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Needs Analysis of Thinking Style and Higher Order Thinking Skills for Solving Problems in Producing Products

Nuraffefa Hamdan[1], Yee Mei Heong[2*], Saiful Hadi Masran[3], Badaruddin Ibrahim[4], Tee Tze Kiong[5], Kok Boon Ching[6], Nurulwahida Azid[7]

[1,2,3,4,5]Faculty of Technical and Vocational Education,
Universiti Tun Hussein Onn Malaysia, 86400, Parit Raja, Batu Pahat, MALAYSIA

[6]Faculty of Engineering Electrical dan Electronic,
Universiti Tun Hussein Onn Malaysia, 86400, Parit Raja, Batu Pahat, MALAYSIA

[7]School of Education and Modern Languages,
Universiti Utara Malaysia, 06010, Sintok, Kedah, MALAYSIA

*Corresponding Author

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Abstract: Problem solving is a practical method that aims to generate ideas to form some more practical and effective solutions. The generation of ideas in producing products requires complex thinking which is regarded as higher order thinking skills (HOTS). The purpose of this study was to analyse the need for students' thinking style and HOTS to solve problems in producing products. This study adopted descriptive design using quantitative approach. A total of 895 technical students at Sultan Abdul Halim Muad'zam Shah Polytechnic were randomly selected as the study sample. A set of questionnaires was developed as the research instrument. Data were then analysed using SPSS software and presented in the form of frequency and percentage. The findings show that 85.5% of students faced problems while solving tasks in the form of problem solving in producing products. The most common problem faced by students when completing tasks in producing products was finding ideas to develop a product. The factors that caused difficulties in solving problems for the production of a product were lack of specialized skills, lack of knowledge of specialized skills, and lack of specialized training. As a result, the students have difficulty in problem-solving during producing products. However, 89.4% of students perceived that they need knowledge of thinking style and HOTS that provide a complete description of work steps to solve problems in product production. These findings have implications on encouraging students to acquire and improve thinking style and HOTS to solve problems in producing products.

Keywords: Thinking style, higher order thinking skills, problem solving, producing product

1. Introduction

The world has entered an era of fourth-generation industry, characterized by the increased connectivity, interaction, and development of digital, artificial, and virtual systems. With the growing boundaries between humans, machines, and other resources, information and communication technology are certainly impacting various sectors, including the education system. Education 4.0 is a new experience-based education system that uses digital technology instead of a memorization-based system and meets the needs of the new world through personalized education. Education 4.0 is also a response to the needs of the Industrial Revolution 4.0, that is humans and technology come together to create new opportunities creatively and innovatively. Fisk (2017) explains that the new vision of learning encourages students to learn not only the skills and knowledge required, but also to identify resources to learn these skills and knowledge.

*Corresponding author: mhyee@uthm.edu.my

The Ministry of Education (MOE) streamlines the education system at the tertiary level through the Malaysian Education Blueprint (MEB) (2015-2025) which aims to improve students' skills to meet the needs of the industry (MOE, 2015). MOE has launched the MEB 2015-2025 (HE) on 7 April 2015 as a guideline to meet the challenges to the country's higher education system. MEB (HE) outlines 10 shifts to achieve its system aspirations and student aspirations. The goal of the 4th shift in MEB (HE), which is the quality of TVET graduates, is to provide a main TVET education to improve skills to meet the demand and increase the opportunities for career advancement.

According to Abdullah (2019), education systems around the world are increasingly emphasizing various skills in the curriculum, to prepare students for the complex challenges of the 21st century as well as technical education into the whole system (Janet, Kimberly & Ken, 2010). Students who master 21st century skills with critical, creative and innovative thinking abilities, and skills can compete globally (Ismail, Sidek & Mahbib, 2015). The goals of the National Higher Education Strategic Plan (PSPTN) also want to produce employees with a first-class mentality characterized as human capital that can meet the needs of individuals, families, communities, countries, and the world (Ministry of Higher Education, 2012).

The skills that every graduate needs to have are the skills in producing products or apprentice (Rusmin, 2015). The development of innovative and creative products requires innovation that plays a role in strengthening the economy of a country (Elizondo et al, 2010). Innovative product design starts from the idea generation stage to apply all the ideas including materials, tools, and processes to produce a prototype product (Hatib, Fairus & Mohd., 2009).

Problem-solving is still an aspect in 21st century pedagogy (Abdullah, 2019). Problem-solving is a practical method that aims to generate a variety of thoughtful ideas to form some more practical and effective solutions (Ismail & Atan, 2011). Through the initial report of MEB 2015 2025 each student must master various cognitive skills such as problem solving and reasoning that is able to predict problems and approach issues critically, logically, inductively, and deductively to find solutions, and ultimately make decisions.

Thinking Skills (TS) in problem-solving will guide each individual using smart problem-solving steps and produce thoughtful ideas in design thinking, opinions, precise arguments and have a high level of creativity in daily life especially for a student. According to Sulaiman et al. (2011), TS refers to the ability to use the intellect to carry out thinking processes. TS whether in terms of conceptualizing ideas, problem-solving, or decision making is important in the daily life and career of students in the future (Chew & Nadaraja, 2014). TS especially high level is very necessary to be integrated and applied when we try to understand something information that will be used for the generation of ideas (Yee at al., 2010).

In this era of globalization, HOTS such as problem-solving skills, critical thinking skills, analysing, evaluating and so on are very important elements in processing the information obtained to generate a new idea in daily life (Marshall & Horton, 2011). The definition of HOTS according to MOE (2015), is the ability to use knowledge, skills and values in understanding and reflecting to solve problems, make decisions, innovate and create something. According to Kings, Goodson, and Rohani (2013), HOTS is the ability to think that not only requires the ability to remember, but also a higher ability. To apply HOTS to solve problems effectively, an individual's thinking style needs to be identified first.

Thinking style is not by itself good or bad, but it is a comfortable way of thinking for human beings (Nazarifar et al, 2011). Thinking style includes intellectual style which also includes cognitive style, learning style and problem-solving style (Zhang & Sternberg, 2006). Fouladi & Sahidi (2016) argue that thinking style is a mental framework that describes how information processes and ability to solve problems in special situations. Navan & Mehdi (2015) also think that understanding various thinking styles helps students adapt their thinking to different thinking styles and at the same time succeed in communication. In recent decades, intellectual style, especially thinking style, has been considered a determinant variable in academic achievement (Lei, 2018; Saif, 2017; Sadeghi et.al, 2017).

1.1 Higher Order Thinking Skill and Thinking Style

In the world of work, the quality and quantity of work are desired by any employer. According to the preliminary MEB report 2015-2025, interviews that have been conducted with employers and industry leaders indicate that there is widespread concern about the extent to which students are equipped with the right skills to succeed in modern society. In particular, employers are concerned about the lack of high-level thinking skills such as problem-solving and creative thinking, and the level of English proficiency of graduates. Other than that, employers report that some graduates lack critical thinking skills (MOE, 2015). This is supported by the study of Ramlan (2012) who stated that skilled manpower and k-workers are weak in solving problems and these problems make it difficult for graduates to get jobs. Study conducted by Shuib (2007) also found that 50%, namely 17 employers agree graduates lack of TS and 47.1% of employers say graduates lack the skills to generate ideas spontaneously.

The findings of Yee (2015) study found that many students have trouble generating ideas whether the idea is used to produce concrete or abstract products. This is supported by the study of Yee et al. (2010) which was conducted on 246 students of Technical Education faculty showed that students perceived the level of difficulty generating concrete ideas in the production of a project is high. Students struggle to produce the final product even though they have a good idea and enough time to produce it, yet they often change concepts when faced with problems in completing assignments (Jansen van Rensburg, 2011). Meanwhile, the study of Md Yunos et al. (2010) also shows that the majority of technical students have difficulty generating ideas while completing individual coursework assignments.

Students find it difficult to initiate ideas. Most students only think of producing good products without measuring their actual capabilities (Mohd Amin & Saud, 2008). This is supported by Chen (2011) who states that students consider the most difficult task in the design process is idea generation. Students also experience the problem of a lack of skills in generating ideas in the learning process and daily life. This statement is in line with the study of Yee et al. (2011) conducted on 131 technical students, that is 34.9% of students stated that the difficulty factor in generating ideas to complete individual coursework assignments among technical students is the lack of specific skills. Students often only make improvements to existing products without producing a new invention (Mohd Amin & Saud, 2008). This shows that students lack skills in producing products despite having ideas.

The teaching and learning process in the classroom places more emphasis on memorized learning and focuses more on learning content and causes students to memorize the knowledge learned rather than analyse and synthesize the true meaning of the knowledge learned to solve problems (Rodzalan & Saat, 2015). Most students master memorization skills more than thinking skills (Syed Mohd Yamin, 2007). Lack of knowledge about problem-solving and related principles will cause students to have trouble understanding design concepts and practices (Ozturk, 2010; Smith, Hedley, and Molloy, 2009). Chen (2011) emphasizes that design education cannot be delivered only through conventional teaching methods.

Students rarely use HOTS to generate ideas resulting in them having problems in completing coursework assignments (Yee et al., 2010). The findings of this study are in line with the survey conducted by (Md Yunos et al., 2010), on 375 students from the Malaysian Technical University explained that as many as 85.1% of students have difficulty generating ideas when completing coursework assignments individually. Students are unable to identify problems, generate, classify, apply, categorize ideas, and are unable to justify the work produced (Wardi, 2016). Shuib's (2007) study also states that most students are less able to think outside the box and generate ideas intuitively and spontaneously.

A report from Kestrel Education Consultants from England and 21st Century School from the United States in 2011 stated that high-level thinking among teachers and students in Malaysia is still low (MOE, 2012). A study conducted by the Higher Education Leadership Academy (AKEPT) in 2011 as recorded in MEB 2013-2025 (2012) revealed that only 50 percent of the 125 lessons observed in 41 schools throughout Malaysia involving students with HOTS. The main reason for this problem is insufficient exposure and lack of resources to teach adequate HOTS in Malaysian schools and institutions of higher learning (Ravinder, 2013).

In general, teachers know that HOTS need to be practiced through lessons to improve student achievement (Sulaiman et al., 2017). Several studies conducted by Puteh et al., (2012) have shown that lecturers have an awareness of the importance of HOTS in teaching and learning, yet they lack knowledge and lack skills to apply HOTS in teaching and learning. Emphasis on exams has caused teachers to pay less attention to student TS instead focus on efforts to complete the syllabus as well as mastery of techniques to answer exam questions (Ismail & Mahamod, 2016).

To apply HOTS to solve problems effectively, the thinking style of an individual needs to be identified first but the study conducted by Kanesan Abdullah et al., (2012)) stated that technical students do not master the thinking style well. According to Ali & Noordin (2010), one of the causes of the problem is the lack of emphasis on teaching thinking style during the teaching and learning process. This can be evidenced by a survey study conducted on 300 technical students in polytechnics which showed that 162 people (54%) technical students perceived they have a low level of knowledge of critical and creative thinking style. A total of 166 (55.3%) technical students also perceived that they have a low level of application of critical and creative thinking styles. Therefore, one of the causes of the problem is the lack of emphasis on teaching thinking style during the teaching and learning process (Ali & Nordin, 2010). Therefore, thinking style and HOTS are important elements for an individual to be able to identify their own strengths and weaknesses, especially in problem-solving issues.

The specific objectives of this study are to:

(i) identify the existence issues for solving problems in producing products.
(ii) identify the factors of difficulty solving problems in producing products.
(iii) identify the needs of thinking style and HOTS for solving problems in producing products.

2. Methodology

The research conducted is research that uses quantitative survey methods for the data collection on the need for thinking style and HOTS to solve problems in producing products among technical students. The survey design was chosen in this study because the survey design was used to measure attitudes, style or achievement (Wiersma & Jurs, 2005). This survey has a wide scope and is useful for presenting examples that illustrate the characteristics of the study. The population of this study is Diploma students in Civil Engineering, Electrical and Electronics and Mechanics located in the north of Malaysia. The sample of this study consisted of 895 randomly selected students.

A set of questionnaires was used as a research instrument to collect all the study data. The use of questionnaires can provide more accurate results or data because when they give answers they do not have to rush (Chua, 2006). The use of questionnaires in the study is appropriate due to time constraints and respondents are not influenced by the researcher's behaviour. In addition, the use of questionnaires can increase the accuracy and truth of the response to the stimulus of a given question (Mohd Majid, 1990).

The questionnaire is divided into four parts, namely Parts A, B, C, and D. Part A is formed to obtain the background of the study respondents. Among the items found in Part A are gender, age, field, and year of study. Sections B, C, and D are the questions that determine the respondents' agreement on each research question. The four parts of the survey form for this study are as shown in Table 1.

Table 1 - Four parts of the questionnaire form

Parts	Items	Number of Questions
A	Demographic Information of Respondents	4
B	Existence Issues for Solving Problems in Producing Products	32
C	The Factors of Difficulty Solving Problems in Producing Products.	13
D	The Needs of Thinking Style and HOTS for Solving Problems in Producing Products	13

The items formed in Sections B, C, and D use the Likert scale. The Likert scale method is suitable for use in this study because the Likert scale is an inventory that shows the consent of the respondents by using the scale set from one extreme level to another extreme level (Wiersma & Jurs, 2005). The Likert scale is shown in Table 2.

Table 2 - Likert scale

Perception	Scale
Strongly Disagree (SD)	1
Disagree (D)	2
Neutral (N)	3
Agree (A)	4
Strongly Agree (SA)	5

However, in data analysis, the Likert scale will be broken down into two perceptions, namely "disagree" and "agree". The data results from the perception of "strongly disagree", "disagree" and "neutral" will be categorized in the perception of "disagree". While the data from the perception of "agree" and "strongly agree" will be categorized in the perception of "agree".

The reliability of both the types of selected items and the grade items was tested using the test-retest method. Since the choice item has a nominal scale and the rank item has an ordinal scale, then the reliability value for the choice item is obtained through Cramer V correlation test. The reliability value for grade item is obtained through Spearman Rho correlation test. The results of Cramer V correlation test and Spearman Rho correlation test showed that there was a significant positive relationship between the score of the first questionnaire with the score of the second questionnaire for each option item and grade item. This means that all of the items are appropriate and reliable to obtain a stable score.

3. Result and Discussion

Descriptive statistics such as frequency and percentage have been used to explain the distribution of data and also to answer research questions. All data analysis was done with the help of SPSS version 2.1 software.

3.1 Existence Issues for Solving Problems in Producing Products

The results of the study in Table 3 shows that students face problems while solving tasks in the form of problem-solving in producing products. One of the factors causing poor problem-solving ability by students can be seen when it is found that students do not fully understand the problem, do not master the strategies to be used in solving problems in product production, ignore the information provided, and ignoring the answer scoring criteria (Saragih, 2011). The various causes give the impression that students are not accustomed to solving problems by relating the various concepts they have learned. Therefore, it is not surprising that students are better at solving routine problems about facts and procedures than solving non -routine questions which are questions that require students to think critically and creatively.

This study is in line with the study conducted by Yee et. al (2016) also shows that students face difficulty solving problems in teaching and learning (T&L). This study also argues that the difficulty of problem-solving causes students to face problems in completing group coursework assignments.

Table 3 - Existence of issues to solve problems in product production

No	Items	Disagree		Agree	
		f	%	*f*	%
1.	Solve tasks in the form of problem solving.	140	15.6	755	84.3
2.	Solve tasks in the form of problem solving in producing products.	130	14.5	765	85.5

The results of the study in Table 4 show that the most common problem faced by students while completing problem-solving tasks are to understanding the entire existing problems, followed by finding alternative solutions to a problem, relate ideas to describe a problem and looking various inputs to create new ideas or results that are better than before in problem-solving. This problem occurs due to the teaching and learning process in the classroom which places more emphasis on rote memorization learning and focuses more on learning content and causes students to memorize the knowledge learned instead of analyzing and synthesizing the true meaning of the knowledge learned to solve problems (Rodzalan & Saat, 2015). Problem solving skills do not necessarily develop naturally, they need to be explicitly taught in a way that can be transferred across multiple settings and contexts.

This study is in line with the study conducted by Ogunleye (2009), the difficulty of students in solving problems in learning is the lack of understanding of the problem. A study conducted by Siswanto & Saefan (2013) also showed that students have difficulty in solving problems because they have difficulty in understanding the problem and do not know the strategy to solve the problem. When students do not understand a problem, they like to make guesses without going through a thought process to solve the problem.

Table 4 - The descending order of problems faced by technical students while completing assignments in the form of problem solving

No	Items	Disagree		Agree	
		f	%	*f*	%
1.	Understanding the entire existing problem.	123	13.7	772	86.3
2.	Find alternative solutions to a problem.	128	14.3	767	85.7
3.	Relate ideas to describe a problem.	130	14.5	765	85.5
4.	Looking various inputs to create new ideas or outcomes that are better than before in problem-solving.	132	14.7	763	85.3
5.	Make appropriate judgments about something.	134	15.0	761	85
6.	Analyze a problem carefully before performing a task.	135	15.1	760	84.9
7.	Looking for various inputs to create new ideas or results that are better than before in decision-making.	141	15.8	754	84.2
8.	Relate facts to explain a problem.	146	16.3	749	83.7
9.	Pay attention first to a matter or issue discussed before giving an idea.	152	17.0	743	83.0

The results of the study in Table 5 show that the most common problem encountered when completing tasks in the form of problem-solving in the producing products is to find ideas to develop a product. This problem is followed by visualizing an idea in producing a product, using various techniques (for example: idea generation) to solve problems in producing products and comparing the ideas produced in producing products. This is because the attitude of students who are too dependent on others can make it difficult for them to come up with creative ideas and quality projects (Roya & Mahmood, 2011). This situation causes students to fail to think critically and creatively (Ismail & Mahamod, 2016).

This study is in line with the study conducted by Yee et al., 2010 showed that students have a high level of difficulty in producing projects (concrete ideas), and a moderate level of difficulty in completing written assignments (abstract ideas) for engineering education subjects. Moreover, through the findings of a pilot study conducted by (Wardi & Kahn, 2016), a major issue in the design process has been identified that students have no idea in making designs.

Table 5 - The descending order of problems faced by technical students while completing tasks in the form of problem solving in producing products

No	Items	Disagree		Agree	
		f	%	*f*	%
1.	Find ideas to develop a product.	134	15.0	761	85.0
2.	Visualize an idea in producing a product.	141	15.8	754	84.2
3.	Using various techniques (for example: idea generation) to solve problems in producing products.	150	16.8	745	83.2
4.	Comparing the ideas produced in producing products.	154	17.2	741	82.8
5.	Use existing knowledge to solve problems in producing products.	158	17.7	737	82.3
6.	Problem-solving using the skills required in producing products.	160	17.9	735	82.1
7.	Submit opinion to generate good ideas in product production.	170	19.0	725	81.0
8.	Completing coursework assignments due to difficulty solving problems.	171	19.1	724	80.9

3.2 Factor of Difficulty Solving Problems in Producing Products

Table 6 shows that the descending order of problem-solving difficulty factors in producing products, is lack of specific skills such as generating ideas, thinking skills, problem-solving skills, producing products skills, and reference material finding skills. The results of the study also showed that most students perceived they do not have knowledge of problem-solving skills, followed by idea generation skills, thinking skills, product production skills and reference material finding skills. The students thought that they do not have training in using thinking skills, followed by idea generation skills, problem solving skills, product production skills and reference material finding skills.

The results of the study show that students do not have the skills to generate ideas to solve problems in product production. This statement is in line with the study of Yee et al. (2011) conducted on 131 technical students, that is 34.9% of students stated that the difficulty factor in generating ideas to complete individual coursework assignments among technical students is the lack of specific skills. A study conducted by Wardi & Kahn (2016) also showed that the inability of students to generate new ideas in the design process is due to idea generation skills and techniques not being taught. This shows that students lack skills in producing products despite having ideas.

In addition, the results of the study show that students do not have the knowledge of problem -solving skills to solve problems in product production. Lack of knowledge of problem solving and related principles will cause students to have difficulty understanding the concepts and practices of design (Ozturk, 2010; Smith, Hedley and Molloy, 2009). Therefore, knowledge of 21st century skills is important for teachers and students to be able to master the learning and teaching activities in the classroom in a way that is not boring and fun.

The results of the study also show that students do not have training in using family planning to solve problems in the production of products. Studies conducted by a number of scholars have reported that some Indonesian students have inadequate thinking skills, due to lack of training and practicality (Indah, 2017; Velayati, Muslem, Fitriani, & Samad, 2017). A study conducted by Yee et al., (2012) on 242 academic staff of University Tun Hussein Onn Malaysia (UTHM) also argued that the KB learned by students in lecture learning is insufficient and not detailed. This means that often, we are trained to apply knowledge but are not taught how to come up with creative ideas and solutions.

Table 6 - The descending order of factors of difficulty solving problems in product production

No	Items	Disagree		Agree	
		f	%	*f*	%
1.	Does not have **specific skills** such as:				
	a) Idea generating skills.	145	16.2	750	83.8
	b) Thinking skills.	166	18.5	729	81.5
	c) Problem solving skills.	177	19.8	718	80.2
	d) Producing products skills.	221	24.7	674	75.3
	e) Reference material finding skills.	241	26.9	654	73.1

2.	Lack of **knowledge** of specific skills such as:				
	a) Problem solving skills.	121	13.5	774	86.5
	b) Idea generating skills.	154	17.2	741	82.8
	c) Thinking skills.	160	17.9	735	82.1
	d) Producing products skills.	167	18.7	728	81.3
	e) Reference material finding skills.	169	18.9	726	81.1
3.	No **training** using:				
	a) Thinking skills.	165	18.4	730	81.6
	b) Idea generating skills.	180	20.1	715	79.9
	c) Problem solving skills.	204	22.8	691	77.2
	d) Producing products skills.	209	23.4	686	76.6
	e) Reference material finding skills.	212	23.7	683	76.3

3.3 The Needs of Thinking Style and HOTS for Solving Problems in Producing Products

The results of the study showed that 88.2% (789 people), students agreed to solve problems in producing products should use the integration of Thinking Style and HOTS. These findings are in line with the findings of one of the specific items showing that a total of 86.6% (775 people) stated that they need the Integration of Thinking Style and HOTS in solving problems while completing coursework assignments in the form of producing products. This is because most students, which is 89.7% (803 people) think that the Integration of Thinking Style and HOTS need to be learned to improve problem solving skills in producing products. Therefore, a total of 89.4% (800 people) agreed that students need a Thinking Style Integration and HOTS manual that provides a complete description of work steps to solve problems in producing products.

According to Hamdan et.al (2019), the use of HOTS Self-Instructional Manual allows students to compare, contrast, organize, classify and identify the causes and consequences according to their own views and opinions in completing the assignment. While, through thinking style self-instructional manual, students have the opportunity to understand their strengths and weaknesses in the learning process. In addition, this manual can accommodate individual differences based on their learning abilities, interests and level of application (Hamdan et.al, 2021). Thus, it can be concluded that the integration of thinking style and HOTS play an important role in improving student achievement. The implication is that learning the integration of thinking style and HOTS brings two simultaneous benefits for students from the aspect of achievement to solve problems in product production.

Table 7 - Distribution of thinking style and Higher Order Thinking Skills (HOTS) requirements to solve problems in product production

No	Items	Disagree		Agree	
		f	%	*f*	%
1.	`To solve the problem in producing products, I **need to use**:				
	a) Thinking Style.	151	16.9	744	83.1
	b) HOTS.	158	17.7	737	82.3
	c) Integration of Thinking Style and HOTS.	106	11.8	789	88.2
2.	I **need** a Thinking Style in solving problems while:				
	a) Completing coursework assignments in the form of producing products.	156	17.4	739	82.6
	b) Learning.	145	16.2	750	83.8
	c) Learning environment.	156	17.4	739	82.6
3.	I **need** a HOTS in solving problems while:				
	a) Completing coursework assignments in the form of producing products.	160	17.9	735	82.1
	b) Learning.	185	20.7	710	79.3
	c) Learning environment.	177	19.8	718	80.2
4.	I **need** an Integration of Thinking Style and HOTS in solving problems while:				
	a) Completing coursework assignments in the form of producing products.	120	13.4	775	86.6
	b) Learning.	167	18.7	728	81.3
	c) Learning environment.	177	19.8	718	80.2
5.	I **need to learn**:				
	a) Thinking Style in teaching & learning.	181	20.2	714	79.8
	b) HOTS in teaching & learning.	173	19.3	722	80.7
	c) Integration of Thinking Style and HOTS in teaching & learning.	129	14.4	766	85.6

6.	To **improve** problem solving skills in producing products, I need to learn:				
	a) Thinking style.	175	19.6	720	80.4
	b) HOTS.	185	20.7	710	79.3
	c) Integration of Thinking Style and HOTS.	92	10.3	803	89.7
7.	I need **a Thinking Style manual** that provides a complete description of work steps to solve problems in producing products.	172	19.2	723	80.8
8.	I need **a HOTS manual** that provides a complete description of work steps to solve problems in producing products.	178	19.9	717	80.1
9.	I need an **Integration of Thinking Style and HOTS manual** that provides a complete description of work steps to solve problems in producing products.	95	10.6	800	89.4

4. Conclusion

In conclusion, the findings of the study based on student opinion have shown that the majority of students face problems while solving tasks in the form of problem solving without producing products and students face problems to solve tasks in the form of problem solving in producing products. Therefore, the problem of difficulty solving in producing products should be addressed by learning how to solve the problem effectively through Thinking Style and HOTS. This is because problem solving is very important in helping students face problems to solve problems in producing products. Directly, difficulty solving will affect student academic achievement. In this regard, students need to be helped to acquire and improve Thinking Styles and HOTS to solve problems in producing products, either through conventional teaching and learning environments or individual self-learning manuals.

An alternative that can be used in solving problems in producing products is the self-learning manual. Through this manual, students have the opportunity to understand their strengths and weaknesses in the learning process. In addition, this manual can accommodate individual differences based on their learning abilities, interests and level of application. The approach of using self-learning manual, students can learn and be able to apply in solving problems according to their abilities. Based on the discussion from the findings of the study, researchers would like to suggest the use of self-learning manual integration of Thinking Style and HOTS to solve problems in producing products.

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