

# Mind Mapping Learning Model to Increase Student Competency and Pattern Thoughts With Mixed Methods Research Approach

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**Abstract**—The main problem of higher education in Indonesia currently lies in the professional effort towards developing the competence of a quality mindset. Cooperative learning method has many models; one model is quite sophisticated is the learning model mind mapping (mind mapping). This research method is a mixed method, that is consist of the qualitative method and quantitative method. In the use of strategy mixed method is done with a sequential exploratory strategy, where research begins by collecting qualitative data, then followed by collecting quantitative data. The population in this study is all students of Mechanical Engineering Department of the Year 2017/2018 who have taken the course of thermodynamics technique. Sampling with non-random sampling technique. This research shows that: 1) the difficult thermodynamic material of the technique involves newton's law and the law of gravity, the equilibrium of the two-dimensional style, the equilibrium of the three-dimensional style, the method of section model, the centers of mass and centroids, the phenomenon of beams affects, the phenomena of beams affects, and the potential energy stability; 2) the factors causing the low competence and mindset of students in the thermodynamic course of engineering include weak level of ability to analyze the calculation, limited availability of learning support media, and effectiveness of mind mapping method as an alternative to problem-solving the low pattern of thinking and competence; 3) mind mapping method proved effective as an alternative to solving the problem of low thinking pattern and student's competence in thermodynamics technique.

**Keywords**-automotive training, tune-up, body-painting

## I. INTRODUCTION

The main problem of higher education in Indonesia currently lies in the professional effort toward developing the competence of quality mindset in learning real life (learning to live)[1]. Higher education as a factory in printing the new generation is still too brittle as a bridge-work with concept-based learning. During this time the learning in higher education is still dominated by boring learning with the verbal and classical system so that learners get more informative experience[2]. Also, learners are also less able to shape his

mindset by every problem he faces. The learning process in higher education is much 'confined' to 'narrow' ability so that learners can do less reading about phenomena and problems with high holistic level.

It is a bitter reality and possibly every year will continue to increase. Also, the explosion problem is caused by the provision and utilization of labor between regions is not balanced. The number of the labor force in a region may be higher than employment, whereas in other areas the opposite may occur. Such circumstances may result in the transfer of labor from one part to another, even from one country to another[1]. Teaching and learning activities should reflect the optimal instructional communication of learners and learners with other learners, not merely providing unidirectional information without developing mental, physical and personal appearance. However, there are still many problems that often occur in learners that is when learners try to recall what has been obtained, studied, designed or that once been studied. Also, learners also have difficulty in doing tasks or concentrate. Therefore it is needed an improvement of teaching and learning process that is doing cooperative learning system[3]. Cooperative learning method has many models; one model is quite sophisticated is the learning model mind mapping. Mind maps are the easiest way of putting information into the brain and retrieving information from the brain. This mind map is based on research on how the actual brain works, where the brain functions to organize and store information. Mind maps have many benefits: helping regarding remembering, getting ideas, saving time, concentrating, and managing the mind in pouring imagination that certainly creates creativity.

Mindmap is a method of recording thoroughly on one page. Mind maps (mind mapping) use reminders in the form of patterns and related ideas[4]. The mind mapping method is a new method of recording that works according to the workings of the two brains. This method teaches to take notes by using interesting images and colors. From Porter & Hernacky's explanation above can be taken the understanding that the learning model by using mind map (mind mapping)

can develop the performance of the brain and regulate the flow of thought and understand the concept of thinking learners [2]. About concept map learning, the interrelation between the various concepts of learning materials can be built by the learners through the learning. The conceptual linkage is built in individual learners as well as in groups. Through this learning, learners are facilitated to find relationships or interconnections between, even between different levels, from the most common to the most specialized. Through learning conceptual learners conceptual map can be built, so that learners have high way thinking ability (high order thinking). According to Crowe memory habits can be memorized by the process of mind mapping. Studying learners will also become more meaningful with concept map learning [5].

So far, the research on the competence of paradigms is done partially, both the research and the methods used. The focus of the study is more on students in general and less complex. The most widely used approach is quantitative with correlation methods or designs. Some researchers are already interested in using a qualitative approach, but there are still many single case studies. As a result, the results of his research are general, discussing only explorative matters, or mutually exclusive cases. The use of multiple perspectives is a necessary force in educational research. For that, researchers use mixed research to produce a study that multiple perspectives it.

## II. METHOD

This research method is a mixed method, that is consist of the qualitative method and quantitative method. In the use of strategy mixed method is done with a sequential exploratory strategy, that research begins by collecting qualitative data, then followed by collecting quantitative data. In the qualitative method used the stage of the survey, observation, and in-depth interviews (in-depth interview). The data obtained from qualitative methods are in the form of: a) the concept of the thermodynamic subjects of engineering that are considered difficult and difficult to understand b) factors causing the low competence and mindset of students in the engineering thermodynamics course. The quantitative method used is a quasi-experimental stage. The data obtained from quantitative methods are a) data understanding of the thermodynamic concepts (tests) of student techniques on the current learning model and mind mapping, and b) product effectiveness test. This research is divided into 2 stages, namely: 1) qualitative research phase (survey, observation, and in-depth interview); and 2) quasi-experimental research stage. The population in this study is all students of Mechanical Engineering Department of the Year 2017/2018 who have taken the course of thermodynamics technique. Sampling with non-random sampling technique, The sample consisted of 2 classes, namely 1 control class which consisted of 29 students and 1 experimental class which amounted to 29 students. The complete research phase is presented in Figure 1.

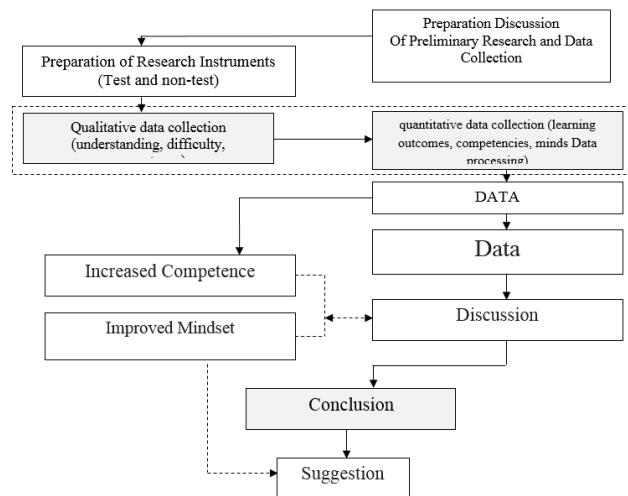


Fig. 1. Research Method Design

Data obtained from the interview and observation stage is done descriptively qualitative. The analysis was conducted to find out: a) the concept/sub-concept of thermodynamic technique to the students, and; b) factors causing degradation of competence and mindset. Relating to quantitative data analysis (on pretest and posttest), that is understanding concept data score then analyzed by t-test. The t-test is done with the help of SPSS program version 20.01 Test Analysis T-test is a statistical test that is a differentiation test that has different levels.

## III. RESULT

The results of this study include the percentage of the material difficulty level of thermodynamics, the result of interviewing factors causing the weakness of mindset in the material of thermodynamics, and the effectiveness test of mind mapping method.

TABLE 1. PERCENTAGE OF LEVEL OF DIFFICULTY MATERIALS TECHNIQUE

No.	Topic	Percent of answer	
		True	False
1	Newton's law and the law of gravity	35%	65%
2	two-dimensional style system	75%	25%
3	three-dimensional style system	80%	20%
4	two-dimensional style equilibrium	45%	55%
5	three-dimensional style equilibrium	25%	75%
6	model of joint method	60%	40%
7	model method of section	35%	65%
8	centers of mass and centroids	35%	65%
9	phenomenon beams affects	45%	55%
10	potential energy and stability	40%	60%

In Table 1 shows that three materials have a percentage of correct answers above 50%. The material includes two-dimensional style system, three-dimensional style system, and model of the joint method. Also, seven materials have a percentage of correct answers below 50%. These include Newton's law and the law of gravity, two-dimensional style equilibrium, three-dimensional style equilibrium, a method of section models, centers of mass and centroids, beams affects phenomena, beams affects, and potential energy and stability.

TABLE 2. PERCENTAGE OF AN INTERVIEWS

No.	Question Topic	Percent of Answer	
		Yes/ True	No/ False
1	The degree of habit of doing a matter of calculation	65%	35%
2	Able to memorize all important formulas on thermodynamics	35%	65%
3	Able to analyze all the problems of thermodynamic count	30%	70%
4	Learning media (books, articles, journals) complete	75%	25%
5	Have someone who is a thermodynamic expert	20%	80%
6	Have a special notebook containing thermodynamic formulas	30%	70%
7	Regular learning intensity	75%	25%
8	Have a high motivation to solve thermodynamic problems	15%	85%
9	The success rate in working on thermodynamic problems is quite high	45%	55%

Table 2 shows that three question topics have a percentage value above 50%. Topic questions include Level Habit work on matter count, Learning media (books, articles, journals) complete, and Intensity learn regularly. Also, 6 questions have values below 50%. The topic of the questions include Able to memorize all the important formulas in thermodynamics, Able to analyze all the matter of thermodynamic count, Have someone who thermodynamic expert, Have a particular notebook containing thermodynamic formulas, Have high motivation solve thermodynamic problems, and Level of success in working on the problem thermodynamics is quite high.

TABLE 3. RESULTS OF T-TEST ANALYSIS OF INITIAL INSTRUCTIONS

t-test for Equality of Means					
t	df	Sig. tailed)	(2- tailed)	Mean Difference	Std. Difference
1.171	56	0.245	0.245	2.69	2.295
1.171	55.587	0.245	0.245	2.69	2.295

This initial capability test data is obtained from the initial ability score before being treated by mind mapping learning method. This initial capability test data is performed to determine the pre-test hypothesis test according to the data to be analyzed. The summary of the above results shows that  $t_{count}$  is 1.171 with the sig. 0.245 and it can be interpreted that there is no significant difference between the test results of the initial ability of the experimental class and the control class. Furthermore, data analysis was done by t-test.

TABLE 4. DATA ANALYSIS T-TEST FINAL CAPABILITIES

t-test for Equality of Means					
t	df	Sig. tailed)	(2- tailed)	Mean Difference	Std. Difference
2.666	56	0	0	5.242	1.966
2.666	53.456	0	0	5.242	1.966

This final capability test data is obtained from the final ability score after being treated by mind mapping learning method. This initial capability test data is performed to determine the pre-test hypothesis test according to the data to be analyzed. Summary of the above results shows that  $t_{count}$  is 2.66 with the sig. 0.00 and it can be interpreted that there is a significant difference between the experimental class initial test results and the control class.

#### IV. DISCUSSION

##### A. Thermodynamic Materials Techniques that are Hard to Understand

The subject of thermodynamic engineering is a complex and interrelated material. That is because every material under study has a correlation with the previous material. In this study explained that a lot of material on thermodynamics techniques that are considered difficult to do student. These include Newton's law and the law of gravity, two-dimensional style equilibrium, three-dimensional style equilibrium, a method of section models, centers of mass and centroids, beams affects phenomena, beams affects, and potential energy and stability. The average material that is considered difficult to do is the matter of matter. Basically, every human brain will be more hard-nosed when working on a question with a number type[1]. That's because the level of analysis of each human brain is different. Just like the three-dimensional style equilibrium material. The material is a material that analyzes vectors and forces on three-dimensional objects with great precision. Another example is material phenomena beams affects. The material is a material with a formula memorization and can understand its use in solving the problem about phenomenon beams affects. Improved brain analysis power can be improved one of them by training the brain too often solve the problem[6]. The problem in question here is a matter related to the matter of the count in the thermodynamics course. Materials such as Newton's law and the law of gravity, two-dimensional style equilibrium, three-dimensional style equilibrium, a method of section models, centers of mass and centroids, beams affects phenomena, beams affects, and potential energy and stability will be easy to do if often do the exercises do the problem[5].

##### B. Factors causing the low competence and mindset of students in the thermodynamic course of engineering

###### 1) Weak Level Of Ability To Analyze The Matter Of Calculation

The lack of ability to analyze calculations is a real serious problem. It becomes an obstacle in developing the ability to achieve the competence of engineering thermodynamics courses. Calculation problems on thermodynamic materials of

engineering are generally a matter of indirect analysis. Students should be able to find a way to solve and be able to use thermodynamic formulas appropriately. The brain will not have the ability to solve a good problem if not often trained[2].

Most of the practice questions on thermodynamics techniques are a matter of computation (numbers). Sometimes, a person will experience a degree of saturation when unable to find a way out on every problem that is done. Saturation is caused by the weak memory of the brain in storing any formulas and materials read. Each brain has a different memory. Therefore, the increase in memory in the brain needs to be improved by reading and doing many calculation problems (numbers).

### *2) Limited Availability Of Learning Support Media*

The availability of learning support media greatly influences the development of one's competency level. Learning support media such as books, journals, articles, or magazines play an important role in the process of updating information on the brain. In addition, learning support media will help one to improve the competence of a field. The limitations of media and learning facilities can decrease learning motivation[7]. It happens because when a person is at high saturation level due to not being able to solve a matter of calculation, will directly look for reference material to help him.

Supporting media such as books and journals is the main learning media that is able to open a person's mindset. The level of accuracy of learning media such as books and journals has high relevance compared to other learning media[1]. If the learning media is not available, then the brain will be more difficult to bias progress toward a higher level of thinking. In addition, someone will find it easier to understand everything they read and do. It happens because the thermodynamic material that is mostly related to the question of calculating the numbers is complex and comprehensive.

### *3) Effectiveness Of Mind Mapping Method As An Alternative To Solving The Problem Of Low Of Thinking Pattern And Competence*

Data computations through the T-test with the help of SPSS 21.0 for Windows show the most significant differences in the control class and in the experimental class. In the experimental class, an average mean analysis of the experimental end-of-pairs obtained 81,30. While the average class of control is 75,66. The results of these values indicate that the results of the effectiveness test of  $H_0$  are rejected so that it concludes that there is a significant difference between the experimental end test results and the experimental results. From the above description it can be understood that the learning outcomes of students of excellence classes with mind mapping learning methods differ significantly with control classes that do not use mind mapping learning methods.

It is in accordance with Sana's statement that mind mapping method can improve the pedagogic ability for teachers. In addition, mind mapping has a significant influence

to develop the ability to analyze the complex. Learning by using mind mapping will stimulate the brain to think creative and able to analyze each problem by its components[8]. Mind mapping can also be used as an evaluation tool to measure a person's ability to make decisions. In other cases, the increase in the level of one's analysis increases dramatically by frequently making notes using the mind mapping model[5].

Mind mapping that directly connects the right brain and left the brain, capable of producing imaginary outcomes in accordance with the context being observed. The power of the brain develops when often get a response in the form of analysis that requires a person to think ahead. That is, the brain will store all the things and materials received well and complete[7]. Therefore, mind mapping method is an effective way to improve the ability of teachers and students.

## V. CONCLUSION

Based on the results of the discussion, in this study can be concluded. First, the difficult thermodynamic material of the technique involves newton's law and the law of gravity, the equilibrium of the two-dimensional style, the equilibrium of the three-dimensional style, the method of section model, the centers of mass and centroids, the phenomenon of beams affects, the phenomena of beams affects, and the potential energy stability. Second, the factors causing the low competence and mindset of students in the thermodynamic course of engineering include the weak level of ability to analyze the calculation, limited availability of learning support media, and effectiveness of mind mapping method as an alternative to problem-solving the low pattern of think and competence. Third, mind mapping method proved effective as an alternative to solving the problem of low thinking pattern and student's competence in thermodynamics technique.

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