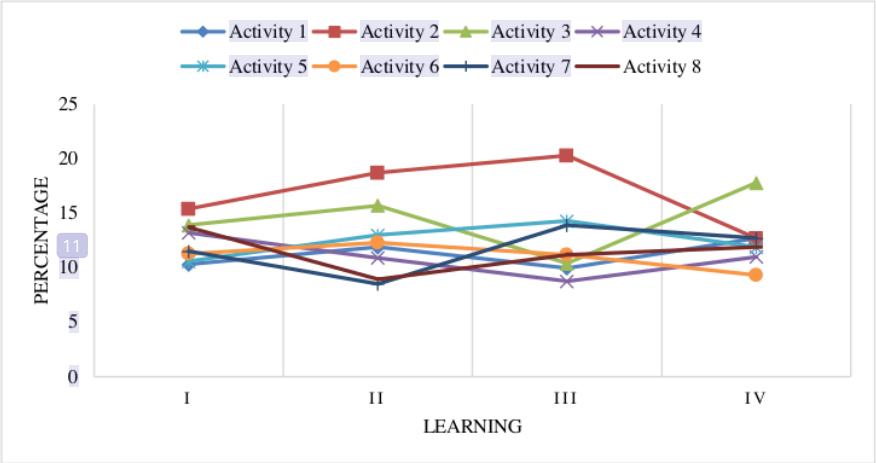

Figure 1. The eight types of student activities.

Based on the data in Figure 1, the following analysis can be given:

1. Activity 1 (religious attitude) looks unstable, where the percentage in learning one to learning two decreases, while there is an increase again in learning three, and decreases at the end of learning, namely learning four.
2. Activity 2 (curiosity attitude) shows that there tends to be an increase in the percentage of students who have a curiosity about the concept of chemical bonds from learning one to learning three, but there is a significant decrease in the fourth lesson.
3. Activity 3 (democratic attitudes) shows an unstable percentage because there is an increase in students 'attitudes in expressing opinions during group work from meeting one to meeting two, while it has decreased at meeting three, but at the fourth meeting, there was a large increase in students' democratic attitudes.
4. Activity 4 (tolerance attitude) has decreased with the way students value other people's opinions, namely from learning one to learning three, but there is a significant increase in the fourth lesson.
5. Activity 5 (attitude of responsibility) has increased from meeting one to meeting three, but a decrease has occurred at the fourth meeting. This proved that students were more responsible in answering the student worksheets given at meetings one to three, but decreased at the fourth meeting.
6. Activity 6 (independent attitude) tends to decrease from the second meeting to the fourth meeting, but from meeting one to meeting two, it is seen that there has been an increase related to the independent attitude of students, especially in terms of sharing tasks well in groups.
7. Activity 7 (honest attitude) tends to be unstable because from meeting one to meeting two it has decreased the percentage, while from meeting two to meeting three it has increased significantly, but there was a decline again at the fourth meeting.
8. Activity 8 (discipline) initially decreased from meeting one to meeting two, but there was an increase in meeting three and meeting four. This proved that at the meeting of two to four students Showed more orderly behavior and obeyed various rules and regulations.

Based on the results of observations of student activities during the learning process, it can show the practicality of the developed audio-visual learning media. Product development can be said to be practical if the practitioner states or argues that theoretically the product can be applied in the field and the level of product implementation is in the "good" category [25]. Audio-visual learning media that integrates character education aims to shape the child's personality so that they become good students in society and the state. Character education is an effort made to influence character or in other words,

character education is education that can shape a person's character and can shape changes that exist within oneself continuously and train one's abilities towards a better direction [26].

3.3. Conceptual Change Analysis (Conceptual Shift and Reduction of Student Misconceptions)

Conceptual is an important aspect of the learning process that can change at a time. Change is changing the meaning of existing conceptions towards a more scientific conception [27]. Furthermore, conceptual change is replacing misconceptions with the conceptions of scientists that are more scientific[28]. Based on these two opinions, the conceptual changes discussed in this section include a shift in the conceptions of students with the status of MK1, MK2, MK3, and TTK towards TK, and reduction of misconceptions (MK1, MK2, MK3).

Conceptual change data (shift in conceptions and reduction of student misconceptions) were obtained through pretest and posttest data which were collected through a written test in the form of a three-tier test. The pretest data were used to determine the initial conceptions of students who were included in the category of knowing the concept (TK), misconception 1 (MK1), misconception 2 (MK2), misconception 3 (MK3), and students who did not know the concept (TTK) on chemical bonding material. Furthermore, post-test data is used to determine the shift in conceptions and reduction of student misconceptions after learning using audio-visual learning media.

After learning using audio-visual learning media, students are given a concept understanding test using a three-tier multiple-choice instrument to map students' conceptions as well as to see the shift in conceptions of students who previously experienced misconceptions and did not know the concept. The conception shift map makes it easy to track shifts in MK1, MK2, MK3, and TTK. The shift in conception that is expected is a shift from MK1, MK2, MK3, and TTK to TK. Conception shift can be identified by comparing the mapping of students 'conceptions before learning activities (pretest results) with the mapping of students' conceptions after learning using audio-visual learning media (posttest results). Comparison data on the percentage of students' conceptions before and after learning with audio-visual learning media is presented in Figure 2.

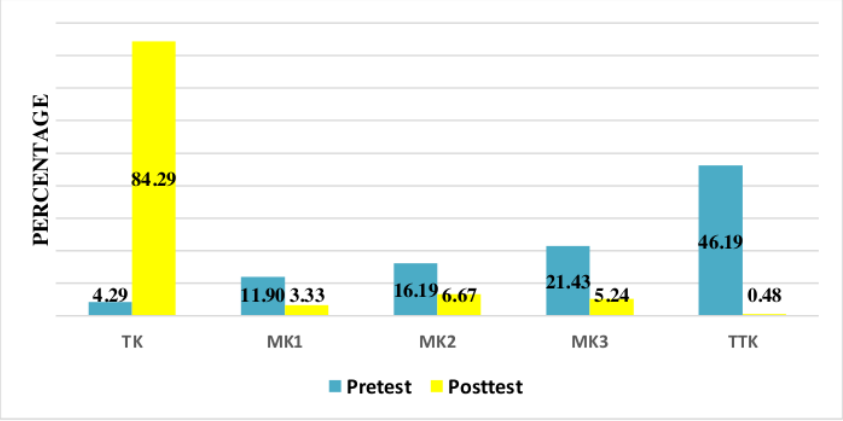

Figure 2. Percentage of students' conception before and after learning.

Based on Figure 2, it is clear that students have left many misconceptions on the concept of chemical bonds. Overall, the percentage of knowing the concept students had reached 84.29% (from 4.29%), while the percentage of students who experienced misconceptions (MK1, MK2, and MK3) and TTK decreased drastically. This fact indicates that the use of tested audio-visual learning media can change students' conceptions from misconceptions and not knowing concepts to knowing concepts.

The increase in the percentage of students who know the concept also indicates an increase in understanding of the concept by students as evidenced by the N-gain score, which is the difference

between the pretest and posttest scores, which is calculated based on the equation [29]. The results of the N-gain analysis are presented briefly as in Figure 3.

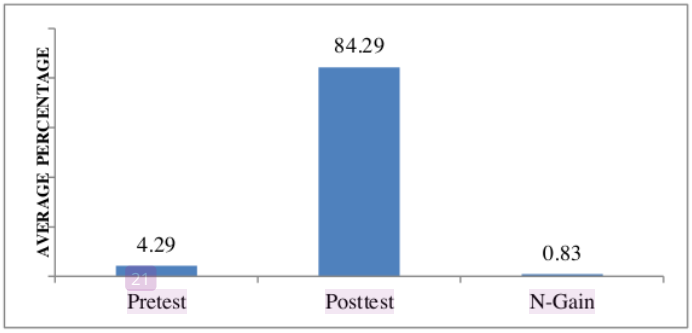

Figure 3. Average pretest, posttest, n-gain of test results in the trial.

Based on Figure 3 as a whole, there was an increase in students' concept understanding scores between before and after learning using audio-visual learning media. Based on the N-Gain criteria, the N-Gain obtained is above 0.7 which means the category is "high"[29]. Thus, learning using audio-visual learning media can shift students' conceptions from misconceptions (MK1, MK2, MK3) and not knowing the concept (TTK) towards knowing the concept (TK), which is shown by an increase in understanding of the concept with the "high" category.

Learning using audio-visual learning media is expected to reduce student misconceptions or a shift in misconceptions (MK1, MK2, and MK3) into knowing the concept (TK). The reduction of misconceptions can be viewed from the shift of misconceptions both individually and classically. Conception mapping is an effort made to facilitate the analysis process of the positions of MK1, MK2, MK3, and TTK. That MK1 and MK2 students are students who have an incomplete understanding of the concept, while students who experience MK3 are students who truly experience misconceptions [30]. That MK1 was a positive misconception and MK 2 was a negative misconception[10]. That students who provide answers that show misconceptions, but can provide responses that show understanding of the concept is categorized as misconceptions.

Data regarding the shift in the conceptions of students starting from MK1, MK2, and MK3 towards MK1, MK2, MK3, TTK, and TK can sharpen further analysis. The shift in student misconception data can be seen in Figure 4.

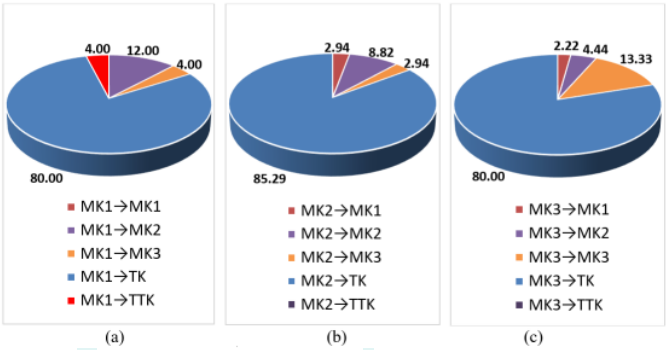

Figure 4. Pastel Diagram of students' conception shift: (a) Shift from MK1; (b) Shift from MK2; (c) Shift from MK3.

Based on the data in Figure, the following analysis results can be obtained:

1. In Figure 5a, the percentage shift in the conceptions of students from MK1 to TK reached 80% although there were still 3.33% of students who were still with MK1. Meanwhile, the shift in students' conceptions from MK1 to MK2, MK3, and TTK was 12%, 4%, and 4%, respectively.
2. In Figure 5b, the percentage shift in the conceptions of students from MK2 to TK reached 85.29%, but there are still 6.67% of students who still use MK2. Meanwhile, in Figure 5c, the percentage of the shift from MK3 to TK is 80% although there are still students who still have MK3 as much as 5.24%.In this figure, it can be seen that 4.44% of MK3 students shifted to MK2 and 2.22% to MK1. This indicates that MK3 students find it more difficult to change their misconceptions.
3. The percentage of MK3 students who did not experience a shift in conception had a greater percentage compared to MK2 and MK1, likewise, for MK2 students who did not experience a shift in conception the percentage was greater than MK1. This fact indicates that changing misconceptions (MK3) is more difficult than MK2. Furthermore, changing misconceptions (MK2) is more difficult than MK1. This is by the opinion of which states that the strongest misconception is MK3, then MK2 and MK1 [10].
4. Based on the results of the descriptive analysis on the three images, further analysis can be given as follows (i) learning using audio-visual learning media on chemical bonding material aimed at reducing student misconceptions has succeeded in forming knowing the concept students, (ii) Learning using audio learning media visual has not been able to reduce students' misconceptions.

Based on the overall results, the shift in students 'conceptions on chemical bonding material proved that audio-visual learning media was effective in being able to shift students' conceptions from having misconceptions (MK1, MK2, and MK3) and not knowing the concept (TTK) to knowing the concept (TK). This is also supported by the results of the analysis of the N-Gain score which is included in the high category and the results of the mapping of students' conceptions before and after learning using audio-visual learning media.

4. Conclusion

Based on the research results that have been described, it can be concluded:

- Audio-visual learning media that integrates character education have validity with a very valid category and deserves to be implemented in the chemistry learning process.
- Audio-visual learning media that integrates character education have practicality that is supported by student activities in the learning process by seeing the characters shown by students during the learning process.
- Audio-visual learning media integrating character education is effective in shifting the conceptions of students from misconception (MK1, MK2, MK3) and not knowing the concept (TTK) to knowing the concept (TK), as evidenced by the increase in the percentage of students and the results of the N-gain analysis which are included in the high category.

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