

Profile of Student Design Thinking in Developing Learning Media

Darmadi^{1*}, Sanusi², Fatria Adamura³ ^{1,2,3}Mathematics Education Study Program, Universitas PGRI Madiun *Corresponding author email: <u>darmadi.mathedu@unipma.ac.id</u>

Received:Revised:Accepted:Published:July 8, 2023July 15, 2023July 27, 2023October 5, 2023

Abstract

Design thinking is interesting to study because it explains the process of solving problems creatively according to the needs of Society 5.0. This study aimed to obtain a design thinking profile of students in developing monopoly science learning media with temperature. The research method used was qualitative research with PPG students at the PGRI Madiun University as subjects who received assignments at SMPN 11 Madiun. Through observation and in-depth interviews, some research results were obtained. In developing monopoly science learning media, students carry out the design thinking stages, namely: interviewing and profiling for needs analysis (at the empathy stage), conducting restrictions and discussions to determine design challenges (at the define stage), independently generating ideas, discussing, and determining common ideas (at the ideate stage), discussing and making rules of the game and discussing making prototypes (at the prototype stage), conducting trials, and seeking input for improvement (at the test stage). To carry out this activity, students carry out information processing in their minds, namely: processing input information from interview answers and written profiling questionnaire answers, collecting, comparing (information and experience), and drawing conclusions (which are represented in the form of data on student needs), collecting comparing (information and experience) and draw conclusions (represented in the form of a design challenge), elicit (information and experience), collect information (from discussions), and draw conclusions (which are represented in the form of ideas to create monopoly learning media on temperature Science), collect material and tools and assembling it (so that a prototype of the temperature IPA monopoly is formed), conducting trials of its application and identifying its deficiencies (which are represented in the form of observations on the application of the temperature IPA monopoly and suggestions for improvement of the next prototype). The principle of design thinking is identical to the Plomp model R&D research method, namely, at the empathize, define, and ideate stages (students carry out the preliminary phase), the prototype stage (students carry out prototyping phase), and the test (students carry out the assessment phase).

Key words: design thinking, learning media



1. Introduction

One of them initiated by the Japanese state is Society 5.0. This concept allows us to use modern science-based (AI, Robot, IoT) for human needs with the aim that humans can live comfortably. Society 5.0 is expected to increase efficiency and productivity in various sectors so as to help achieve sustainable development goals. Industry 5.0 focuses on how to optimize working hours to get work done. For this reason, a design thinking lesson is needed which explains the process of solving problems creatively according to the needs of society 5.0.

Design thinking is an iterative process of trying to understand users, challenge assumptions, and redefine problems to find alternative strategies and solutions that may not be immediately apparent at the initial level of understanding [1]. Design Thinking is important to understand because it is a method for innovating [2].

The stages of design thinking are to empathize, define, ideate, prototype, and test. An overview of the design thinking process is as follows.



Design Thinking Process

Figure 1. The design thinking process [3]

At the empathize stage, expert consultations are involved to learn more about the areas of concern through observation, participation, and sympathy with other people, to understand their experiences and motivations in order to have a clearer personal understanding of the problems involved. At the stage of determining the design challenge (define) the information that has been created and collected in the empathize phase is collected. At the stage of generating ideas (ideate) generated ideas. At the prototyping stage, an experiment is carried out to identify the best solution. At the test stage, trials were carried out on the prototype that had been made. The design thinking stage is very suitable for project-based learning.

PPG student at PGRI University who was assigned a PPL at SMPN 11 Madiun tried to apply design thinking to develop the Temperature Science monopoly. Monopoly Science Temperature is a learning medium that becomes a student project in applying design thinking. Therefore, research was carried out with the aim of obtaining profiles of the design thinking of students in developing the IPA Temperature monopoly.

Several studies have been conducted regarding design thinking. Application of design thinking can be done in visual communication media introduction to campus life for new students [4]. Application of design thinking can be done to Sayurbox (PT Kreasi Nostra Mandiri) [5]. We can identifications of the application of design thinking in learning office interior design [6]. Application of the design thinking method can be done in food product development design courses [7]. Application of design thinking can be done to the clothing business using a website [9]. Application of the design thinking method can be done to the clothing business using a website [9]. Application of the design thinking method can be done in website design for UMKM [10]. Design thinking can be used in the development of handicraft products [11]. Application of design thinking can be done in the utilization of design thinking can be done in gradient products [12].

A few applications of design thinking for applications and computers. Application of design thinking with gamification can increase motivation for fruit and vegetable consumption in children [13]. Design thinking can applicate to vegetable suppliers [14]. User interface design can be applicated by the design thinking method in UI and UX development [15]. Application of the design thinking method can be done in designing applications for handling reports of theft of valuables [16]. Application of design thinking can be done in innovative places for buying and selling transactions at thriftier online stores things [17]. Application of the design thinking method can be done to the UI/UX design model for handling lost and found lost goods reports [18]. Design thinking also can be applied to develop learning media.

The development of learning media is carried out in each educational unit. The development of multimedia-based learning media can be done for mentally retarded children [19]. The development of interactive learning multimedia can be done for science subjects for elementary students [20]. The development of digital science learning media can be done at SMP [21]. The

development of multimedia-based learning media can be done in the concept of sensory systems in class [22]. The development of multimedia learning English can be done for SMK students [23].

The development of learning media is important for learning. The development of learning media can improve student learning outcomes [24]. The development of physics flipbook learning media can improve student learning outcomes [25]. The development of video-based interactive learning multimedia can increase the learning interest of students [26]. The development of picture storybook learning media can increase school students' interest in reading [27].

The purpose of this research is to focus more on obtaining design thinking profiles of students in developing monopoly science learning media. A study that has never been done by anyone else. The design thinking profile is known to be able to find out the activities and thoughts of students in applying design thinking as well as in terms of the Plomp R&D model. Thus, the application of design thinking in learning can be more optimal.

2. Method

The research method used to obtain design thinking profiles of students is a qualitative research method.

The research subjects were 4 (four) PPG students at PGRI Madiun University, namely Dedy Irawan, Desy Ria Pratama, Dewi Nur Rohmatin, and Galang Sasmito Aji. The determination of the subject was carried out randomly and became a student under the guidance of the writer. This was done to make it easier in terms of coordination, interviews, and observation.

The research location is SMPN 11 Madiun. This location was chosen randomly by the PPG committee. This location was chosen because students (respondents) and writers (researchers) received assignments at SMPN 11 Madiun. SMPN 11 Madiun is located at Jl. PG. Kanigoro No. 11, Manisrejo, Taman, Madiun City, East Java. Similar studies have never been conducted at this location.

The main instrument is the researcher himself. Researchers benefited from being assigned as student supervisors (respondents) at SMPN 11 Madiun. Researchers need to make observations and prepare interview designs or guidelines. Interviews were conducted in a semi-structured manner. This was done with the consideration of facilitating the presentation and analysis of data but also being able to follow the flow of thought of the respondents.

Data validation is done by source triangulation. Sources of information in this study are respondents or subjects. In addition, for data validation, documentation photos were also used during the activity.

Valid data for further analysis, namely reduced, coded, categorized, and presented again until conclusions are drawn. The conclusions given are related to the design thinking profile of students at SMPN 11 Madiun.

3. Result and Discussion

3.1. Presenting the Results

In accordance with the research method plan, the researcher conducted observations and interviews with the subject while carrying out learning with design thinking at SMPN 11 Madiun. Subjects carry out design thinking stages, namely: empathize, define, ideate, prototype, and test.

The first stage of design thinking is empathy. Based on the results of interviews using the in deep interviews method for 7F grade students. The following interview results were obtained.

- Students get bored easily when learning science only memorizes material or formulas.
- Students have difficulty in simple mathematical calculation operations.
- Time management between learning and playing is not maximized and science material is not preferred, namely material related to calculations because learning is not packaged in an attractive way.
- Students expect learning to be packaged interactively and interestingly.
- Students prefer learning that is combined with physical activity in learning, such as game/practicum-based learning.

In addition, students also conduct profiling by using a questionnaire. Some of the results of student profiling are as follows.

- The results of observing students' profiling regarding learning styles show that the learning styles possessed by students are mostly audiovisual and kinesthetic.
- The results of observing students' profiling regarding motor skills showed that students' gross motor skills were still lower when compared to their fine motor skills.

Starting from the problems found in interviews, profiling, and the results of analysis of student characteristics, the subject is interested in developing interesting learning media by

involving students' physical activity in learning science. The material we choose is temperature material and temperature conversion.

The second stage of design thinking is to define the problem. The limitations of the problem are presented in the form of a formulation (design challenge) as follows.

"How to develop learning media that can involve physical activity in science learning?" In making this design challenge, students do brainstorming to get a common agreement.

The third stage of design thinking is making ideas. Ideas convey orally in a joint discussion. From several existing ideas, an idea was chosen to create a monopoly learning media for science. The update of the temperature science monopoly learning media, namely: The temperature science monopoly printed on a large scale and the implementation of the Temperature Science Monopoly game involves physical activity carried out directly by students as PIONs in the game.

The fourth stage of design thinking is to make a prototype. After conducting joint discussions, the following prototype of monopoly learning media was obtained.



Figure 2. The prototype of monopoly learning media

Game Instructions are made as mutually agreed rules. After conducting the discussion, the subject gets game instructions as follows.

- Every player, each gets 20 points as the first capital. Each player gathers on the monopoly board at the start, as pawns. Players take turns to roll 2 dice at once. Players walk through each box according to the number of numbers that come out on the dice.
- In the first round, each player must first collect points by answering the questions on the heating cards for up to one round. In the second round and so on, players may use their points to buy laboratory equipment listed on the monopoly board.



- The game lasts for a predetermined time limit. The player who gets the highest points, will be the winner.
- Pay attention when stopping at monopoly spots or boxes:
 - If it stops at a picture of laboratory equipment, players may buy the tool by paying the number of points listed for ownership.
 - o If you stop at an image that is already owned by your opponent, the player must pay a rental fee of 50% of the points listed. If it stops at the heating box, the player must take one heating card and must answer the questions shown on the card. If you answer correctly, you will get additional points and if you answer incorrectly you will not get additional points
 - If it stops at the cooler, the player must take one cooler card and must do what is written on the card. Cooling cards contain rewards or punishments.
 - If you stop at the image warning of breakable and flammable goods (there are points marked with a minus), then the points that have been collected by the players will be reduced according to the points in the image as a form of compensation.

The final stage of design thinking is to do a test. The trial was carried out at SMPN 11 Madiun. Because only 1 (one) monopoly is provided. Just few students can take part. Only 4 (four) students as representatives of each group can play the IPA temperature monopoly. The following is the documentation of the implementation of the temperature IPA monopoly at SMPN 11 Madiun.



Figure 3. The implementation of the temperature IPA monopoly at SMPN 11 Madiun.

After completing the trial, students ask for suggestions and input from students. Some suggestions and input from students are as follows.

- The monopoly banner board size is enlarged.
- Students' initial points should be added so that in practice, the minus score is not too big.



- Cooling cards should be added to challenge or entertainment activities and points are still given to appreciate students' efforts.
- Added picture box Question levels are made more varied.

3.2. Discussion

In developing monopoly natural science learning media, students carry out the stages of design thinking, namely: empathize, define, ideate, prototype, and test. At the empathy stage, students conduct interviews and profiling for needs analysis. At the fine stage, students carry out restrictions and discussions to determine the design challenge. At the ideate stage, students independently come up with ideas, discuss, and determine ideas together. At the prototype stage, students discuss and make rules of the game and discuss making prototypes. At the test stage, students conducted trials and looked for input to improve the temperature science monopoly learning media. An overview of student activity in applying design thinking is as follows.



At the empathy stage, students conduct interviews and profiling for needs analysis. To carry out this activity, students process information in their minds in each activity. The input information in the interview is the sound of the interview answers. The profiling input information is the writing of the questionnaire answers. Information is processed in the mind by collecting, comparing (information and experience), and drawing conclusions. The output information of this activity is the data on student needs. At the fine stage, students carry out restrictions and discussions to determine the design challenge. To carry out this activity, students process information in their minds in each activity. The input information for this activity is data on student needs. Information is processed by gathering, comparing (information and experience) and drawing conclusions. Information on the output of this activity is expressed in the form of a design challenge.

At the ideate stage, students independently come up with ideas, discuss, and determine ideas together. To carry out this activity, students process information in their minds in each activity. The input information for this activity is a design challenge. Information is processed by generating (information and experience), gathering information (from discussions), and drawing conclusions as ideas. The output information of this activity is an idea to create temperature science monopoly learning media.

At the prototype stage, students discuss and make rules of the game and discuss making prototypes. To carry out this activity, students process information in their minds in each activity. The input information for this activity is the idea to create temperature science monopoly learning media. This information is processed by collecting materials and tools and assembling them to form a prototype. The output information of this activity is the temperature IPA monopoly prototype.

At the test stage, students conducted trials and looked for input to improve the temperature science monopoly learning media. To carry out this activity, students process information in their minds in each activity. The input information for this activity is the temperature IPA monopoly prototype. Information is processed by conducting implementation trials and identifying deficiencies. The output information of this activity is the result of observing the application of the temperature IPA monopoly and suggestions for improving the prototype.

The principles of design thinking are synonymous with R&D research methods. One theory that is often used is Plomp's theory. The Plomp model development model consists of three stages, namely, preliminary research, prototyping phase, and assessment phase. The preliminary stage is the stage where the researcher conducts a thorough analysis of the needs of the research subjects, such as material characteristics, teacher and student characteristics, learning suggestions and infrastructure, and so on. The prototyping stage is the stage where the researcher designs the desired product, by conducting a validity test by material experts (expert appraisal), and practitioners, revising the product according to the validator's suggestions. The assessment phase is the product trial stage through the use of the product on the research subject/practical effectiveness test of the product produced. The aspects of effectiveness observed at this stage can be from increasing student learning outcomes, learning interest, student learning motivation or something else according to the effectiveness limits intended by the researcher.

In the empathize, define, and ideate stages, the subject performs the preliminary stage. At this stage, the subject conducts a thorough analysis of the needs of the research subject such as material characteristics, teacher and student characteristics, learning suggestions and infrastructure, and others. This initial research was not carried out in-depth due to time constraints. Apart from that, the subject also defines, ideates which is not stated by Plomm.

At the prototype stage, the subject did prototyping. At this stage, the subject designs the desired product, by conducting a validity test by material experts (expert appraisal), practitioners, revising the product according to the validator's advice.

In the test phase, the subject conducts an assessment (assessment phase). At this stage, the subject carried out the product trial stage through the use of the product on the research subject/tested the effectiveness of the product's practicality. The aspects of effectiveness observed at this stage can be from increasing student learning outcomes, learning interest, student learning motivation or something else according to the effectiveness limits intended by the researcher.

4. Conclusion

In developing monopoly science learning media, students carry out the stages of design thinking, namely: empathize, define, ideate, prototype, and test. At the empathy stage, students conduct interviews and profiling for needs analysis. At the fine stage, students carry out restrictions and discussions to determine the design challenge. At the ideate stage, students independently come up with ideas, discuss, and determine ideas together. At the prototype stage, students discuss and make the rules of the game and discuss making prototypes. At the test stage, students conducted trials and looked for input to improve the temperature science monopoly learning media.

To carry out this activity, students process information in their minds in each activity. Input information is interview answers and profiling questionnaire answers. Information is processed in the mind by collecting, comparing (information and experience), and drawing conclusions that are represented in the form of data on student needs. Furthermore, information is processed by



gathering, comparing (information and experience) and drawing conclusions which are represented in the form of a design challenge. Furthermore, information is processed by generating (information and experience), gathering information (from discussion), and drawing conclusions as ideas represented in the form of ideas to create science monopoly learning media. Furthermore, the information is processed by collecting materials and tools and assembling them to form a temperature IPA monopoly prototype. Furthermore, the information is processed by conducting application trials and identifying deficiencies which are represented in the form of observations on the application of the IPA temperature monopoly and suggestions for further improvement of the prototype.

The principle of design thinking is identical to the Plomp model R&D research method, namely, preliminary research, prototyping phase, and assessment phase. In the empathize, define, and ideate stages, the subject performs the preliminary stage. At the prototype stage, the subject did prototyping. In the test phase, the subject conducts an assessment (assessment phase).

5. Acknowledgement

Thanks a lot to LPPM Universitas PGRI Madiun for providing financial assistance for the implementation of this activity. Thanks also go to the PPG study program at the University of PGRI Madiun for assisting in the implementation of this research. We also thank the students, teachers, and principals of SMPN 11 Madiun who have helped carry out this research.

6. References

- Fariyanto, F., Suaidah, S., & Ulum, F. Village Head Election Application Design Using the Ux Design Thinking Method (Case Study: Kampung Kuripan). *Jurnal Teknologi dan Sistem Informasi*, 2(2), 52-60. 2021.
- [2] Aman, S., Supriyanto, S., & Putri, M. A. Implementation of BMC with the Design Thinking Method in Facing Covid-19 at IKM Pati. *Jurnal Teknologi dan Manajemen Industri*, 1(2), 6-14. 2021.
- [3] https://eduparx.id/blog/insight/5-tahap-design-thinking/. Retrieved July 31, 2023
- [4] Syahrul, Y. Application of Design Thinking in Visual Communication Media Introduction to Campus Life for New Students of Stmik Palcomtech and Palcomtech Polytechnic. *Jurnal Bahasa Rupa*, 2(2), 109-117. 2019.



- [5] Ginanjar, J., & Sukoco, I. Application of Design Thinking in Sayurbox. JURISMA: Jurnal Riset Bisnis & Manajemen, 12(1), 70-83. 2021.
- [6] Dewi, S. K., Haryanto, E. K., & De Yong, S. Identification of the Application of Design Thinking in Learning Office Interior Design Design. In *Seminar Nasional Seni Dan Desain 2018* (pp. 33-38). State University of Surabaya. 2018.
- [7] Baskoro, M. L., & Haq, B. N. Application of the Design Thinking Method in Food Product Development Design Courses. *IKRA-ITH HUMANIORA: Jurnal Sosial Dan Humaniora*, 4(2), 83-93. 2020.
- [8] Suprobo, P. Application of Design Thinking in Design and Architecture Learning Innovation. In Proc. Seminar Nasional Dies Jurusan Arsitektur Universitas Kristen Petra (pp. 4-5). 2012.
- [9] Rabbani, A. R. The Application of Design Thinking to the Clothing Business in Setal Pangkalpinang Stores Using a Website as One of the Solutions. *RAINSTEK: Jurnal Terapan Sains & Teknologi*, 3(3), 167-175. 2021.
- [10] Soedewi, S., Mustikawan, A., & Swasty, W. Application of the Design Thinking Method to the Design of the Kirihuci MSME Website. 2022.
- [11] Ardian, N. F., & Werdhaningsih, H. The Use of Design Thinking in the Development of IKM Handicraft Products (Case Study: Center for Wooden Sculptures, Subang). Jurnal Dimensi Seni Rupa Dan Desain, 15(1), 1-16. 2018.
- [12] Putri, S. A., Sari, D. I., Marzuki, K., & Taryana, A. Application of Design Thinking Eco-Boba in Utilizing Crushed Plastic Waste and E-commerce Package Packaging. *Journal of Technopreneurship on Economics and Business Review*, 3(2), 71-81. 2022.
- [13] Destriani, R., & Heroza, R. I. Application of Design Thinking with Gamification to Increase Motivation for Fruit and Vegetable Consumption in Children. *Jurnal Tekno Kompak*, 17(1), 81-95. 2023.
- [14] Sutanto, S. Y., Kurniawan, F., Rijaya, R., & Firmansyah, M. Application of Design Thinking in Vegetable Supplier Application User Interface Design. In *MDP Student Conference*. Vol. 1, No. 1, pp. 284-289. 2022.

- [15] Herfandi, H., Yuliadi, Y., Zaen, M. T. A., Hamdani, F., & Safira, A. M. Application of the Design Thinking Method in UI and UX Development. *Building of Informatics, Technology and Science (BITS)*, 4(1), 337-344. 2022.
- [16] Triayudi, A., & Rubhasy, A. Application of the Design Thinking Method in Designing Applications for Handling Reports of Theft of Valuables at the Sukmajaya Police. JIPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika), 6(2), 267-276. 2021.
- [17] Firli, O. M., Sukoco, I., & Muftiadi, A. Application of Design Thinking in Innovation Place for Buying and Selling Transactions at Thrifter Online Stores. Things. *Entrepreneur: Jurnal Bisnis Manajemen dan Kewirausahaan*, 2(2), 288-292. 2021.
- [18] Razi, A. A., Mutiaz, I. R., & Setiawan, P. Application of the Design Thinking Method to the UI/UX Design Model for Handling Lost and Found Lost Goods Reports. *Demandia: Jurnal Desain Komunikasi Visual, Manajemen Desain, dan Periklanan, 3(02), 219-237. 2018.*
- [19] Saputra, V. H., & Febriyanto, E. Multimedia-Based Learning Media for Mentally Disabled Children. Mathema: Jurnal Pendidikan Matematika, 1(1), 15-23. 2019.
- [20] Dwiqi, G. C. S., Sudatha, I. G. W., & Sukmana, A. I. W. I. Y. Development of Interactive Learning Multimedia for Science Subjects for Fifth Grade Elementary School Students. *Jurnal Edutech Undiksha*, 8(2), 33-48. 2020.
- [21] Okra, R., & Novera, Y. Development of Science Digital Learning Media at SMP N 3 Pangkalan. *Journal Educative: Journal of Educational Studies*, 4(2), 121. 2019.
- [22] Rasyid, M., Azis, A. A., & Saleh, A. R. Development of Multimedia-Based Learning Media in the Concept of Sensory Systems in Class XI High School Students. *Jurnal Pendidikan Biologi*, 7(2), 69-80. 2017.
- [23] Surjono, H. D., & Susila, H. R. Development of English Language Learning Multimedia for Vocational High Schools. *Jurnal Pendidikan Vokasi*, 3(1). 2013.
- [24] Nurrita, T. Development of Learning Media to Improve Student Learning Outcomes. Jurnal misykat, 3(1), 171-187. 2018.



- [25] Hayati, S., Budi, A. S., & Handoko, E. Development of Physics Flipbook Learning Media to Improve Student Learning Outcomes. In *Prosiding Seminar Nasional Fisika (E-Journal)* (Vol. 4, pp. SNF2015-II). 2015.
- [26] Anggraeni, S. W., Alpian, Y., Prihamdani, D., & Winarsih, E. Development of Video-Based Interactive Learning Multimedia to Increase Learning Interest of Elementary School Students. Jurnal Basicedu, 5(6), 5313-5327. 2021.
- [27] Apriliani, S. P., & Radia, E. H. Development of Picture Story Book Learning Media to Increase Elementary School Students' Interest in Reading. *Jurnal basicedu*, 4(4), 994-1003. 2020.