Development Of Integrated Elements Chemical Domino Card Game With Ethnochemistry Madura Jamu Ingredients

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Abstract

This study aims to develop an elemental chemistry domino card game integrated with the ethnochemistry of Madurese herbal ingredients. The concept raised is an educational game that connects domino card games, elemental chemistry, and natural ingredients of Madurese herbal medicine. The development of this media uses the ADDIE development model. The ADDIE model consists of Analyze, Design, Development, Implementation, and Evaluation stages. The development of this media was carried out with two trials, namely in the form of validation questionnaires and student response questionnaires. The validation test consists of media validation (appearance and program) and material (content and presentation). The response questionnaire consists of indicators of convenience, interest, and usefulness. Media trials were conducted on 30 students of class XII IPA 2 SMAN 3 Pamekasan. The results of this study were the development of an elemental chemical domino card game that was integrated with ethnochemistry on Madurese herbal ingredients with an average percentage of very valid material category validation results (97.19) and very valid media category validation (92.70). The results of the response questionnaire to the elemental chemical domino card trial with indicators of ease, interest, and usefulness of the media obtained an average percentage in the very good category (75). Elemental chemical domino card media integrated with ethnochemistry of Madurese herbal ingredients is very valid for use in learning.

Keywords: Domino, Elements, Herbalism

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INTRODUCTION

Learning media in chemistry subjects is very necessary so that students can better understand very complex chemical materials (Defingatun et al., 2020). Media can also be used as a means for students to get scientific processes in learning chemistry. Learning at school rarely does a teacher provide a real example for students to understand scientific processes, especially in chemical material (Sarika & Tesmanto, n.d.). Students become ignorant about laws, concepts, theories and facts about chemistry in full. Therefore, real examples in chemistry learning are needed so that students can understand correctly through a medium.

Achievement of optimal learning outcomes, when supported by teaching materials in the form of learning media. The media used in learning must be interesting and in accordance with the characteristics of students. The characteristics of students tend to like humor and jokes that lead to play, so that media in the form of games is suitable for students (Fitriani et al., 2021). The use of game media can make learning activities active, not boring, increase understanding of the material, and foster interest in learning. One of the learning media that can be used in the form of a game is a domino card game (Fadhilah, D., Hartini, T. N. S., Gunawan, I. M. A., & Triani, 2018).

The development of media by combining game elements is one of the innovative solutions to improve chemistry learning in the classroom. Media improvement in this case is devoted to the formal school education level in order to create active, creative, interactive, effective and fun learning (Fitriani et al., 2021). Moreover, at this level of education, students usually still like to play, are still learning to understand and think about operating logical rules and concrete concepts (Wahyudiati & Fitriani, 2021).

Someone has the ability to understand something, (concrete operational) has understood logical operations with the help of concrete objects. This ability is manifested in understanding the concept of eternity, the ability to classify and harmonize, being able to view an object from different perspectives objectively (Setiawan et al., 2019). Humans at this stage are mature enough to use logical thinking, but only physical objects that currently exist (hence the concrete operational stage).

Based on the illustration above, efforts are needed to improve monotonous learning and increase students' active attitudes by using better media and methods. One alternative is to use domino card game media which will later use the concept of elemental chemistry. In addition, domino card games will be developed with a barcode connected to a web page that can support conventional games with technological advances (Yulianti & Ekohariadi, 2020). The barcode will help in accessing web pages that contain the contents of chemical elements and how to play dominoes. The use of this barcode will be easily accessed using students' cellphones.

The domino cards that are developed will adapt like domino card games in general. However, the domino cards used contain various elements based on class and period. In general, in domino card games, each card will be combined in the same number position. Meanwhile, this time the concept of domino cards will be equated based on the same class, especially the main class (A). Students will learn groups and periods for each element on a domino card.

Chemical materials will integrate with the concept of ethnochemistry, especially in Madurese herbal ingredients. Students will be able to better understand the material if it is related to the contextual concepts that exist in the life around them. Linking a concept of elemental chemistry to traditional herbal medicine will provide more insight to students, especially the concept of culture with a science (Pramasari & Wijaya, 2021). This media can accommodate students in learning a chemical concept with traditional Madurese herbal medicine culture.

Ethnochemistry is the study of chemistry from a cultural point of view. How chemistry has shaped a culture and how culture has contributed to science and its changes. Information about this ethnochemistry can be obtained, one of which is from exploring the use of plants (flora), either as food or medicine (Sutrisno et al., 2020).

Ethnochemical studies combine the understanding passed down in society (opinion) with scientific knowledge (scientific facts) regarding the effectiveness of these plants which are considered to act as drugs or food additives based on the chemical compounds contained in the plants and the role of these chemical compounds (Maedja & Ningsih, 2021).

In elemental chemistry there are sub-materials related to the use of each element. Each of these elements will be connected with things that have the value of Madurese local wisdom, especially Madurese herbal ingredients. As an example of the elements C, O and H in the medicinal plant material of turmeric which is commonly known in organic herbal medicine. There are still many things that need to be explored in Madura herbal medicine (Husain et al., 2020). This is evidence if there is a relationship between elemental chemical materials that integrate with Madurese herbal ingredients.

Students will be more familiar with the chemicals in Madurese herbal medicine, so that they can preserve the culture of Madurese herbal medicine (Gita & Danuji, 2021). In order to more optimally introduce Madurese herbal ingredients to students, a media is needed that can accommodate learning media about Madurese herbal medicine (Roosinda, 2021). Based on the description above, it is necessary to develop an elemental chemical domino card game media that is integrated with the ethnochemistry of Madurese herbal ingredients.

METHOD

This research is in the form of developing a web-based elemental chemical domino card game that is integrated with the ethnochemistry of Madurese herbal ingredients. This research is a development research with the ADDIE development model (Branch, 2009), where the stages in the development of instructional media go through several stages, namely:

1. Analyze, analyze the condition and specifications of the media needed to be developed.
2. Design, carry out media design in accordance with the analysis of the previous stages.
3. Development, namely compiling web-based elemental chemical domino cards that are integrated with the ethnochemistry of Madurese herbal ingredients and appearance based on predetermined designs.
4. Implementation, is the activity of implementing learning media that has been developed in the scope of development, namely the scope of media validation on material and media expert validators. Then it was tested on 30 class XII students of SMAN 3 Pamekasan as media users.
5. Evaluation, which includes explaining the results of evaluations from expert validators and the results of trials on class XII students of SMAN 3 Pamekasan, in the form of quantitative response questionnaire data and qualitative through observation. The following is a table of validation result categories and student response questionnaires:

Table 1. Criteria for Validation Test Results

Percentage (%)	Criteria
$75 < V \leq 100$	Very valid without revision
$50 < V \leq 75$	Valid with minor revisions
$25 < V \leq 50$	Invalid major revision
$0 \leq V \leq 25$	Not valid for use

Table 2. Student Response Questionnaire Criteria

Percentage (%)	Criteria
$75 < P \leq 100$	Very Good
$50 < P \leq 75$	Good
$25 < P \leq 50$	Not Good
$0 \leq P \leq 25$	Very Not Good

RESULTS AND DISCUSSION

In this study there were two data, namely the results of media validation, material validation, and student response anget, as follows:

Table 3. Media Aspect Validation Results

No	Assessment Aspects	Validity	Category
1	Appearance	97,51	Very Valid
2	Program	96,87	Very Valid
Average		97,19	Very Valid

Table 4. Material Aspect Validation Results

No	Assessment Aspects	Validity	Category
1	Content	93,50	Very Valid
2	Presentation	91,90	Very Valid
Rata-rata		92,70	Very Valid

The development of this media is carried out using the ADDIE development model. There are five stages in the model, which are carried out to develop elemental chemical domino card game media. The advantage of the ADDIE development model is that there is an evaluation at each stage so that it can minimize the level of errors or product deficiencies in the final stages of this model.

Analyze (Analysis) is the first stage performed. This process analyzes the state and specifications of the media required. In this section, what is explored is chemical elements adapted to the concept of domino card game media. In general, domino cards are games based on numbers equal to the number zero to six. So you have to modify the game based on the main groups in elemental chemistry. This media only uses the main elements (group A) in elemental chemical domino cards.

Domino cards developed with the concept of elemental chemical material that integrates the concept of Madurese herbal medicine. Chemical elements must be found in every part in the concept of Madurese herbal medicine. Especially in terms of herbal ingredients which certainly contain a lot of chemical compounds.

Design is the second stage of the media development process. This process is carried out by designing media according to the previous stage of analysis. Next, design an elemental chemical domino card whose concept is almost the same as domino cards in general. This media has a design and color that is almost like domino cards in general which are yellow with red lines.

In this media, a barcode is added to the back of each card to provide access to additional information on each element on the card, especially in the concept of Madurese herbal ingredients. The barcode contains a link that contains a web about each group A element which is generally found in natural ingredients of Madura herbal medicine. Technology is very helpful in maximizing the process of developing learning media.

Development is the third stage in this development process. The process of compiling and making web-based elemental chemical domino cards that integrates with the ethnochemistry of Madurese herbal ingredients and appearance based on a predetermined design. The number of cards is 28 according to domino cards in general. The elements used are elements IA to VII A, to match the domino cards which have the numbers zero to six.

Each card will have a pair of elements that correspond to the position of elements IA to VIIA and the back contains a barcode about the Madura herbal medicine web. This concept will make it easier for students to memorize elemental chemistry if students always play this card.

The fourth stage is Implementation (Implementation), which is the activity of applying learning media that has been developed in the scope of development, namely the scope of expert validators (media and material) and trials of class XII high school students as users of elemental chemical domino card learning media. The results of the implementation of the scope of development will be used as the basis for the implementation of the evaluation phase.

The validation results from media experts stated that the elemental chemical domino card media obtained a value in the very valid category (97.19) based on Table 3. The aspects that were assessed were the appearance and program of the media being developed. The results of the validation from the material experts stated that the elemental chemical domino card media obtained an average value in a very valid category (97.19) based on Table 4. The aspects that were assessed were the content and presentation in the developed media.

The results of the validation show that the elemental chemical domino card media that has been developed has been declared valid. Furthermore, the media was tested on a limited basis to students. So that it will be seen how the process of using media directly in the field.

Evaluation is the fifth stage in the development of this media. The process of recapitulating the results of student response questionnaires that have used elemental chemical domino card media. In the questionnaire there are 3 indicators, namely ease of use, interest, and the usefulness of the media that has been developed. This data is in the form of the average percentage of each indicator. Media evaluation is needed to find out the results of media trials that have been developed.

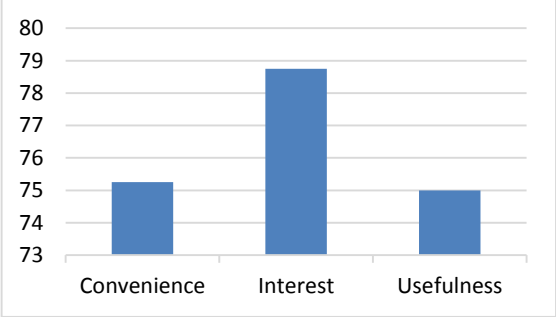
The results of the evaluation of the development of this media are related to the printed results of elemental chemical domino cards. The printing process already uses a printing process, so that the color and accuracy of the position are maintained. There was no pack for the cards, so it was difficult to explain at the beginning regarding the elemental chemical domino card game being developed.

Educational games are very effective for learning games while playing and vice versa. Learning by using games will be more memorable than memorizing because students will try to solve problems or questions by thinking for themselves (Widoretno et al., 2021). There are many types of educational games, one example is an educational game using the concept of domino cards.

Domino card games as learning media that package chemistry education in an entertaining medium are effective in increasing students' interest in the chemistry learning process so that they can improve student learning outcomes in elemental chemistry material (Sukerti & Pudjawan, 2020). These results are supported by research which states that domino card games can train students' thinking skills and have a positive effect on chemistry learning outcomes.

Table 5. Student Response Questionnaire Results

No	Indicator	Percentage	Category
1	Convenience	75,25	Very Good
2	Interest	78,75	Very Good
3	Usefulness	75	Very Good
Average		75	Very Good



Picture 1. Percentage of Student Response Questionnaire

The stages of conducting trials of integrated elemental chemical domino card media with ethnochemistry of Madurese herbal ingredients to students of class XII IPA 2 SMAN 3 Pamekasan. This study uses class XII because at that level students have already received complex chemical knowledge, especially in the concept of elemental chemistry.

The trial was carried out by means of students playing using elemental chemical domino cards that integrate with the ethnochemistry of Madurese herbal ingredients. Each class is divided into 5 groups containing 4 students. Each group is conditioned so that there

are children who understand how to play domino cards. This is to make it easier for the group to play the game. Because the way to play elemental chemical dominoes is almost the same as domino card games in general. Domino cards are generally played by 3-4 children.

Based on Table 5, it can be seen that the results of the average percentage of student response questionnaires after using the chemical element domino card media obtained a very good category. Shows the results of the average percentage on the indicators of convenience, interest, and usefulness of the media, all of which are in the very good category.

The lowest percentage is found in the usefulness indicator. In this indicator there are statement items regarding the use of barcodes in elemental chemical domino card games. When testing in the field students find it difficult to determine the appropriate group for each element on the card. To make it easier for students, each group is given a table of the Periodic System of the Elements, making it easier for them to determine the group on each card.

In the first round the students still felt confused because many did not memorize the elemental groups. In addition, some students are still confused between groups and periods. After doing several rounds of the game, students begin to understand how to match the class to each element on the card they have.

The indicator with the highest percentage lies in the interest indicator. This shows that students are very interested in the games used during the learning process. Domino cards are a card game where the majority of people know how to play (Sumarni et al., 2021). This makes it easier to explain how to play the cards that have been developed.

Elemental chemistry is very broad and a lot of material, so the majority of the material is in rote form (Suarsani, 2019). The existence of media that is interesting to students will help students understand and memorize elemental chemistry material (Putera et al., 2022). In addition, this elemental chemical domino card is integrated with the values of Madurese local wisdom, especially in the concept of natural ingredients of Madurese herbal medicine.

Ethnochemistry is a variety of cultural practices that exist in society and have a chemical relationship that describes the chemical practices of cultural groups that can be identified as the study of chemical ideas that can be found in any culture. In other words, ethno refers to members of a community group in any cultural environment that can be identified through certain cultural traditions, codes, symbols, myths, and ways used to consider and conclude.

Card games that are related to everyday life will be easier for students to remember (Rahman & Amalia, 2019). This game emphasizes natural ingredients in herbal medicine, which is often found in Madurese culture. When playing elemental chemical domino cards, students will get information regarding the elements found in natural ingredients of Madura herbal medicine (Agustina & Fitrianti, 2020).

For the Madurese people, Jamu is a recipe passed down from generation to generation so that it can be maintained and developed (Astutik, 2018). In addition, Jamu ingredients are easily obtained in Madura which is famous for its natural wealth, fertile soil with a wide expanse of various plants (Sholihah & Dwiyanti, 2020). Fertile land with a wealth of plants greatly influences the life of the Madurese people because they depend on nature in their efforts to meet various needs (Syahfitr & Asra, 2021).

The difference between Madurese and Javanese herbal medicine lies in the aroma. The aroma of Madura herbal medicine is sharper, especially herbal medicine in powder form (Satriyati et al., 2020). This is because in the manufacturing process the ingredients use sharp-smelling ingredients such as majakan, masoyi, cloves, and cinnamon (Alang hasria, Hastuti, 2021). The form of a sharp-smelling powder is a characteristic of Madura herbal medicine which is preferred and considered to have superior properties compared to other forms of herbal medicine (Septiani & Listiyani, 2021).

Students will better understand the connection and application of elemental chemistry material with their daily lives (Nurwidodo et al., 2021). Many things around us are related to elemental chemistry material, so it will help students understand the material if the teacher connects chemistry learning material with

what is around them (Deery & Kennedy, 2021) (Suarsani, 2019). The direct use of a learning material for students will strengthen students' curiosity in the material.

CONCLUSION

The conclusions of this study are:

1. Successfully developed an unsyr chemical domino card game integrated with ethnochemistry on Madurese herbal ingredients with an average percentage of very valid category material validation results (97.19) and very valid media category validation (92.70).
2. The results of the response questionnaire to the elemental chemical domino card trial with indicators of ease, interest, and media usefulness obtained an average percentage in the very good category (75).

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