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DEVELOPMENT OF CHEMISTRY POCKET BOOK WITH MIND MAPPING STRATEGY ON PERIODIC TABLE TO IMPROVE CREATIVE THINKING SKILLS

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Abstract

This study aimed to determine the validity, practicality, and effectiveness of a Chemistry Pocket Book (CPB) with a Mind Mapping Strategy to improve students' creative thinking skills on the topic of the Periodic Table. This research employed a Research and Development (R&D) method using the 4-D model, which was limited to the Develop stage. The validation involved three validators, consisting of two chemistry lecturers and one chemistry teacher. The field trial involved 25 tenth-grade students at SMAS Surabaya. The research instruments included validation sheets, student response questionnaires, observation sheets, creative thinking tests, and mind mapping assessment sheets. The data were analyzed using mode, percentage, the Shapiro–Wilk normality test, the paired-samples t-test, and N-Gain. The results showed that the developed CPB was valid, with the mode values for the validity aspects ranged from 4 to 5. The students' responses reached 92.01%, indicating that the CPB was highly practical. The effectiveness results showed an average N-Gain of 0.78 (high category) for students' ability to construct mind maps and 0.76 (high category) for their creative thinking skills. The paired-samples t-test also showed a significant difference between the pretest and posttest scores ($p < 0.05$). Therefore, the developed CPB with a Mind Mapping Strategy is valid, practical, and effective for supporting students' creative thinking skills on the topic of the Periodic Table.

Keywords: chemistry pocket book, mind mapping, creative thinking skills, periodic table, learning media

INTRODUCTION

Creative thinking is an important skill that should be developed in science education because it enables students to generate ideas, explore different perspectives, and develop solutions to problems [1]. The development of creative thinking skills requires learning experiences that actively engage students in constructing, connecting, and developing their ideas [2]. A systematic review also showed that appropriate learning models and strategies can contribute to the development of creative thinking skills among high school students [3].

Chemistry learning involves various abstract and interconnected concepts that require students to understand relationships among different pieces of information [4]. One topic that requires conceptual understanding is the Periodic Table of Elements. Students need to understand the relationships among atomic structure, electron configuration, groups, periods, and periodic properties. However, previous research showed that students still experience difficulties in understanding conceptual relationships in the Periodic Table of Elements [5]. Therefore, appropriate learning support is needed to help students organize and understand these interconnected concepts[6].

The preliminary study conducted at SMAS Surabaya also indicated difficulties in chemistry learning. The results showed that 64.29% of students considered chemistry difficult, while 75.00% experienced difficulties in understanding the Periodic Table of Elements [7]. In addition, 85.71% of students stated that they needed learning strategies that could facilitate their understanding. The learning media used were also considered less attractive by 64.29% of students. Furthermore,

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students experienced difficulties in developing ideas, providing different answers, and solving problems in their own ways. These findings indicate that the existing learning process had not optimally supported students' conceptual understanding and creative thinking skills [8].

One alternative to address these problems is the development of learning media that present information concisely and systematically while facilitating students' active learning [9]. A Chemistry Pocket Book (CPB) presents chemistry information in a practical and portable format [10]. Previous research has demonstrated the development of a Chemistry Pocket Book integrated with a mind mapping strategy in chemistry learning [5,6,7]. However, learning media should not merely function as a source of concise information. They should also provide learning activities that enable students to actively organize information and develop their ideas [11].

Mind mapping is a visual learning strategy that enables students to organize information through keywords, central ideas, branches, and connections among concepts [3]. Through mind mapping activities, students can identify important concepts, establish relationships among concepts, and develop information into more detailed representations [3]. The use of mind mapping in chemistry learning has also been applied in the development of Chemistry Pocket Books for several chemistry topics [5,6,7].

Previous studies have developed Chemistry Pocket Books with mind mapping strategies for hydrocarbon material [5] and mind-mapping-based Chemistry Pocketbooks for reaction rate material [6]. These studies indicate that the integration of a pocket book and mind mapping can facilitate students in organizing chemistry concepts visually and systematically [7]. However, the previous studies focused on hydrocarbon material [5] and reaction rate material [6], rather than the Periodic Table of Elements and students' creative thinking skills.

Therefore, this study developed a Chemistry Pocket Book (CPB) with a Mind Mapping Strategy for the Periodic Table of Elements. The CPB was designed not only to provide concise information but also to facilitate learning activities that encouraged students to identify concepts, connect information, organize ideas, and develop their understanding [3,10]. The activities in the CPB were related to the development of creative thinking through the aspects of fluency, flexibility, originality, and elaboration [16].

Accordingly, this study aimed to determine the validity, practicality, and effectiveness of a Chemistry Pocket Book with a Mind Mapping Strategy to improve students' creative thinking skills on the topic of the Periodic Table [10].

METHOD

This study employed a Research and Development (R&D) method using the 4-D development model proposed by Thiagarajan, Semmel, and Semmel, consisting of Define, Design, Develop, and Disseminate stages [9]. However, this study was limited to the Develop stage because the study focused on determining the validity, practicality, and effectiveness of the developed learning medium without conducting large-scale dissemination [10].

The research was conducted at SMAS Surabaya during the 2025/2026 academic year. Product validation involved three validators, consisting of two chemistry education lecturers from State University of Surabaya (UNESA) and one chemistry teacher from SMAS Surabaya. A limited field trial involved 25 tenth-grade students.

The product developed in this study was a Chemistry Pocket Book (CPB) with a Mind Mapping Strategy on the topic of the Periodic Table of Elements, designed to improve students' creative thinking skills. The research instruments consisted of CPB review sheets, CPB validation sheets, teaching module validation sheets, creative thinking pretest and posttest sheets, mind mapping assessment sheets, student response questionnaires, and student activity observation sheets [11].

The qualitative data obtained from the CPB review sheets were analyzed descriptively based on the reviewers' suggestions and comments regarding the content, presentation, language, and graphical aspects [11]. The review results were used as the basis for revising the developed Chemistry Pocket Book before the validation stage.

The validity of the developed CPB was determined using the mode of the validators' scores because the validation data were ordinal. The validators assessed each criterion using a five-point Likert scale as presented in Table 1 [12]. The developed CPB was considered valid if each assessed aspect obtained a mode score of ≥4 [12].

Table 1. Likert Scale for Validity Assessment

Scale	Criteria
1	Very weak
2	Weak
3	Fair
4	Strong
5	Very Strong

[12]

The practicality of the developed CPB was evaluated through student response questionnaires and student activity observations. Student responses were analyzed using the Guttman scale shown in Table 2.

Table 2. Guttman Scale

Response	Positive Statement	Negative Statement
Yes	1	0
No	0	1

[11]

The percentage of students' responses was calculated using Equation (1).

$$P = \frac{F}{N} \times 100\% \qquad (1)$$

where P is the percentage of students' responses, F is the total score obtained, and N is the maximum score [11].

The obtained percentages were interpreted according to Table 3. The developed CPB was considered practical if the percentage reached ≥61% [11].

Table 3. Practicality Criteria

Percentage (%)	Criteria
0-20	Very Weak
21-40	Weak
41-60	Fair
61-80	Strong
81-100	Very Strong

[11]

The effectiveness of the developed CPB was determined based on students' creative thinking skills and student learning activities [10,16]. Creative thinking skills were assessed through pretest and posttest consisting of four indicators, namely fluency, flexibility, originality, and elaboration [16]. Students' creative thinking scores were calculated using Equation (2).

$$Score = \frac{\sum obtained\ score}{maximum\ score} \times 100 \qquad (2)$$

The creative thinking scores were interpreted according to Table 4.

Table 4. Creative Thinking Skills Criteria

Percentage (%)	Criteria
0-20	Very Weak
21-40	Weak
41-60	Fair
61-80	Strong
81-100	Very Strong

[11]

The pretest and posttest scores were first analyzed using the Shapiro–Wilk normality test. If the significance value was greater than 0.05, the data were analyzed using the paired sample t-test. Otherwise, the Wilcoxon Signed-Rank Test was employed. The improvement in students' creative thinking skills was determined using the normalized gain (N-Gain) shown in Equation (3).

$$g = \frac{Posttest - Pretest}{Maximum\ Score - Pretest} \qquad (3)$$

The N-Gain values were interpreted according to Table 5.

Table 5. N-Gain Interpretation

N-Gain	Category
$g < 0.30$	Low
$0.30 \leq g < 0.70$	Medium
$g \geq 0.70$	High

[17]

The developed CPB was considered effective if there was a significant difference between the pretest and posttest scores ($p < 0.05$) and the N-Gain score reached at least the medium category [17]. Student activities were analyzed descriptively using percentage scores obtained from three observers. The percentage of student activities was calculated using Equation(4).

$$Activity(\%) = \frac{obtained\ observation\ time}{maximum\ observation\ time} \text{x}100 \qquad (4)$$

The developed CPB was considered to effectively support the learning process when the percentage of relevant student activities was higher

than that of irrelevant activities during the implementation.

RESULTS AND DISCUSSION

The result of this development study is a Mind Mapping-Based Chemistry Pocket Book (CPB) on the Periodic Table of Elements to improve students' creative thinking skills. The developed CPB is designed as a learning medium that facilitates students in understanding the relationships among concepts through the use of mind mapping strategies. The development of the CPB was carried out using the 4-D development model, which consists of four stages: Define, Design, Develop, and Disseminate. However, this study was limited to the Develop stage to determine the feasibility of the developed learning media in terms of its validity, practicality, and effectiveness.

Define Stage

The first stage of the 4-D development model is the define stage, which aims to identify the learning problems and determine the requirements for developing the Chemistry Pocket Book (CPB) using the mind mapping strategy. At this stage, preliminary information was collected through classroom observations, interviews with chemistry teachers, and pre-research questionnaires administered to tenth-grade students at SMAS Surabaya. The collected data were used as the basis for designing a learning medium that addresses students' needs and supports the implementation of the Merdeka Curriculum.

The define stage consisted of five analyses, namely front-end analysis, learner analysis, task analysis, concept analysis, and learning objective analysis. Each analysis contributed to the development of a Chemistry Pocket Book that is relevant to the characteristics of the learning material and students' needs.

1. Front-end Analysis

   The front-end analysis was conducted to identify the problems encountered during chemistry learning, particularly on the topic of the Periodic Table of Elements. The analysis was carried out through classroom observations, interviews with chemistry teachers, and preliminary questionnaires administered to tenth-grade students of SMAS Surabaya. The findings indicated that students experienced difficulties in understanding the relationships among concepts because the topic contains numerous interconnected concepts that require conceptual understanding rather than memorization. Learning activities were still predominantly supported by textbooks and teacher explanations, resulting in limited opportunities for students to actively construct their own understanding and develop creative thinking skills. Therefore, an innovative learning medium that presents learning materials in a concise, systematic, and visually attractive manner is needed. Based on the pre-research questionnaire results, 64.29% of students experienced difficulty learning chemistry, with 75.00% specifically finding the Periodic Table of Elements (SPU) topic challenging. Additionally, 85.71% of students expressed the need for varied learning strategies and materials that support independent study. Furthermore, 64.29% of students stated that pocketbook media was not yet available at school, and 78.57% agreed that a concise, practical pocketbook would significantly aid their learning process.

2. Student Analysis

   Learner analysis was conducted to identify students' characteristics and learning needs. The results showed that the students preferred learning resources that were concise, easy to understand, visually attractive, and practical to use during classroom learning. Students also required learning activities that encourage active participation rather than passive memorization. These characteristics became the basis for developing the Chemistry Pocket Book (CPB), which integrates the mind mapping strategy to help students organize concepts using keywords, branches, symbols, colors, and images. Through this strategy, students are expected to construct meaningful learning experiences while improving their creative thinking skills.

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3. Task Analysis

Task analysis was performed to identify the competencies and learning activities that students should accomplish during the learning process. The learning tasks were designed according to the learning outcomes of the Merdeka Curriculum on the Periodic Table of Elements. Students were expected to explain the historical development of the periodic table, determine electron configurations, identify groups and periods, analyze periodic trends, and apply these concepts in solving chemistry problems. To facilitate the achievement of these competencies, the Chemistry Pocket Book includes a series of learning activities integrated with mind mapping tasks, enabling students to summarize concepts and demonstrate their understanding creatively.

4. Concept Analysis

Concept analysis was carried out to determine the scope and sequence of the learning materials presented in the Chemistry Pocket Book. The developed CPB covers the historical development of the periodic table, electron configuration, determination of groups and periods, periodic properties of elements, and their applications. The concepts were organized systematically so that students could understand the relationships among concepts more easily. The integration of the mind mapping strategy further supports students in organizing information visually and connecting concepts meaningfully showed in Figure 1.

Figure 1. The Periodic Table Concept Map

4. Learning Objectives Formulation

Learning objective analysis was conducted based on the results of the previous analyses. The learning objectives were formulated according to the learning outcomes of the Merdeka Curriculum and the characteristics of the students. Through the developed Chemistry Pocket Book, students are expected to explain the concepts of the Periodic Table of Elements accurately, organize concepts using mind maps, solve chemistry problems appropriately, and demonstrate creative thinking skills through the indicators of fluency, flexibility, originality, and elaboration. Therefore, the define stage provided the foundation for designing a learning medium that addresses students' learning needs while supporting the development of creative thinking skills.

Design Stage

The design stage was carried out after completing the define stage. This stage aimed to produce the initial design of the Chemistry Pocket Book (CPB) integrated with a mind mapping strategy to improve students' creative thinking skills on the Periodic Table of Elements material. The design process was based on the results of the needs analysis, student analysis, task analysis, concept analysis, and learning objectives formulated during the define stage. The activities conducted in this stage included media selection, format selection, and initial product design.

1. Media Selection

The learning media developed in this study was a Chemistry Pocket Book (CPB) integrated with a mind mapping strategy for the Periodic Table of Elements material. The selection of this medium was based on the results of the needs analysis, which indicated that students experienced difficulties in understanding the relationships among concepts in the Periodic Table of Elements and required a learning resource that was practical, visually attractive, and easy to use independently.

The Chemistry Pocket Book was selected because it is portable, concise, and can be used as an independent learning resource anytime and anywhere. Furthermore, the integration of

the mind mapping strategy enables students to organize concepts visually, facilitating meaningful learning and helping them understand the relationships among concepts more effectively. In addition, the activities embedded in the CPB were designed to facilitate the development of creative thinking skills, including fluency, flexibility, originality, and elaboration.

2. Format Selection

The format selection stage aimed to determine the presentation format of the Chemistry Pocket Book according to the characteristics of the Periodic Table of Elements material, the learning objectives, and students' needs. The format was designed based on the Merdeka Curriculum learning outcomes and the principles of instructional material development.

The Chemistry Pocket Book consists of several components, including the cover page, preface, table of contents, learning outcomes, learning objectives, instructions for use, concept map, learning materials, mind mapping examples, mind mapping activities, creative thinking activities, practice exercises, glossary, answer key, and references. The content was presented using clear and communicative language, supported by illustrations, attractive color combinations, and an organized layout to improve students' motivation and comprehension.

3. Initial Product Design

The initial product design stage aimed to produce Draft I of the Chemistry Pocket Book integrated with the mind mapping strategy. The draft was developed using Canva for graphic design and Microsoft Word for preparing and organizing the learning content before integrating it into the final layout.

Draft I was developed based on the findings from the define stage, including the results of the needs analysis, concept analysis, task analysis, and learning objectives. The initial product contains all essential components of the Chemistry Pocket Book, including learning materials, concept maps, mind mapping activities, creative thinking tasks, evaluation questions, glossary, and references.

In addition, mind mapping activities were integrated into each learning topic to encourage students to identify key concepts, establish relationships among concepts, and organize information visually. This design was expected to facilitate meaningful learning while promoting students' creative thinking skills. The completed Draft I was subsequently prepared for expert review and validation before proceeding to the development stage.

Develop Stage

The develop stage aimed to evaluate and improve the quality of the developed Chemistry Pocket Book (CPB) integrated with a mind mapping strategy before its implementation in classroom learning. This stage consisted of product review, expert validation, revision, and a limited trial to determine the feasibility of the developed CPB in terms of validity, practicality, and effectiveness.

1. CPB Review

The initial product (Draft I) of the Chemistry Pocket Book was reviewed by the supervising lecturer. The review focused on the content, presentation, language, graphic design, and the integration of the mind mapping strategy within the learning activities. Suggestions and comments provided during this stage were used to revise the product, resulting in Draft II.

The review process aimed to ensure that the developed media met the characteristics of an effective learning material before being submitted for expert validation. Several revisions included improvements to the layout, consistency of illustrations and typography, clarity of learning instructions, organization of learning activities, and refinement of the mind mapping components to better support students' creative thinking skills. The results are shown in Table 6.

Table 6. Results of CPB Review

Draft I	Draft II
Cover layout and illustrations were less proportional.	The cover layout and illustrations were improved for a more balanced appearance.

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Draft I	Draft II
Learning objectives were not clearly highlighted.	The learning objectives were highlighted more clearly.
Some learning instructions were unclear.	The learning instructions were revised for greater clarity.
Mind mapping activities lacked clear guidance.	Clear instructions for mind mapping activities were added.
Some illustrations were not relevant to the learning material.	Relevant illustrations were incorporated to support concept understanding.

2. CPB Validation

After revision, Draft II was validated by three validators, consisting of two Chemistry Education lecturers and one senior chemistry teacher. The validation process employed a Likert-scale validation sheet covering content validity and construct validity.

Content validity evaluated the suitability of the learning material with the learning outcomes, learning objectives, scientific accuracy, and relevance to the Periodic Table of Elements. Construct validity assessed the organization of the learning material, language clarity, presentation, graphical appearance, and the integration of the mind mapping strategy to promote students' creative thinking skills.

The validation results indicated that the developed Chemistry Pocket Book met the criteria of valid and was therefore appropriate for limited implementation after revisions based on validators' recommendations. The results are shown in Table 7.

Table 7. Results of CPB Validation Revision

Draft II	Draft III
Creative thinking components were absent from the table of contents.	Added to the table of contents.
Learning objectives were not aligned with the assessment.	Aligned with the assessment indicators.
Mind mapping examples could encourage copying.	Added instructions for independent mind mapping.
Several subtopics were omitted from the table of contents.	Included all subtopics.
Learning materials used limited references.	Added relevant references.
Layout and typography needed improvement.	Improved layout and typography.
"Elements in Everyday Life" contained excessive content.	Condensed to essential concepts.
The material was too detailed for a pocket book.	Simplified to suit a pocket book format.

Based on the validation results, the developed Chemistry Pocket Book (CPB) can be interpreted as a valid learning medium. The overall validation results are presented in Table 8.

Table 8. Validation Results of CPB

No.	Validation Aspect	Mode
1	Content Validity	5
2	Construct Validity	5
3	Graphics	4
4	Presentation	5
5	Language	5

The content validity aspect received a mode score of 5, indicating that the learning materials were relevant to the learning objectives and scientifically accurate. The construct validity aspect also obtained a mode score of 5, demonstrating that the organization and instructional design of the Chemistry Pocket Book were appropriate. The graphics aspect obtained a mode score of 4, suggesting that minor improvements were needed in the visual design and layout. The presentation aspect received a mode score of 5, indicating that the material was systematically organized and easy to follow. Finally, the language aspect obtained a mode score of 5, showing that the language used was clear, communicative, and appropriate for the target students. Overall, the Chemistry Pocket Book fulfilled the validity criteria and was considered feasible for

classroom implementation after minor revisions.

After the developed Chemistry Pocket Book (CPB) was validated by three validators, a limited trial was conducted to assess its practicality and effectiveness.

Limited Pilot Test

The observation sheets were completed by three observers using a Likert scale, while the student response questionnaire employed a Guttman scale. The obtained data were analyzed to determine the practicality level of the developed media.

The Chemistry Pocket Book was considered practical if the percentage score reached at least the good category according to the predetermined interpretation criteria.

1. Practicality

The practicality of the Chemistry Pocket Book was determined through students' response questionnaires and observations of student activities during the learning process. The results showed that students gave positive responses to the developed CPB with an overall category of very practical. In addition, classroom observations indicated that students were actively involved in learning activities using the Chemistry Pocket Book and successfully completed the mind mapping tasks according to the learning objectives. These findings indicate that the developed CPB is practical and can be implemented effectively in chemistry learning. The results are shown in Table 9.

Table 9. Student Response Questionnaire Results

No.	Criteria	Average (%)
1	Content	92.16
2	Presentation	93.63
3	Language	95.59
4	Creative Thinking	90.44
5	Mind mapping	88.24
	Average	92.01
	Category	Very Practical

Table 9. shows the results of students' responses toward the developed Chemistry Pocket Book (CPB). Overall, students gave positive responses to all assessed aspects, including content, presentation, language, and the implementation of the mind mapping strategy. The average response percentage was categorized as very practical, indicating that the developed CPB was easy to use, attractive, and supported students in learning the Periodic Table of Elements. The integration of mind mapping activities also helped students organize concepts more systematically, making it easier to understand the relationships among concepts and encouraging active participation during the learning process. The results are shown in Table 10.

Table 10. Students' Activity Observation Results

No.	Meeting	Relevant Activities (%)	Irrelevant Activities (%)
1	1	97.22	2.78
2	2	98.61	1.39
	Average	97.92	2.08

Table 10 presents the results of students' activity observations during the implementation of the Chemistry Pocket Book (CPB) incorporating the mind mapping strategy. The percentage of relevant activities reached 97.22% in the first meeting and increased to 98.61% in the second meeting, with an average of 97.92%. Conversely, the percentage of irrelevant activities was only 2.78% and 1.39%, respectively, with an average of 2.08%. These findings indicate that students were actively engaged in learning activities and participated according to the planned learning procedures. The increase in relevant activities from the first to the second meeting also suggests that students became more familiar with the use of the CPB and the mind mapping strategy, enabling them to participate more effectively throughout the learning process.

2. Effectiveness

The effectiveness of the developed Chemistry Pocket Book (CPB) was assessed based on two aspects: students' learning achievement and the improvement of students' creative thinking skills. Student learning achievement was assessed based on the completeness of students' learning outcomes, while creative thinking skills were measured

through pretest and posttest scores. The results are shown in Figure 2.

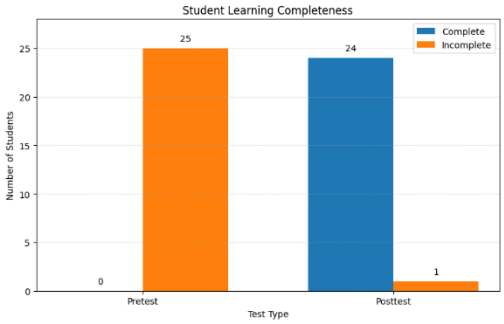

Figure 2. Analysis of Student Learning Achievement

Based on Figure 2, student achievement during the pretest was 0%, as none of the 25 students achieved learning completeness. Meanwhile, during the posttest, student achievement increased to 96%, with 24 out of 25 students achieving learning completeness. Only 1 student (4%) remained incomplete. This indicates a 96% increase in the percentage of classical learning completeness from the pretest to the posttest.

The effectiveness of the developed Chemistry Pocket Book (CPB) was determined based on the improvement of students' creative thinking skills as measured by the pretest and posttest. The improvement was analyzed using the normalized gain (N-Gain) score.

The analysis showed that the average pretest score increased from 43.90 to an average posttest score of 85.90, resulting in an average N-Gain score of 0.75, which is categorized as high. These findings indicate that the implementation of the Chemistry Pocket Book integrated with the mind mapping strategy effectively improved students' creative thinking shown in Table 6skills on the Periodic Table of Elements shown in Figure 3.

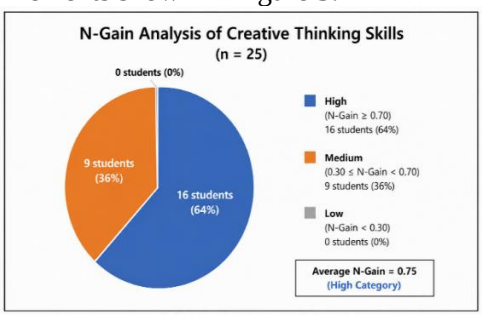

Figure 3. Distribution of Students' N-Gain Categories

To provide a clearer description of students' improvement, the distribution of N-Gain categories is presented in Figure 2.

Based on Figure 2, 16 students (64%) achieved a high N-Gain category, while 9 students (36%) achieved a medium N-Gain category. No students were categorized as having a low N-Gain.

These results indicate that the majority of students experienced a high improvement in their creative thinking skills after learning with the developed Chemistry Pocket Book. The results are shown in Figure 4.

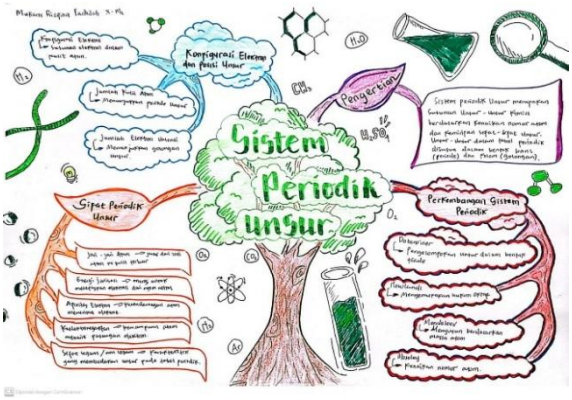

Figure 4. An Example of a Student's Posttest Mind Map with the Highest Creative Thinking

Figure 4 presents an example of a student's posttest mind map with the highest creative thinking score of 97.77%, categorized as Highly Creative. The mind map demonstrates the student's ability to organize the Periodic Table of Elements as the central concept and develop it into several interconnected branches.

The main concepts were further developed into more detailed sub-concepts. This structure demonstrates the student's ability to elaborate ideas by expanding general concepts into increasingly specific information. The interconnected branches also demonstrate how the student organized relationships among concepts related to the Periodic Table of Elements.

In addition, the use of colors, illustrations, and visual representations demonstrates the student's creative representation of ideas. Therefore, Figure 3 provides visual evidence of the students' ability

to organize and elaborate concepts through the mind-mapping activity.

Overall, the average N-Gain score and the distribution of students across the N-Gain categories demonstrate that the developed Chemistry Pocket Book integrated with the mind mapping strategy was effective in improving students' creative thinking skills.

CONCLUSION

This study successfully developed a Chemistry Pocket Book (CPB) integrated with a mind mapping strategy for the Periodic Table of Elements material using the 4D (Define, Design, Develop, and Disseminate) development model. The developed CPB was designed to facilitate students' understanding of chemical concepts while promoting their creative thinking skills through structured mind mapping activities.

The validation results indicated that the developed CPB met the validity criteria. The product obtained a mode score of 5 for content validity, construct validity, presentation, and language, and a mode score of 4 for the graphics aspect, indicating that the Chemistry Pocket Book is suitable for use as a learning medium after minor revisions.

The developed CPB was also found to be effective in improving students' creative thinking skills. The average pretest score increased from 43.90 to an average posttest score of 85.90, resulting in an average N-Gain score of 0.75, which falls into the high category. Furthermore, 64% of students achieved a high N-Gain category, while 36% achieved a medium category, indicating that the majority of students experienced substantial improvement in their creative thinking skills after using the developed Chemistry Pocket Book.

Overall, the findings demonstrate that the Chemistry Pocket Book integrated with the mind mapping strategy is a valid and effective learning medium for improving students' creative thinking skills on the Periodic Table of Elements.

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