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DEVELOPMENT OF THE UNO CHEMICAL CARD GAME AS A LEARNING MEDIUM ON THE PERIODIC SYSTEM OF ELEMENTS FOR HIGH SCHOOL STUDENTS

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Abstract: This study aims to develop a chemical uno card game as a learning medium on the periodic system of elements for tenth-grade students and determine its validity and practicality. This type of research is research and development with the Plomp development model, which consists of three stages, namely (1) preliminary research, (2) prototyping stage, and (3) assessment phase. The research subjects were five chemistry lecturers at the Faculty of Mathematics and Natural Sciences, Padang State University, two chemistry teachers, and ten senior high school SMAN 13 Padang students for the 2022/2023 academic year. The research instrument was in the form of one-to-one evaluation interview sheets, media expert validity questionnaires, material expert validity questionnaires, and practicality test questionnaires. Validity data were analyzed using the Aiken'V formula, and practicality data were processed using the percentage formula. The validity value of the media expert was 0.88, and the material expert was 0.85 with the valid category. The results of the practicality analysis by teachers and students are in the very practical category, with respective values of 95.38% and 97%. In conclusion, the uno chemical card game as a learning medium in the periodic system of elements was valid and practical.

Keywords: *Chemistry Uno Card Game, Periodic System of Elements, Plomp Model.*

INTRODUCTION

Media means intermediary or introduction. Meanwhile, media is an introduction to information from those who send it to those who will receive it [1]. Learning media is a set of tools an educator uses to communicate with students to facilitate learning [2].

The use of media in the learning process will make teaching more interesting to students' attention, the lesson material will have a clearer meaning, teaching models can be more varied, and students can also do more learning activities. Students become bored with learning because they do more activities by observing, doing, and demonstrating [3].

One of the chemistry materials studied by tenth-grade students is the periodic system of elements. The periodic system of elements is a material that studies the development of the periodic system of elements, groups, periods, and periodicity of elements (atomic or ionic radii, electronegativity, ionization energy, electron affinity, and physical and chemical properties of an element). The material of this periodic system of elements has a lot of factual and conceptual knowledge. An example of factual knowledge of this matter is From left to right in a period; the atomic radius decreases as the effective nuclear charge increases [4]. An example of conceptual knowledge in this material is periodicity, a difference in properties that changes with a recurring trend in the next group or period [5]. The amount of factual and conceptual knowledge in this material means that students must read a lot, discuss, and do exercises. Developing thinking skills to solve problems and strengthening learning outcomes regarding the material studied must be practiced [6]. Based on the results of the questionnaire given to each of the two chemistry teachers at SMAN 10 Padang and SMAN 13 Padang, as well as one teacher at the Faculty of Mathematics and Natural Sciences, Padang State University Laboratory Development High School, data was obtained that the teacher always gave exercises to students after the learning process. The teacher's practice questions come from modules, textbooks, student worksheets, and questions made by himself. However, the weakness of the source of the practice questions used has yet to attract students' attention fully, and the exercises carried out tend to be individual, not varied and do not increase competition. While varied exercises that contain elements of competition can increase motivation and help make the environment fun, happy, and relaxed while still having a conducive atmosphere [7].

The results of the questionnaire given to 90 students found that 74% of students still needed to be more active in working on practice questions. Therefore, a way was needed to increase student activity when doing exercises. One way to do this is to use the game as a variation of the training model. The game is an activity in which a rule must be carried out to achieve a goal played by players in completing the game [8].

Learning media in the form of educational games that are both challenging and fun can make students actively involved in the process of understanding learning material [9]. The purpose of the learning process with the help

of a media game is so that students can learn independently, foster student learning motivation, and create a recreational atmosphere so that students do not easily feel bored during the learning process [10].

The game's advantage is students' active participation in learning; it is fun because of the competitive element, and the game can provide direct feedback. It is in line; with using games in the learning process [11]. Learning activities while playing are created so that students are interested in participating in the learning process.

Games that can be used in the learning process can be taken from everyday games which students usually enjoy playing and can be processed by integrating subject matter so that students can learn while playing. One alternative learning media in the form of a game is uno cards modified into chemical uno cards on the periodic system of elements material for tenth-grade students. The UNO card game was first created in 1971 di Reading, Ohio [12]. The UNO chemistry card learning media that will be developed is played by 4-5 students with one student coordinator. The way to play it is almost identical to the UNO card game. Still, the chemistry UNO card that will be developed is modified by adding questions based on competency achievement indicators and accompanied by pictures and symbols related to the questions. The question cards aimed to determine how far the level of students' understanding of the periodic system of elements is. This game also has symbol cards that can be used as student strategies in playing. Winning or losing in this game is determined by looking at the highest score that the player gets from answering questions. This score is used so students can play an active role during the game. The results of previous research stated that the Uno card game as a learning medium in the optical theme of class VIII was effective on student learning outcomes as indicated by the mastery of learning outcomes reaching 79.31%, the gain test was 0.56 [13]. Furthermore, The uno card game on hydrocarbon compounds positively influenced students' motivation and learning outcomes [14]. In subsequent research, the uno card game on atomic structure positively influenced learning outcomes and student activity, with a percentage of student activity observations of 90.1% and a gain test score of 0.6 [15].

Based on previous research that has used the uno card game as a learning medium from various materials and based on some of the data obtained, the researcher wants to develop a chemical uno card game product that can increase motivation, make the learning environment not boring, attract students' interest in doing exercises as well as for consolidating concepts, especially on the material of the periodic system of elements, the research focuses on Development of the Uno Chemistry Card Game as a Learning Media on Material Periodic System of Elements for tenth-grade students.

RESEARCH METHODS

This type of research is Research and Development with the Plomp development model. The Plomp model has three stages: (1) preliminary research, (2) prototyping stage, and (3) assessment stage. This study aims to determine the validity and practicality of the chemical uno card game by using research instruments in the form of questionnaires and one-to-one evaluation interview sheets.

The subjects of this study were five chemistry lecturers at the Faculty of Mathematics and Natural Sciences, Padang State University, as media and material expert validators, two chemistry teachers at SMAN 13 Padang as validators for material experts and practitioners, and ten students at SMAN 13 Padang as practitioners. The object of this research is the uno chemical card game as a learning medium on the periodic system of elements for tenth-grade students. Data analysis techniques use Aiken's V formula to determine validity and percentages to determine practicality.

RESULTS AND DISCUSSION

Preliminary research

a. Needs Analysis

Based on the questionnaire results given to the teacher and students, it is known that the teacher always gives exercises to students at the end of the material. However, the exercises carried out are still individual and have yet to vary, so students do not participate actively in working on the questions. So to increase the activity of students in doing the exercises, learning media is needed to follow the characteristics of students. A game is one of the learning media that can be used as a variation of the training model. Learning media in the form of games will make students actively involved in learning [16]. One of the games that can be used is the uno chemistry card game.

b. Context Analysis

The context analysis carried out is the Basic Competency analysis, translated into Competency Achievement Indicators. The translation of basic competencies into GPA can be seen as follows:

Basic competencies:

3.4 Analyze the similarities in the properties of the elements in the group and their periodicity

GPA:

3.4.1: Analyzing an element based on its periodicity in the periodic system

3.4.2: Predicting the Position of an Element in the periodic table

3.4.3: Detecting the periodic properties of elements in one group and period
3.4.4: Comparing the periodic properties of elements based on electron configurations
3.4.5 Analyzing the periodicity of elements in one group and period The purpose of learning is through the uno chemical card game as an alternative learning media in providing exercises for strengthening concepts; it is hoped that students can carry out exercises in games actively answering questions about the similarity of the properties of elements in groups and their periodicity.

c. Review of Literature

The literature review aims to find and understand sources related to development activities. The sources and references can come from journals, books, or internet sources. The literature review results showed that the uno card game was feasible to use as a learning evaluation tool, with a percentage of 96.31% [17]. There is an increase in students' critical thinking using the Uno card game learning media [18].

d. Conceptual framework development

The results of developing the conceptual framework are made in a chart containing problems in learning the solutions provided. The problems obtained from needs and context analysis to literature review are problems regarding the inactivity of students in doing the exercises, so a media is needed as a variation of the exercises to determine the validity and practicality of the media to be developed.

Prototype Stage

a. Prototype I

The activity carried out at this stage is to design the product to be made, namely the uno chemical card game media on the material of the periodic system of elements for tenth-grade students. This chemistry uno card game was designed or designed using the Canva application. The results of the prototype I design can be described as follows:

1) Card Box

The display on the game box contains the game's name, the material's title, the author's identity, and the supervisor's name. The chemical uno card game box can be seen in Figure 1.

The display on the cover contains the title of the game material and the characteristics of the color of the chemical uno card. The cover for the chemical uno card game can be seen in Figure 2.

Figure 1. Chemistry Uno Card Game Box Cover

Figure 2. Cover of the Chemistry Uno Card Game

2) Game Rules

The rules for the uno chemical card game consist of instructions for using the game. Game rules are given so teachers and students can learn how to play uno chemical cards in learning. The rules for this chemical uno card game contain the number of players, the steps to play, and the game's scoring.

3) Question Cards

There are 44 question cards in the uno chemistry card game. This question card was created using the Canva application, the Alice font type. This card is made like a 7 cm x 10 cm rectangle with the kind of paper used, namely Laminated Tik Carton paper. These question cards have four colors (red, yellow, green, and blue) and contain the numbers 0 to 5, each number consisting of 2 cards in each color except zero. An example of a question card can be seen in Figure 3.

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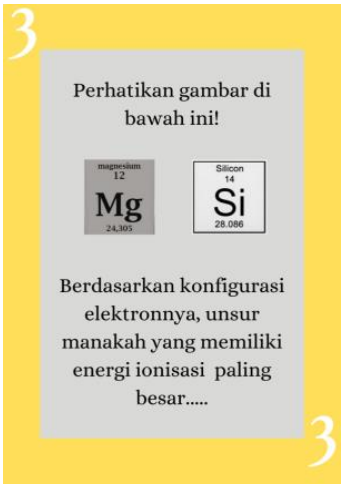

Figure 3. Example of Question Cards

4) Action cards

There are 28 action cards in this chemical uno card game. 8 skip cards, 8 reverse cards, 8 +1 cards, and 4 wild cards. This card is also designed using the Canva application, the Alice font type. This card is also made to resemble a rectangle of 7 cm x 10 cm, and the type of paper used is Laminated Tik Carton paper.

After prototype I is produced, the next step is to do a self-evaluation to produce prototype II. Self-assessment was carried out using a checklist system in a questionnaire.

b. Prototype II

In the second prototype stage, a formative evaluation stage was carried out through expert assessment and one-to-one trials to obtain the validity value of the developed chemical uno card game.

1) *expert review*

At this stage, the validation of the chemical uno card game was carried out. This uno chemistry card game was validated by five chemistry lecturers who are experts in the media and material fields and two chemistry teachers who are experts in the material field. Based on the data processing results, the assessment of the validity of the material is categorized as valid. The results of the material validity analysis can be seen in Table 1.

Table 1. Material Validity Results

Rated aspect	V	Category
Content feasibility component	0.87	Valid
Language Component	0.93	Valid
Serving Components	0.81	Valid
Benefits Component	0.82	Valid

Table 1 shows that the validity value in content feasibility is 0.87 with a valid category. It shows that the media developed follows basic competencies and GPA based on the applicable curriculum.

Regarding language, the validity value is 0.93 with a valid category. It shows that the Uno Chemistry card learning media that has been developed follows good and correct Indonesian language rules and has precise, clear, and simple sentence structure.

Regarding benefits, the validity value is 0.82 with a valid category. It shows that the developed media can increase students' understanding and motivation in chemistry.

The assessment of media validation consists of a graphical assessment of the product being developed. From the graphical component, the validity value is 0.88 with a valid category. It shows that the uno chemical card game that has been developed is good and interesting, which includes, in terms of design, the appropriate font size and shape, the images presented are attractive and relevant to the material, and the selection of appropriate and attractive colors. The results of the media validity analysis can be seen in Table 2.

Table 2. Media Validity Results

Rated aspect	V	Category
Graphic Components	0.88	Valid

2) One-to-one evaluation

At this stage, one-on-one trial interviews were conducted regarding the chemical uno card game on the periodic system of elements material with three students of SMAN 13 Padang with different levels of ability through one-on-one trial interview sheets. Based on the interview, the results of the student's assessment showed that the cover display was very attractive, the rules of the game were easy to understand, the color selection was good and attracted students' interest in playing it, the questions presented were easy to understand, and according to the students, the uno chemistry card game was very helpful to solidify concept on the periodic material system of elements.

After carrying out an expert review and one-to-one evaluation, revisions will be carried out according to suggestions and input from the validator and also students to produce prototype III.

c. Prototype III

At this stage, an assessment is carried out through a product trial through a practicality questionnaire. The practicality of the Uno Chemistry card game was carried out with 2 chemistry teachers and 10 students. Regarding the practicality of learning media, teacher's and students responses were asked to use learning media [19]. Practicality is determined based on the results of user assessments, such as whether the product being developed is applicable and practical in its use [20]. Based on the results of data processing for practicality assessment by the teacher, it is categorized as very practical. The results of the practicality data analysis by the teacher can be seen in Table 3.

Table 3. Results of Teacher Practicality

Rated aspect	P	Category
Ease of Use	97.5%	Very Practical
Benefit	94%	Very Practical
Attractiveness	95%	Very Practical

Based on the data processing results, the practicality assessment by students is categorized as very practical. The results of the analysis of students' practicality data can be seen in Table 4.

Table 4. Student Practical Results

Rated aspect	P	categories
Ease of Use	97%	Very Practical
Benefit	97.5%	Very Practical
Attractiveness	96.5%	Very Practical

At the practicality stage, the results of the data analysis show that the learning media for chemical uno cards on material periodic system elements for tenth-grade students, which is valid, has an average practicality of 95.38% by teachers and 97% by students in the practical category.

Regarding ease of use, the practicality value obtained by teachers and students is 97.5% and 97%, respectively, in the valid category. It proves that the developed chemical uno card game media presents questions in a clear, simple way that is easy to understand, carry, and use at any time.

Regarding benefits for the practicality value of teachers and students, respectively 94% and 97.5% in the practical category. It proves that the uno chemical card game can increase students' activity, helping students solidify the concept of the periodic system of elements material through practice.

In the aspect of attractiveness, the practicality value obtained by the teacher and students is 95% and 96.5%, respectively, in the very practical category. It shows that the Uno Chemistry card game media as a whole is interesting to use by teachers and students. It follows the statement, which states that learning media that have high attractiveness can make it easier for students to use them [21].

CONCLUSION

Based on the research results, the researcher can conclude that the learning media for the chemical uno card game on the periodic system of elements for tenth-grade students developed using the Plomp model is valid and very practical. So that teachers can use it as an alternative learning media in providing exercises to solidify students' concepts on the material of the periodic system of elements

REFERENCES

[1] Arsyad, A. (2002). Media Pembelajaran Jakarta: Raja Grafindo Persada.
[2] Marwah, S. M. Sabang dan I. M. T. (2014). Pengaruh Penggunaan Media Kartu Struktur Atom dan Sistem Periodik terhadap Hasil Belajar Siswa Kelas XI SMA Negeri 6 Palu. Jurnal Akademika Kimia, 3(1), 36-41.
[3] Sudjana, N., & Rivai, A. (2013). Media Pengajaran Bandung. S inar Baru Algesindo.
[4] Chang, R. (2005). Kimia Dasar: Konsep-konsep inti edisi ketiga jilid 2.
[5] Syukri, S. (1999). Kimia Dasar Jilid 2. Bandung: ITB.
[6] Hamalik, O. (2012). Kurikulum dan Pembelajaran. Jakarta: Bumi Aksara.
[7] Latuheru, J. D. (1988). Media pembelajaran dalam proses belajar mengajar masa kini. Jakarta: Depdikbud.
[8] Bintiningtiyas, N. (2016). Pengembangan permainan varmintz chemistry sebagai media pembelajaran pada materi sistem periodik unsur (development of varmintz chemistry as learning media on periodic system of element). Unesa Journal of Chemical Education, 5(2).
[9] Listyarini, D. W., As'ari, A. R., & Furaidah, F. (2018). Pengaruh Model Teams Games Tournament Berbantuan Permainan Halma terhadap Minat dan Hasil Belajar pada Materi Bunyi Siswa Kelas IV Sekolah Dasar (Doctoral dissertation, State University of Malang).
[10] Purwanto, dkk. (2010). Evaluasi Hasil Belajar. Surakarta: Pustaka Pelajar.
[11] Daryanto. (2011). Media Pembelajaran. Yogyakarta: Gava Media.
[12] Hakim, E. P. (2010). Perancangan Aplikasi Game Kartu Uno Berbasis Client Server (Doctoral dissertation, Universitas Sumatera Utara).

[13] Estiani, W., Widiyatmoko, A., & Sarwi, S. (2015). Pengembangan Media Permainan Kartu Uno Untuk Meningkatkan Pemahaman Konsep dan Karakter Siswa Kelas VIII Tema Optik. Unnes Science Education Journal, 4(1).
[14] Sari, Y., Solehah, G. H., & Mashuri, M. T. (2018). Pengaruh Penggunaan Media Permainan Kartu Uno Pada Materi Senyawa Hidrokarbon Terhadap Hasil Belajar Siswa. Vidya Karya, 33(1), 35-41.
[15] Bm, R. R. S. (2015). Kelayakan Permainan Uno Card sebagai Media Pembelajaran pada Materi Pokok Struktur Atom (Eliginility of "Uno Card" Games as Learning Media in Sructur Atom). UNESA Journal of Chemical Education, 4(2).
[16] Sadiman, dkk. (2012). Media Pendidikan. Jakarta: Raja Grafindo Persada.
[17] Dahlianis, L., & Iswendi, I. (2023). Development of the uno chemical card game as a learning medium on the chemical bonding material for high school student. *Jurnal Pijar Mipa*, *18*(2), 231-236.
[18] Rahmawati, R., Muttaqin, M., & Listiawati, M. (2019). Peran Permainan Kartu Uno Dalam Meningkatkan Keterampilan Berpikir Kritis Siswa. Jurnal Program Studi Pendidikan Biologi(Agustus), 9(2).
[19] Juliana, J., Dewi, N. K., & Khair, B. N. (2021). The development of sisperman games on science teaching for primary school student. *Jurnal Pijar Mipa*, *16*(4), 512-518.
[20] Haviz, M. (2016). Research and development; penelitian di bidang kependidikan yang inovatif, produktif dan bermakna. Ta'dib, 16(1).
[21] Kurnia, E. D., Setiadi, D., & Handayani, B. S. (2022). Analysis of blended learning effectiveness at senior high school during covid-19 pandemic. *Jurnal Pijar Mipa*, *17*(2), 260-264.