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Development of Domia Card (Domino Chemistry) as Evaluation Media of Mol Concept

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Abstract
The level of achievement of students at State Senior High School (SMAN) 1 Putussibau in the material of the mole concept only reached 20%, and this figure cannot even depict the true potential of students in understanding the mole concept due to indications of cheating in every monotonous evaluation. Domia (Chemical Domino) was developed to address the problem of a lack of variation in evaluations while also reducing the incidence of student cheating in the evaluation process. Domia was developed with the R&D principle using the ADDIE model, and each process will be revised according to needs and field findings. The development of Domia took place after the needs analysis process through direct interviews with subject teachers and several randomly selected students. The developed Domia was then validated to test the level of feasibility and reliability based on Guilford indicators as a reference in assessment. Domia has Kr = 0.97 and Ks = 0.947, indicating that Domia is highly valid and very reliable, making it ready for implementation and serving as a new evaluation tool that has not existed in the chemistry subject before.

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INTRODUCTION

Every learning activity requires evaluation as a measure of the success and suitability of the implementation of the learning process. Evaluation essentially serves two main functions: assessing the extent of students' success in understanding the material concepts and evaluating the teacher's success in developing strategies, methods, and classroom management in the learning process (D. D. Putri, 2018). Evaluation is a systematic assessment to measure and judge an object, requiring assessment data that includes various aspects such as ability, attitude, creativity, interest, skill, and others (Mochtar Kusuma, 2016).

Evaluation is needed to measure the extent of students' development and achievements, both individually and in group activities. Through the use of media, evaluation and assessment can be more controlled, and the continuity of the evaluation process can be more easily facilitated (Febriana, 2019). In the evaluation process, judgments are given as an effort to determine the value of an object to be measured, which can indirectly be subjective (I. W. Putri & Ermawaty, 2020). However, the evaluation systems and media used so far have been too monotonous and have not been able to provide accurate measurements. Therefore, a new evaluation tool is needed to support the assessment process and achieve the desired goals.

To assess the extent of students' understanding of the stoichiometry material, especially the mole concept, an evaluation is needed. The level of understanding and mastery of the mole

concept material by students must be carefully considered because the mole concept is the basis and foundation for future chemical stoichiometry calculations. However, observations at SMAN 1 Putussibau through interviews and questionnaires revealed that the evaluations given so far have only been assignments to solve exercise problems in printed books, student worksheets (LKS), and daily test questions, most of which can be found in printed books or on the internet. From these evaluations, it was found that 80% of students received low scores and did not meet the minimum completeness criteria (KKM), with indications of cheating seen in the similarity of correct and incorrect answer patterns among students. This indicates that the evaluations conducted have not been able to truly depict the potential of the students.

Conventional evaluation processes may often create tension and discomfort, preventing students from demonstrating their optimal abilities (Sasongko & Suswanto, 2017). Results obtained from evaluations may not be pure because students who do not understand concepts tend to ask, cheat, or copy answers from friends, making the evaluation process ineffective (Candra Rolisca & Achadiyah, 2014).

Students' mood, the learning environment, and the atmosphere play a role in supporting students to unleash their optimal potential (Monica & Qurrotaini, 2019; D. D. Putri, 2018). On the other hand, besides understanding concepts, students are also required to actively and creatively seek knowledge from various sources. Therefore, teachers, as facilitators of student learning, must be able to provide an environment that supports both the learning and evaluation processes, avoiding monotony, and enabling students to be more active and creative. The need for a variety of evaluation media encourages the development of Domia (Chemical Domino) cards as an evaluation tool for the mole concept material.

Monotonous evaluation processes sometimes create pressure and a unique sensation for students. Evaluations often conducted in schools, such as tests and daily quizzes, often lead to tension and cheating, resulting in inaccurate results. Additionally, easier access to internet allows students to easily find answers to every question in books and repetitive test questions, further contributing to the low understanding of the concept. Therefore, an evaluation media is needed as a measuring tool that can assess students' abilities as individual and their roles in a group with minimal risk of cheating.

The evaluation media should create a pleasant atmosphere without neglecting the essence of the evaluation itself. Hence, the development of Domia (chemical domino) is necessary as a game-based evaluation media that can measure not only the extent of students' understanding but also build teamwork, creativity, critical thinking, and leadership skills. By using Domia, it is expected to increase students' knowledge of the basic concepts of the mole concept through concise and clear presentation on the cards, ultimately improving students' completion rates in this sub-chapter. The use of Domia cards is also expected to address issues related to students' tendencies to cheat in various ways, such as through the internet, as the game system used in Domia is time-limited and full of concepts, making it difficult to be copied directly from the internet

The development of game-based evaluation media has been previously conducted by several researchers and has yielded excellent results. These media include snake ladder games (Elly Dwiyana Hendrawati, 2018; D. D. Putri, 2018), box number star games (Puspitasari, 2017), domino cards (Mumpuni & Supriyanto, 2020; Vina Aprianingsih, 2013), and many more. However, there has not been a development of domino cards specifically for chemistry lessons due to the abstract and complex nature of chemistry concepts. Therefore, with the development of Domia, teachers can create a enjoyable evaluation atmosphere, and students can experience a learning process that is not monotonous and more varied. The evaluation process unfolds like a group game but does not diminish the essence of the assessment itself. This development also

aims to add variety to evaluation media and address the issue of students memorizing and cheating in assessments.

METHOD

The basic principles used in this study adhere to the principles of research and development (R&D) using the ADDIE model. Where in the process there are five main stages in the form of Analyze which is the stage of analyzing the needs in the field, analyzing tasks and identifying problems.

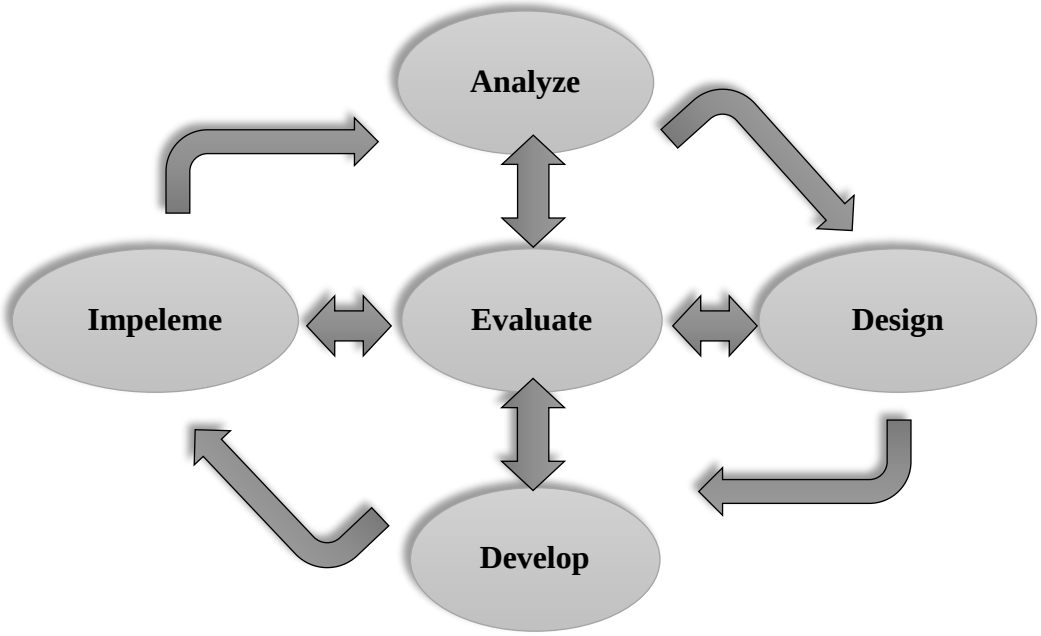

Figure 1. Instructional development design by the ADDIE model

The second stage is design which is a design stage, both designing objectives, tests, tests and formulating development plans. The third stage is develop which is the actual development stage, where at this stage the design or manufacture of the media to be developed is adjusted to the objectives and design in the previous stage. The media that has been developed will then enter the implementation stage which is the stage of application, use and utilization of the media that has been developed. After the developed media is applied, the media is then evaluated to assess the extent of the effectiveness of the media in the field, this assessment is the final stage of the ADDIE model, namely the evaluation stage.

The analysis stage is carried out with initial observations in the form of interviews and questioners to class X students and chemistry teachers at SMA Negeri 1 Putussibau. The results of these observations then became the basis for formulating problems, identifying needs and formulating the media design that would be chosen.

The results of the feasibility test that have been collected will then be calculated to determine the value of the reproducibility coefficient (Kr) to determine the degree of media feasibility and the scalability coefficient (Ks) to calculate the value of the reliability of the media developed. Data collection on the results of its own feasibility will be carried out using a guttman scale which only has two assessment categories, namely feasible where each answer will be worth 1 (one) and not feasible where each choice will be worth 0 (zero). This 0 is then used as an error value in the calculation.

In developing Domia media, each ADDIE stage carried out will pass the evaluation stage, so that each stage of development will be revised according to its stages and get a product that is suitable for use.

Table 1. Guilford Validity Test Index (Guilford; 1956) in (Kiswanto, 2013)

Validity Level	Criteria
0,81 < rxy ≤ 1,00	Very High (Very good)
0,61 < rxy ≤ 0,80	High(Good)
0,41 < rxy ≤ 0,6	Medium (Good enough)
0,21 < rxy ≤ 0,40	Low (bad)
0,00 < rxy ≤ 0,20	Very Low (Very Poor)
rxy 0,00	Invalid

Table 2. Guilford Reliability Test Index. (Guilford; 1956) in (Kiswanto, 2013)

Validity Level	Criteria
0,81 - 1,00	Very Reliable
0,61 - 0,80	Reliable
0,41 - 0,60	Moderately Reliable
0,21 - 0,40	Rather Reliable
0,00 - 0,200	Less Reliable

RESULTS AND DISCUSSION

The results of interviews with teachers and students at SMA Negeri 1 putussibau obtained a finding that the evaluation system carried out is still a traditional evaluation in the form of written tests, both assignments, daily tests, semester tests and enrichment. From the results of these observations, the needs analysis refers to the choice of developing evaluation media. Domia that has been designed, both in terms of products and materials, is then tested by three material experts who are lecturers who are experts in their fields as well as subject teachers who will later use this media as evaluation media. Three linguists, namely Indonesian language lecturers, and also high school subject teachers, three graphic experts who also come from lecturers who understand the techniques and principles of graphics and media development itself.

At the development stage, the Domia product underwent several revisions in terms of graphics, because it was considered inconsistent in terms of the font size used in the media, from three validators 2 of them wanted changes and consistency in that aspect. The Domia card was finally made using Times New Roman 18 font. In terms of material and language feasibility, all indicators were met with decent answers (1) from all validators so that no further revisions were needed. The results of the feasibility test are then recapitulated and calculated for all indicators, which will then calculate the index or reproducibility coefficient (Kr) and scalability coefficient (Ks) to assess the extent of the feasibility of this media.

Tabel 3. Feasibility Test Recapitulation

Aspect	Indicator	Score
Suitability of material	Conformity with syllabus	3
	Compliance with learning objectives	3
	Clarity of material	3
	Correctness of the material	3
Content	Explanation of the concept of mole	3
	Explanation of the relationship between moles and mass	3
		3

	Explanation of the relationship between moles and number of particles	3
	Explanation of the relationship between moles and volume (STP)	3
	Explanation of the relationship between moles and molarity	
Question	Questions in accordance with the material	3
	Questions are appropriate for the learners' education level	3
Game Cards and Problem Cards	The writing can be read clearly	6
	The terms used are easy to understand	6
Material	The writing can be read clearly	3
	The terms used are easy to understand	3
	Systematic material	3
Rule of game	The writing can be read clearly	3
	The terms used are easy to understand	3
	Systematic game instructions	3
Design	Writing Size	1
	Type of Writing	1
	Writing Color	3
	Layout	3
	Systematics	3
	Space	1
	Motif/background design	3
	Media Size	3
Use of Evaluation Media	Used in groups	3
	Easy to carry and store	3
	Fit for purpose evaluation	3
	According to student characteristics	3
	Consistency of font shape and size	3
Usability	Clarify the delivery of material	3
	Facilitate learning activities	3
	Improves focus of attention	3
	Can be used as a learning resource	3
	Improving knowledge	3
	Can be used as an independent learning resource	3
	N = 3 x 40 = 120 Kr = 0,97 e = 3 Ks = 0,5	

The reproducibility coefficient was calculated using the formula as below.

Kr = 1 – e/n
= 1 – 3/120
= 1- 0,025
= 0,97

With n = number of validators x number of question indicators and e = error value, in this case the answer is not feasible (Guilford; 1956) in (Kiswanto, 2013). Based on Guilford's validity index, the value of Kr = 0.97 has very good criteria (very feasible).

The Scalability Coefficient is used to measure the level of reliability of the developed media, with the following calculation formula.

Ks = 1- e/x
= 1- 3/ 0,5 x (120-6)
= 1- 3/57
= 0,947

With x = expected number of errors (c x (n-Tn). Where c is the possibility of the same answer (0.5) and Tn is an error answer (Fitria, 2013; Kiswanto, 2013) based on the Guilford index, the value of Ks = 0.947 indicates that the media developed is very reliable.

Domia which was developed in accordance with the initial design at the design and develop stage has several appearances, the game card displays two segments bounded by blue lines, this card contains answers to questions in the form of numbers and words.

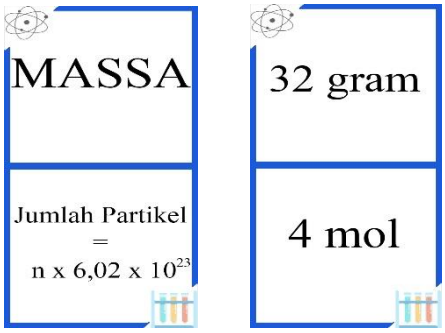

Figure 2. Game card display

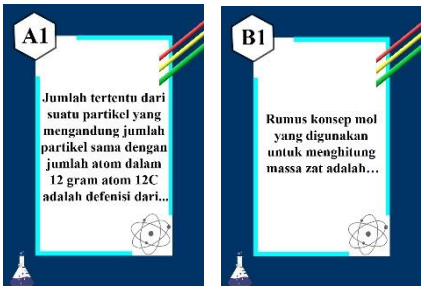

Figure 3. Problem card display

The cards can be played two ways, played in groups with the technicalities of a regular dominoes game, but with some special rules. Each person in the group holds only three game cards that are dealt randomly at the start of the game. Game turns will be determined by suit or override, where the winner will have the advantage of taking the first turn The game can start with an opening card that contains a choice of questions.

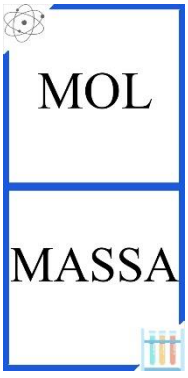

Figure 4. Opening card of the game

The student who gets the first turn is free to choose the question card listed on the opening card of the game. After the first turn student takes the question card, he must match the answer with the card he has. If the student has an answer that matches the question, then the student can immediately open the game line. However, if the card that the student has does not match or the time has run out, then the student must give the question card he chooses to the next turn. As a sanction, the student must take the game card back that is in the remaining array. Each student only has 45 seconds to match the Domia card, and the game will continue with the

same technique. The game will be over, when one student manages to spend all the cards in his hand.

The evaluation process using Domia cards can be more fun. And teachers can also have a variety and more varied measuring tools in conducting assessments. To make it easier for teachers to use and store, Domia cards are also equipped with a special box, so that the media can be easily stored and carried without worrying that the media will be scattered.

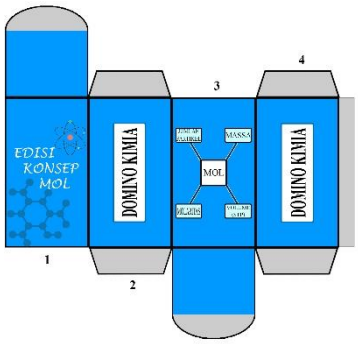

Figure 5. Dominoes box

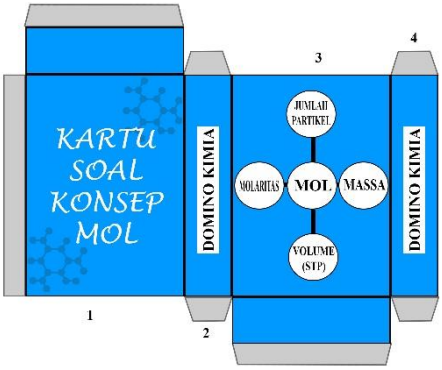

Figure 6. Problem card box

When the teacher forgets, or when students are confused in using it, students and teachers can review how to play by looking at the question instruction card.

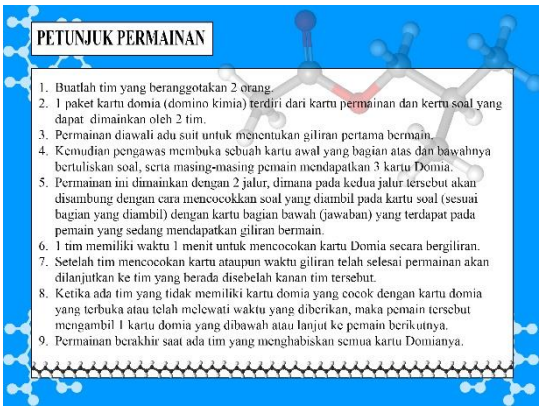

Figure 7. Game instructions

Thus the use of Domia as an evaluation media can be used as an option as a measuring tool for achieving learning objectives, because in addition to being valid, and reliable. This media is fun, practical and interesting, And during the conduct of this research, there has not been a single card domino media used in chemistry learning for any subject matter.

CONCLUSION

The Domia (Domino Chemistry) cards developed meet the eligibility criteria in the form of a degree of validity (Kr) of 0.97 and reliability (Ks) of 0.947. And Domia represents a new media variation for chemistry subjects.

RECOMMENDATIONS

The following are some research recommendations that can be considered below.

Development of a more comprehensive domia card: research to develop a more complete and comprehensive Domia Card to facilitate a deeper understanding of the mole concept. Includes various aspects of the mole concept such as mole calculation, molar mass, and its application in chemistry.

Analyze the effectiveness of Domia cards: conducting empirical research to evaluate the effectiveness of Domia Cards as a learning medium involves comparing students who use Domia Cards in their learning with students who do not use Domia Cards, and then measuring their improved understanding of the mole concept.

Learning module development: integrate Domia cards into a comprehensive learning module to guide students in understanding the mole concept. The module can include additional materials, exercises, and assessments to measure student understanding.

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