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Abstract. This research aims to produce song innovations in multimedia that are feasible and effective for teaching stoichiometry. This research is development research through the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) approach. Sample of this study consisted of students of class X MIPA from two different high schools. A combination method (Mixed Methods) of data analysis technique was used in this study. The innovative product has been tested for quality, with a very good level of feasibility in contents aspects, language, presentation, technical quality and learning aspects. Responses of the students of class X MIPA 1 and X MIPA 5 were 88.59% and 89.73%, respectively and both of the responses were in very good categories. The number of students who passed the minimum mastery learning standard (KKM) in class X MIPA 1 and X MIPA 5 was 83% and 86%, respectively. The song innovation in multimedia was found very feasible and effective when applied in stoichiometry learning.

INTRODUCTION

Stoichiometry is a topic in chemistry which involves intensive mathematical operation and often considered difficult by students that can lead to misconceptions[1]. Commonly students experience difficulties in solving chemical reactions and stoichiometry calculations due to poor understanding of the concepts and lack of interest in chemistry. The misconceptions occur in all stoichiometry concepts, especially in the concept of determining the mass of substances through limiting reagents, with a misconception rate of 56% [2], the reaction equation of 40.46%; molar mass 38.36% and mole concept 53.77% [3]. The results of the study are very close to the real situation in schools. Then why do misconceptions occur in all parts of stoichiometric material? Stoichiometry studies and calculates the quantitative relationships of reactants and products in chemical reactions, all of which are complex and interrelated concepts, principles and laws. The material part in stoichiometry includes (1) the basic laws of chemistry (2) chemical reaction equations (3) molar mass (4) mole concept (5) empirical formula (6) molecular formula (7) elemental levels in compounds (8) reaction stoichiometry (limiting reagents) and (9) hydrate compounds.

A misconception is a misunderstanding of concepts due to students' poor cognitive construction which leads to low learning achievement. Misconceptions can be triggered by internal factors and external factors. The internal factors may come from poor reasoning ability, the left-behind stage of development of the students' thinking ability, learning styles and low interest or motivation of learning. Whilst the external factors can may com from the low performance of the teacher, teaching materials, media and teaching methods [4]. The difficulty of teachers in finding the right learning methods and media has become a serious problem that causes the stoichiometric learning process less effective, monotonous, and boring. Previous research has succeeded in finding effective media applied in stoichiometric learning through smart card media and concept maps. A smart card is a card that contains short material and formulas related to stoichiometry material. In teaching the topic of stoichiometry these cards are distributed to

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students to help complete the assignment given by the teacher. Moreover, in studying stoichiometry the students were also equipped with concept maps. The concept map is a diagram showing the relationships between concepts that represent learning. The choice of concept maps is because students are often confused in learning Stoichiometry because they cannot distinguish one concept from the other [5]. Other studies also found effective media in learning stoichiometry through chemical learning animation. This media is an animated film that results from hand drawing processing into a moving image using the Flash application. However, there are some weaknesses in its implementation, namely having to pay attention to time management, maximum student control and must provide explanatory material [6].

The object of the current research is the product of song innovation in multimedia on stoichiometry learning. Song innovation in multimedia aims to provide a stimulus for the students according to the needs of learning styles of the input dimension (visual-verbal balanced) based on Felder Silverman learning style [7]. The balanced visual-verbal aspect is of particular concern to meet the needs of student learning styles based on a needs analysis which has shown that as many as 74% of students dominate this type of learning style. Students of the type of visual learning are only 19%, the type of verbal learning style is 3%, the type of dominant visual learning style is 3% and the dominant verbal learning style is 1%. Needs analysis is done to prepare learning media according to student characteristics. Previous research has not prepared complete media in all parts of stoichiometric material. For this reason, there will be a complete media innovation for nine parts of the material of stoichiometry. The goal is that students can clearly distinguish between concepts that are closely related to one another. Collaboratively in groups, students are given a project to make concept maps and intelligent summaries containing keywords, basic laws of chemistry, formulas, calculation steps and other important things in each part of stoichiometry material. This is an effort to directly involve students as a critical thinking learning experience, discover and develop concepts independently, student-centred. This learning experience will give students the opportunity to find problems, find difficulties, ask questions, be skilled and communicative, learn from mistakes to solve problems. This stage will help students find important things that must be remembered and understood well. It is not teachers who must give smart cards to their students, because this still shows teacher-centred learning. The teacher's role is only as a moderator who collects questions, then provides motivation and media facilities to encourage students to find solutions to solve problems they have not been able to overcome. The teacher not only gives instructions for making concept maps and intelligent summaries but also gives instructions on how to use practical methods to remember formulas and keywords they have written through songs. The song acts as a verbal language that is easily spoken and repeated anytime anywhere easily and practically. Intelligent student summary projects will be selected by the teacher and will be processed into multimedia-based products. Hand-drawn images of students' work and songs that have been made in MP3 format with East Kalimantan Dayak Ethnic pop music are designed through a video scribe application. This application was chosen because it is practical, easy to operate and suitable for presentation in learning. Song and multimedia media prepared by the teacher only act as a stimulus to encourage understanding of concepts that have been built by students at the previous learning stage.

The use of songs in science learning can eliminate the boredom of learning because students are required to sing and involve the senses spontaneously. Someone who is accustomed to using the five senses simultaneously (eyes, ears, pronunciation and mind) will have new hopes, attitudes and habits which are the effects of their cognitive processes [8][9]. The design of Multimedia in this study adopted the cognitive theory of multimedia learning according to Mayer by following the way of human learning (the way the brain works) [10]. Multimedia design refers to two elements of the message channel presented in words (verbal) and picture (visual) to enhance spontaneous understanding and long-term memory [11]. This research was carried out various renewal steps to refine the results of previous studies that have ever existed, to make effective media innovations that can be applied to the nine parts of stoichiometry material. A multimedia-based song is a medium that can directly help students remember all parts of the stoichiometry material practically so that it can be used as a reference for stoichiometry learning to complement the media that was previously found. Its role as a media begins with the critical thinking process of students and teachers helping to realize it as a medium that can be used visually verbally balanced. This is a form of application of the teacher's exemplary values to students to build will and creativity. Involving students in preparing the media so that it has more positive benefits on students' cognitive abilities, skills and characters so that they are very relevant to 21st-century learning. This media can be implemented in various learning models and can also be combined with other assisted media so that learning becomes more effective. Integrating elements of art and technology in science learning becomes an interesting finding to change students' opinions about difficult and frightening chemistry. A touch of local cultural wisdom provides added value in stoichiometry learning in unique and different ways to increase learning enthusiasm, students explore, interact, try and repeat subject matter in a happy atmosphere (edutainment) [8].

METHODS

Research subjects came from two different schools namely X MIPA 1 SMAN (Public senior high school) 6 Samarinda and X MIPA 5 SMAN 1 Samarinda. Product innovation has been carried out through the ADDIE approach developed by Robert Maribe Branch [12] with the following steps: Analysis (1) analysing the student learning styles on the input dimension (visual-verbal); Design (1) make lyrics and song notation with Sibelius software (2) making music compositions and recordings, made in MP3 format (3) designing visual appearance of handmade images (4) create multimedia designs with video scribe applications; Development (1) validating the design of the product (2) revision; Implementation (1) limited trials (2) revisions (3) applying the products in research classes; Evaluation (1) evaluating the implementation of learning in the classroom (2) measure the product effectiveness based on response and learning outcomes of students. The data analysis technique used in this study was a combination of methods (Mixed Methods). Quantitative and qualitative data collection was done together at the same time [13].

Instrument

The instruments used in this study were questionnaires, observation sheets, and evaluation sheets. Measurements were made on (1) validity, to measure the quality and feasibility of the media, (2) effectiveness of the products in learning based on positive responses and student learning outcomes, (3) the implementation of learning in the classroom by observers.

The instrument has been developed based on various aspects by paying attention to the content, language, presentation, quality of the technique and the influence of the media on the learning process according to the standard of teaching material development set by the National Education Standards Board (BSNP) [14]

Likert scale was employed to measure people's perceptions and opinions of the innovative products. The measurement of the quality of media used the criteria quality (%) set by Depdikbud. The criteria scale was: very good (90-100%), good (80-90%), enough (65-80%), weak (55-65%), and very weak (0-55%) [16].

Stoichiometry is the subject matter that has just been studied by students in class X of high school. Thus the product effectiveness parameters were measured based on the positive response of students in the implementation of the products in learning [17] supported by student learning outcomes graduating reaching minimum mastery learning (KKM) must reach a minimum level of 75% of the total number of students [18].

RESULTS AND DISCUSSION

Song Innovation

The song is made for nine parts of stoichiometry material in accordance with the intelligent summary made by students. Song verse contains about: (1) the contents of the basic laws of chemistry (2) fast steps to equalize chemical reactions (3) molar mass concepts and formulas (4) mole concept formulas (5) steps to determine empirical formulas (6) steps to determine molecular formulas (7)) elemental formula in compound (8) calculation steps of limiting reagents and (9) concepts and steps of determining hydrate compounds. This song was created spontaneously with original, self-made tones. Because the song is a work of art, then to fulfil the truth and originality of the work, poetry is written in song notation using the Sibelius software, the results are printed in block notation and also made in MIDI audio format so that it is easy to test. In learning, the teacher builds student creativity by playing music and singing together live. However, to provide broad benefits, the song was made with the composition of pop music of ethnic Dayak Bahau in East Kalimantan, combining Sape (a typical Dayak musical instrument played by picking) with Yamaha keyboard type PSR-S950, guitar, cajoon, calti, bass, drum set and violin are varied on nine songs. Music is made with the Allegretto 110 tempo (rather fast) with the aim of increasing student enthusiasm for learning. Music and songs have been mixed and made in MP3 format.

Song Innovation in Multimedia

The design of multimedia in this study uses a video scribe application, which is an application that displays a video of moving images. This application helps the students' original visual combination of hand-made images containing intelligent summaries be interesting shows. MP3 music and song formats are arranged so that the song lyrics are

appropriate and follow the moving picture shows. When students sing while watching a video, students will spontaneously understand the flow of the material. Multimedia-based songs on nine stoichiometry materials are designed as effective messages to encourage student understanding.

The five stages in designing and composing multimedia messages by combining verbal and visual aspects include: (1) choosing relevant words to explain each part of the contents of the stoichiometric material in the form of an intelligent summary (2) choosing an appropriate picture to explain each part of the contents stoichiometric ingredients. Intelligent summaries are drawn and coloured with various themes (3) arrange verbal words into song lyrics (4) arrange the sequence of visual images according to the concept to be conveyed (5) combine and arrange verbal and visual presentations so that the song matches the display image is supported too with ethnic music nuances audio.

Analysis of Media Quality

Table 1 below shows that the nine songs in the multimedia design fulfilled various aspects of content, language, presentation, technical quality and aspects of learning with a very good level of eligibility. Have the correct concept of chemistry so that it can be used in stoichiometric learning. Validation was carried out by three content experts, two multimedia experts and two practitioners. The revision phase has also been carried out so that the product is perfectly based on expert advice. Furthermore, to assess works from the aspect of art, validation is also performed on music and songs by music and song experts.

TABLE 1. The results of song and multimedia validation by content experts, multimedia experts and practitioners

aspects	content validator	multimedia validator	practitioners	average score (%)	category
Quality of content	98	92	85	92	very good
Language quality	92	88	86	89	good
Quality of presentation	94	90	99	94	very good
Technical quality	96	96	100	97	very good
Learning aspects	100	100	88	96	very good

Table 2 shows that nine songs made with East Kalimantan Dayak ethnic music arrangements have very good quality. The results of the validation assessment of song and music experts show that the song has the accuracy of the notation, the suitability of the tone, the composition of the music that is interesting, easy to hear and remember, contains motivation, has the right rhythm and tempo, it is interesting to sing, the lyrics in the song notation are easy to read and original.

TABLE 2. Results of music and song validation by music and song experts

aspects	expert validator	category
Accuracy of song notation	100	very good
Tone match	92	very good
Music arrangement	93	very good
Music and song suitability	94	very good
Contain motivation	95	very good
Rhythm and tempo suitability	94	very good
Interest in music and songs	95	very good
The lyrics in the song notation	91	very good
Music and song originality	96	very good

Effectiveness of Media

The effectiveness of the media is summarized in Table 3 below.

TABLE 3. Product effectiveness in learning

Class	student responses to the product (%)			Qualitative result	learning outcomes (passed the passing grade)	classroom observation
	song	multimedia	learning style			
X MIPA1	89,16	88,00	88,93	100% positive	83%	90
X MIPA 5	90,06	89,86	90,71	100% positive	86%	91

Table 3 shows that songs in multimedia are very effective to be applied in stoichiometric learning. This can be seen through positive student responses to the application of songs verbally and visually through multimedia after each of them reaches the measurement aspect. The response to the needs of students' learning styles is very good, meaning that the media really helps students visually-verbally to understand stoichiometric calculation material that has been considered difficult. All students give positive comments openly. Through songs in multimedia learning stoichiometry becomes very practical and fun. As many as 83% of students of class X MIPA 1 of SMAN 6 Samarinda have exceeded the standard grade (KKM), while students of class X MIPA 5 of SMAN 1 Samarinda is 86%. This means that students who have graduated from KKM have achieved very good numbers because they exceed 75% of the number of students. The effectiveness of stoichiometry learning in class X MIPA 1 and X MIPA 5 through songs in multimedia is monitored by observers with very good ratings, active students and the media are very effective in helping the achievement of learning goals.

It is very difficult to find the right media to assist students in understanding all parts of the stoichiometry chapter. Has never been found in previous studies the use of song media in stoichiometric learning. This has been confirmed because stoichiometry is calculated so it is not possible to apply to learn through songs. In fact, nine songs designed in multimedia as a stimulus given after students find concepts in accordance with the learning stages of the 2013 curriculum have created very meaningful learning. Students are trained to have good reading skills through the process of reading, analyzing, making concept maps in the form of handmade visual images and then presenting them in songs that contain formulas and keywords that must be remembered. This turned out to be very effective in helping students learn stoichiometry more easily.

The use of songs proved to be very practical in studying stoichiometry. Teachers no longer need to give much explanation, learning time is faster and efficient, through songs students can distinguish concepts from one another as clearly and easily, the state of students in the classroom is conducive and well-controlled. Students can sing anytime and anywhere easily. This is certainly a refinement of some of the results of previous research in making stoichiometric learning media. Singing (1) provides positive stimulation and increases students' spontaneous understanding so they can quickly remember all the keywords and formulas, construct concepts and apply them in calculations correctly and thoroughly. (2) Learning in class is more fun. (3) Students are more interested and enthusiastic about studying stoichiometry, reaction equations, calculating mole concepts, limiting reagents, hydrate compounds and others. (4) Cooperation between students is better. (5) No more formula strokes are found on tables and walls and eliminate fraudulent habits. (6) Students are more independent and want to answer questions. (7) Playing music with friends while studying in class makes the chemistry learning atmosphere very unique and different. (8) Increase learning motivation. (9) Relieve stress (10) Provide an unforgettable learning experience.

Multimedia through moving picture performances accompanied by songs turns out to be very practical and effective because it involves all the senses (eyes, ears, pronunciation and mind). This is very appropriate to prove the various theories that exist so as to provide a very positive impact on the ability of knowledge, skills and character of students in the learning process in class. This media is easy to play anytime, anywhere. This makes it easy for students to understand the material seen and read while singing. This learning experience greatly affects long-term memory and facilitates the recall of information. A whole series of student learning activities, seeing, reading, listening, singing, writing, analyzing, linking concepts, and counting are effective in helping students solve problems. Unconsciously, students happily work on problems quickly while singing stoichiometry songs. Songs in multimedia stimulate students to continue to do and try to solve the problem of stoichiometric calculations to measure their understanding. Student responses to songs in multimedia have proven to be more practical and effective ways to learn stoichiometry. The learning phase takes place very well through this multimedia-based song. The use of this media is very helpful for students in mastering concepts in its entirety so that it is very suitable to be integrated with various models and innovative learning strategies. Besides multimedia-based songs can also be combined with a variety of other assisted media. Thus, media like this can be recommended to be applied to other chemical materials to achieve better learning outcomes.

CONCLUSIONS

Song innovation in multimedia has been done with excellent product quality so it is very feasible, practical and very effective in learning stoichiometry which is measured in grade X MIPA at two different schools. This shows that the measurement of the effectiveness of multimedia-based songs has a very good level of trust as evidenced by the achievement of excellent responses and student learning outcomes at the two schools. The achievement of student learning outcomes is also accompanied by a very positive accompaniment effect on numeracy skills, problem solving and the quality of student character through good attitudes and habits.

SUGGESTION

1. This research has succeeded in making media in nine parts of the complete stoichiometry material through multimedia-based songs that have never existed in the previous research results.
2. Integrating aspects of art to elevate the wisdom of local culture and technology in science learning becomes a new invention that has never been seen before.
3. This media is suitable to be combined with various models and other innovative learning media.
4. This innovation is new research so it requires enormous inspiration and is not easy to make it happen. It takes motivation and high artistic value so that it can produce good work.
5. This media will be more highly valued if combined with multimedia tutorial example problems that can explain how examples of applying songs in solving stoichiometry problems. This will certainly be more cool and interesting if it can be realized in the future so that the method of learning while singing can be applied by students everywhere at large.
6. The student's handmade drawing collection contains an intelligent summary of the nine parts of stoichiometric material which will certainly be of high value if it is poured into a book accompanied by song notation in each part of the material and is equipped with exercises. A brilliant idea that will bring many benefits if it can be realized in the future.

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