

# THE DEVELOPMENT AND EVALUATION OF THE QUALITIES OF THINKING SKILLS MODULE

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## ABSTRACT

*Using self-instructional modules could be an alternative approach and make significant contributions to teaching and learning. Module is a planned series of learning activities designed carefully to assist the learners to accomplish certain specific objectives based on individual differences, interest and capability on learning. An attempt to develop and implement a modular approach on teaching thinking skills was made in the secondary school. This paper will discuss various components of this modular approach by referring to Meyer Model. Fleiss's Kappa was used to determine the degree to which consensus agreement ratings vary from the rate expected by chance, with values greater than .60 indicating substantial non-chance agreement. Fleiss's Kappa for the inter-rater reliability score was  $\kappa = .6357$ , S.E. = .0990, 95% C.I. = .4416 to .8298, which can be taken to represent constant agreement among three raters for the instrument "Rating scale for the qualities of a module". The internal-consistency reliability value for the instrument "What you thought of the module" was  $\alpha = .89$  based on 38 students. Analysis on the qualities' evaluation revealed that eight raters showed an agreement on satisfactory level and above for all 34 items. Meanwhile, 36 students gave positive feedbacks on the format and content of the module.*

**Keywords:** *Self-instructional module, Thinking Skills, Evaluation, Quality.*

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## 1 INTRODUCTION

Learning activities should involve explicit thinking skills. It is more convenient to categorize thinking skills based on the existing frameworks. The framework that is still considered very useful and popular among educators is Taxonomy Bloom (1956). Bloom's Taxonomy of cognitive domain is categorized into six type of thinking skills (Meyer, 1988; Nor & Mohd Ramli, 1998; Othman, Selamat & Hashim, 2010). According to Tee *et al.* (2012a), lower order thinking skills are the level of knowledge, understanding and application, while the level of higher order thinking skills are analysis, synthesis and evaluation. However, a revised on Taxonomy Bloom had been done by Bloom's students, Anderson and Krathwohl in the year of 2001. There are some significant changes based on the revised taxonomy (Marzano, 2001). A revised on Taxonomy Bloom had been done by Bloom's students, Anderson and Krathwohl in the year of 2001. There are six type of thinking skills based on the cognitive domain in the taxonomy table, namely remember, understand, apply analysis, evaluate and create. The major differences in the updated version is in the more useful and comprehensive additions of how the taxonomy intersects and acts upon different types and levels knowledge -- factual, conceptual, procedural and metacognitive (Tee, *et al.*, 2012a).

## 2 TAKSONOMY ANDERSON AND KRATHWOHL (2001)

Bloom's taxonomy was revised by his former students, Lorin Anderson, working with one of his partners in the original work on cognition, David Krathwohl (Marzano & Kendall, 2007). The group redefining Bloom's original concepts, worked from 1995-2000. The group was assembled by Anderson and Krathwohl and included people with expertise in the areas of cognitive psychology, curriculum and instruction, and educational testing, measurement, and assessment (Tee, *et al.*, 2012a). Table 1 shows the cognitive process dimension (Anderson & Krathwohl, 2001).

**Table 1: The cognitive process dimension**

	<b>Categories &amp; cognitive processes</b>	<b>Alternative names</b>	<b>Definitions and examples</b>
1.	<b>Remember</b> –	Retrieve relevant knowledge from long-term memory	
1.1	<b>Recognizing</b>	Identifying	Locating knowledge in long-term memory that is consistent with presented material (e.g., Recognize the dates of important events in U. S. history.)
1.2	<b>Recalling</b>	Retrieving	Retrieving relevant knowledge from long-term memory (e.g., Recall the dates of important events in U. S. history.)
2.	<b>Understand</b> –	Construct meaning from instructional messages, including oral, written, and graphic communication.	
2.1	<b>Interpreting</b>	Clarifying, paraphrasing, representing, translating	Changing from one form of representation (e.g., numerical) to another (e.g., verbal) (e.g., Paraphrase important speeches and documents.)

**Table 1 (continued)**

Categories & cognitive processes		Alternative names	Definitions and examples
2.2	<b>Exemplifying</b>	Illustrating, instantiating	Finding a specific example of illustration of a concept or principle (e.g., Give examples of various artistic painting styles).
2.3	<b>Classifying</b>	Categorizing, subsuming	Determining that something belongs to a category (e.g., concept of principle) (e.g., Classify observed or described cases of mental disorders).
2.4	<b>Summarizing</b>	Abstracting, generalizing	Abstracting a general theme or major point(s) (e.g., Write a short summary of the events portrayed on a videotape).
2.5	<b>Inferring</b>	Concluding, extrapolating, interpolating, predicting	Drawing a logical conclusion from presented information (e.g., In learning a foreign language, infer grammatical principles from examples).
2.6	<b>Comparing</b>	Contrasting, mapping, matching	Detecting correspondences between two ideas, objects, and the like (e.g., Compare historical events to contemporary situations).
2.7	<b>Explaining</b>	Constructing models	Constructing a cause-and-effect model of a system (e.g., Explain the causes of important 18 <sup>th</sup> -century events in France).
3.	<b>Apply –</b>	Carry out or use a procedure in a given situation	
3.1	<b>Executing</b>	Carrying out	Applying a procedure to a familiar task (e.g., Divide one whole number by another whole number, both with multiple digits).
3.2	<b>Implementing</b>	Using	Applying a procedure to an unfamiliar task (e.g., Use Newton's Second Law in situations in which it is appropriate.)
4.	<b>Analyze –</b>	Break into its constituent parts and determine how the parts relate to one another and to an overall structure and purpose.	
4.1	<b>Differentiating</b>	Discriminating, distinguishing, focusing, selecting	Distinguishing relevant from irrelevant parts or important from unimportant parts of presented material (e.g., Distinguish between relevant and irrelevant numbers in a mathematical word problem).
4.2	<b>Organizing</b>	Finding coherence, integrating, outlining, parsing, structuring	Determining how elements fit or function within a structure (e.g., Structure evidence in a historical description into evidence for and against a particular historical explanation).
4.3	<b>Attributing</b>	Deconstructing	Determine a point of view, bias, values, or intent underlying presented material (e.g., Determine the point of view of the author of an essay in terms of his or her political perspective).

**Table 1 (continued)**

<b>Categories &amp; cognitive processes</b>	<b>Alternative names</b>	<b>Definitions and examples</b>
<b>5. Evaluate –</b>		Make judgments based on criteria and standards
<b>5.1 Checking</b>	Coordinating, detecting, monitoring, testing	Detecting inconsistencies or fallacies within a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented (e.g., Determine if a scientist’s conclusions follow from observed data).
<b>5.2 Critiquing</b>	Judging	Detecting inconsistencies between a product and external criteria, determining whether a product has external consistency; detecting the appropriateness of a procedure for a give problem (e.g., Judge which of two methods is the best way to solve a given problem.)
<b>6. Create –</b>		Put elements together to form a coherent or functional whole, reorganize elements into new pattern or structure.
<b>6.1 Generating</b>	Hypothesizing	Coming up with alternative hypothesis based on criteria (e.g., Generate hypothesis to account for an observed phenomenon).
<b>6.2 Planning</b>	Designing	Devising a procedure for accomplishing some task (e.g., Plan a research paper on a given historical topic).
<b>6.3 Producing</b>	Constructing	Inventing a product (e.g., Build habitats for a specific purpose).

## **2.1 The Action Verbs Widely Used**

These are the skills that every educator needs to develop in his or her teaching every day. Students should be exposed and taught about these verbs in schools to help them learn and achieve better grades.

### **2.1.1 Remember**

The skills demonstrated at this level are those of:

- (i) Observation and recall of information
- (ii) Knowledge of dates, events, places
- (iii) Knowledge of major ideas
- (iv) Mastery of subject matter

These are some great ideas for activities that will develop the “remember” level of thinking. Here are some of the activities:

- (i) List main points of the topic.
- (ii) Match the characteristics with the pictures.
- (iii) Identify the main characteristics.
- (iv) Recall the important details by referring to the given pictures.
- (v) Match the main statements with the supporting details.

## **2.2 Understand**

The skills demonstrated at this level are:

- (i) Interpretation of facts, compare, contrast
- (ii) Order, group, and infer causes
- (iii) Understanding information
- (iv) Grasping meaning

These are some great ideas for activities that will develop the “understand” level of thinking. Here are some of the activities:

- (i) Interpret pictures of tools from the given passage.
- (ii) Explain selected ideas or parts from the text in own words.
- (iii) Draw a picture showing what happened before and after from a given topic.
- (iv) Write a sentence explaining what happened before and after from a given text.
- (v) Construct a pictorial time line which summarizes what happens in the procedures from a passage.
- (vi) Explain opinion at the beginning, middle and end of the text.

## **2.3 Apply**

The skills demonstrated at this level are:

- (i) Use information
- (ii) Use methods, concepts, theories in new situations
- (iii) Solve problems using required skills or knowledge

These are some great ideas for activities that will develop the “apply” level of thinking. Here are some of the activities:

- (i) Classify the characters as human, animal, or thing.
- (ii) Transfer a main character to a new setting.
- (iii) Act based on the given script.
- (iv) Select a main point from the text and explain why you choose it.
- (v) Think of a new method based on the text and explain what you would have handled it differently.
- (vi) Give real examples based on the passage.

## **2.4 Analyze**

The skills demonstrated at this level are:

- (i) Seeing patterns
- (ii) Organization of part
- (iii) Recognition of hidden meanings
- (iv) Identification of components

These are some great ideas for activities that will develop this “analyze” level of thinking. Here are some of the activities:

- (i) Identify general characteristics (main or implied) from the given text.
- (ii) Distinguish what could happen from what couldn't happen in the passage in real situation.
- (iii) Select parts of the text based on the chosen characteristics.
- (iv) Differentiate fact from opinion.
- (v) Compare and/or contrast two of the main points.
- (vi) Select an action from the passage that was exactly the same as something other would have done in real life.

## **2.5 Evaluate**

The skills demonstrated at this level are:

- (i) Assess value of theories
- (ii) Make choices based on reasoned arguments
- (iii) Verify value of evidence
- (iv) Recognize subjectivity
- (v) Compare and discriminate between ideas

These are some great ideas for activities that will develop this “evaluate” level of thinking. Here are some of the activities:

- (i) Decide which sentence is the most important point from the text and explain why.
- (ii) Judge the validity of the main points.
- (iii) Decide if the incident from the text really could have happened and justify why.
- (iv) Consider how this skill can help one in the real situation.
- (v) Appraise the value of the incident from the text.
- (vi) Compare this incident with another one.
- (vii) Write a recommendation as to why the book should be read by others or not.

## **2.6 Create**

The skills demonstrated at this level are:

- (i) Generalize from given facts
- (ii) Relate knowledge from several areas
- (iii) Predict, draw conclusions
- (iv) Use old ideas to create new ones

These are some great ideas for activities that will develop this “create” level of thinking. Here are some of the activities:

- (i) Create a story from just the title before the passage is read. Use this as a pre-reading exercise.
- (ii) Rewrite several new titles for the text.
- (iii) Advertise the story on a poster to make people want to read it.
- (iv) Restructure the main points from the text.
- (v) Imagine that you are involved with the incident from the passage.
- (vi) Create an original character and weave him/her into the existing story.
- (vii) Write a lyrics or music to a song based on the text.

## **3 MEYER MODEL FOR DEVELOPING A MODULE**

The development of Thinking Skills module was based on Meyer Model (Figure 1).

### **3.1 The Fundamental Characteristics of Modules**

Based on Meyer (1988), modules meet the conditions necessary for effective learning. This occurs because modules have certain fundamental design characteristics which have emerged through the application of ideas from the theory of learning. In summary these characteristics are as follows:

- (i) Essentially self-contained
- (ii) Self-instructional
- (iii) Concern for individual differences
- (iv) Statement of objectives
- (v) Optimal association, sequence and structure of knowledge
- (vi) Utilization of a variety of media and methods
- (vii) Information provided on progress (feedback)
- (viii) Immediate reinforcement of responses
- (ix) Active participation by the learners
- (x) Mastery evaluation strategy

### **3.2 The Components of a Module**

Most modules are designed on similar principles and Meyer (1988) listed the components of a module as bellow:

- (i) Instructional on how to use the module
- (ii) Statement of purpose and aim
- (iii) List of pre-requisite skills
- (iv) List of instructional objectives expressed in performance terms
- (v) Diagnostic pretest
- (vi) List of equipment and other resources required
- (vii) Sequenced instructional activities
- (viii) Mastery post test

### **3.3 Overall Steps in the Trailing Procedure**

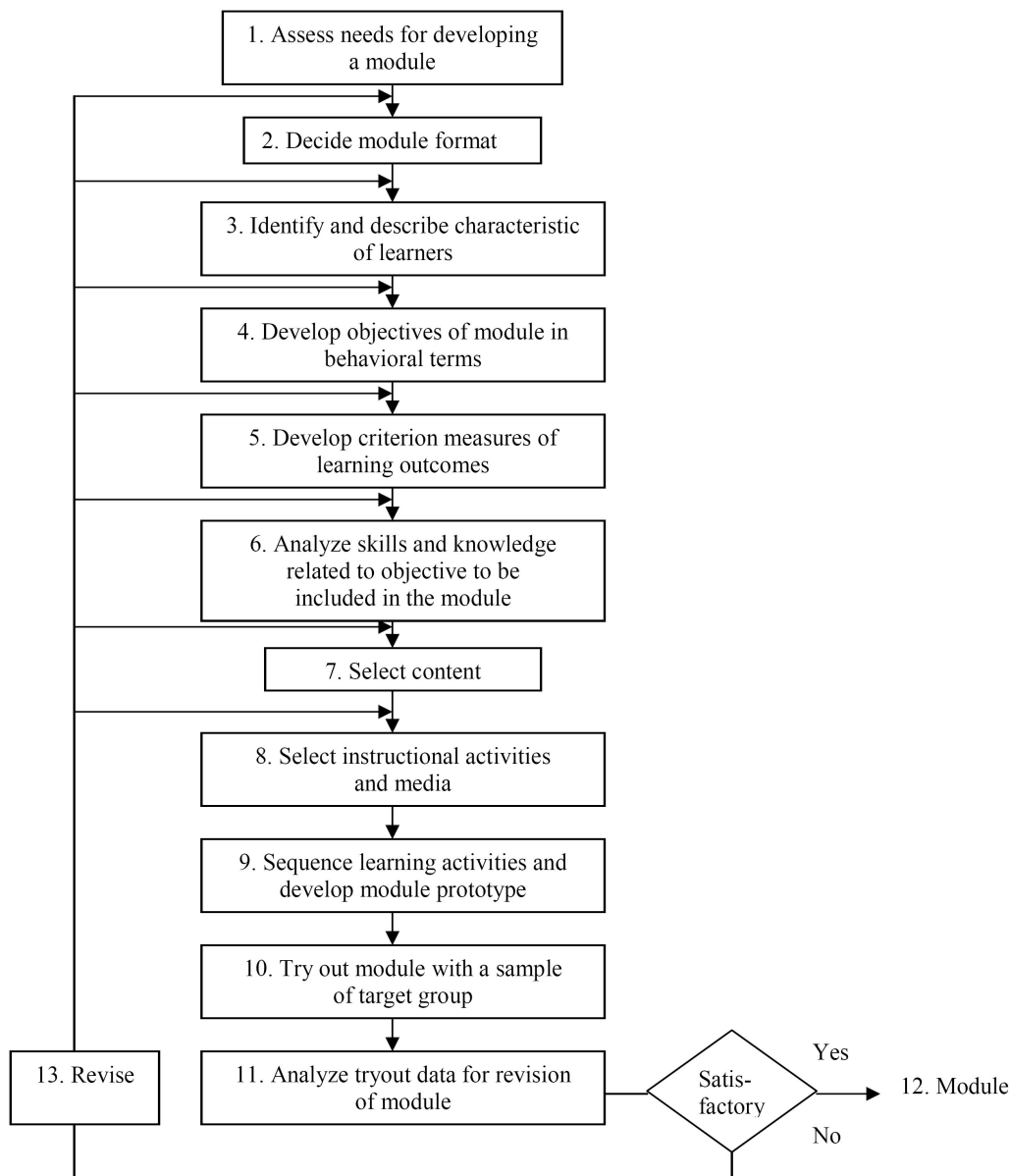
The trailing and validation of draft learning materials, including modules, usually follow a three steps process including Step 1: Judgment by peers; Step 2: Trail with small group of students, and Step 3: Trail with a representative class or classes. At each stage data are collected and used to modify the material. The data may suggest the need for a total rewrite



which implies the preparation of what is virtually a new draft which needs to be put through one or more phases of the process a second time. More often, however, the data indicate where amendments need to be made before the process proceeds to the second or third stage.

### 3.4 Steps in design and development of a module

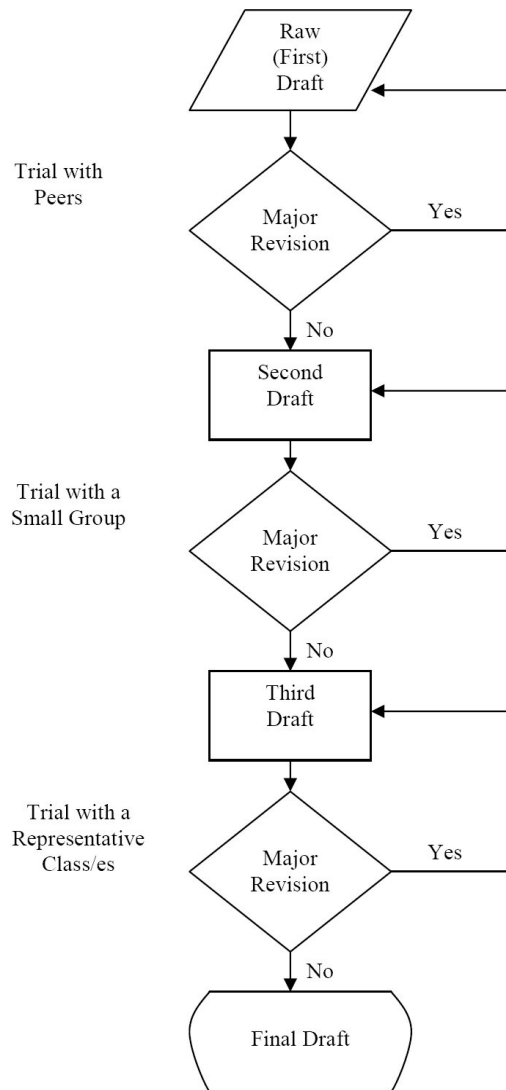
Figure 1 shows the steps in design and development of a module. There are 11 main steps on developing a module based on the Meyer Model.



**Figure 1: Steps in design and development of a module**

### 3.5 Steps In Trialling A Draft Module

At each stage data were collected and used to modify the draft module. Figure 2 shows the steps in trialling a draft module.



**Figure 2: Steps in trialling a draft module**

## 4 RELIABILITY

According to Wood (2007), the Kappa coefficient with the value 0 indicates agreement due to chance alone and 1 indicates perfect agreement. Fleiss's Kappa was used to determine the degree to which consensus agreement ratings vary from the rate expected by chance, with values greater than .60 indicating substantial non-chance agreement (Landis, 1977). Fleiss's

Kappa for the inter-rater reliability score was  $\kappa = .6357$ , S.E. = .0990, 95% C.I. = .4416 to .8298, which can be taken to represent constant agreement among three raters for the instrument “Rating scale for the qualities of a module”. The internal-consistency reliability value for the instrument “What you thought of the module” was  $\alpha = .89$  based on 38 students.

## 5 FINDINGS AND DISCUSSIONS

Eight raters (content and design experts) used the instrument to rate the qualities of the Thinking Skills module. Analysis of the raters showed an agreement on satisfactory level and above on all 34 items (Table 2). Based on the results, it shows that a good quality module could be produced by using Meyer Model. Anyway, time constraint as reported in Noordin (1994) study is one of the main factors to be considered as the whole process on developing the draft module consists of 60 small steps. Besides that, there are three steps to be followed in the trialling procedure. Trialling with small group and representative group using students as samples in the research could be difficult if it is not well planned (Tee *et al.*, 2012b). Module developer also needs to assure that the time allocated for the samples to go through the module is sufficient.

**Table 2: Rating scale for the evaluation of the qualities of Thinking Skills module (Experts)**

Title: Thinking Skills module				
QUALITY	Rating			
	VS (3)	S (2)	U (1)	VU (0)
3 = VS = Very Satisfactory				
2 = S = Satisfactory				
1 = U = Unsatisfactory				
0 = VU = Very Unsatisfactory				
Need	6	1	1	
Purpose	5	3		
Introduction	6	2		
Knowledge and skills required	4	4		
General aims	5	3		
General objectives	5	3		
Specific objectives	5	3		
Content is directly relevant	6	2		
Logical learning sequence	5	3		
Defined category	5	3		
Units	5	3		
Activities are appropriate	1	7		
Active participation and response		7	1	
Learning activity into small steps	4	4		
Input-process-output cycles	3	5		
Feedback questions and answer	2	6		
Feedback questions answered clearly	3	4	1	
Feedback questions interpreted	6	2		
Feedback statements.	6	2		
Reinforcement statements	2	5	1	
Visual elements	1	7		
Bridge passages	3	5		
Instructions	3	5		

**Table 2 (continued)**

Title: Thinking Skills module				
QUALITY	Rating			
	VS (3)	S (2)	U (1)	VU (0)
3 = VS = Very Satisfactory				
2 = S = Satisfactory				
1 = U = Unsatisfactory				
0 = VU = Very Unsatisfactory				
Layout	1	7		
Humour	4	4		
Consolidation passages	3	5		
overview of all main points	4	4		
Post test includes at least one item for each specific objective	4	4		
Form and wording	5	3		
Post test questions answered	2	6		
Results of the post test interpreted	4	3	1	
Motivate	1	7		
Length of time	6	2		
Well integrated		8		

After the experts (peers) have evaluated the draft module, corrections were made upon recommendations. Some input from the module were removed as the experts identified it is not suitable for the samples level. Meanwhile, typing errors and content ambiguity were also been changed. The trialling moved on to the second step after the peers evaluated and corrections had been made.

Three students (small group) were involved in this step. Responses on the module were collected using “*Sheet I – comment on general aspect*” and “*Sheet II – comment on the tasks*” in the module. Generally, samples highlighted typo errors and minor content ambiguity in the module. Corrections and improvements were made based on the second trialling and a newer version of the module was published and distributed to 36 secondary school students in a class. Table 3 and 4 show the students’ opinion on the module for format and content aspect.

Based on Table 3, more than 89.5% of the samples gave positive feedbacks on the format aspect, except for item 1 – more than one third of the samples do not like the size of the module. The samples preferred a smaller size of the module. They stressed that it would be easier for them to carry along the module if the size is smaller.

**Table 3: What you thought of the module (students - representative group) format aspect**

No.	ITEM	AGREE		DISAGREE	
		SA (3)	A (2)	D (1)	SD (0)
1	Size.	1	20	15	2
		2.6%	52.6%	39.5%	5.3%
		21		17	
		60.5%		39.5%	
2	Layout.	24	13	1	0
		63.2%	34.2%	2.6%	0%
		37		1	
		97.4%		2.6%	
3	Font.	24	12	2	0
		63.2%	31.6%	5.3%	0%
		36		2	
		94.7%		5.3%	
4	Propotion of diagrams and photos.	24	14	0	0
		63.2%	36.8%	0%	0%
		38		0	
		100%		0%	
5	Location of diagrams and photos.	27	10	1	0
		71.1%	26.3%	2.6%	0%
		37		1	
		97.4%		2.6%	
6	Tables.	19	15	4	0
		50.0%	39.5%	10.5%	0%
		34		4	
		89.5%		10.5%	
7	Text arrangement.	19	16	2	1
		50.0%	42.1%	5.3%	2.6%
		35		3	
		92.1%		7.9%	
8	Instructions.	19	16	3	0
		50.0%	42.1%	7.9%	0%
		35		3	
		92.1%		7.9%	
<b>Avarage</b>		<b>34</b>		<b>4</b>	
		<b>89.5%</b>		<b>10.5%</b>	

Based on Table 4, more than 84.2% of the samples gave positive feedbacks on all items for content aspect. Samples could understand the whole idea of the module and able to learn the types thinking skills with minimum assistance from others. They also found that using this module to learn a new topic is easier and more interesting.

**Table 4: What you thought of the module (students - representative group) content aspect**

No.	ITEM	AGREE		DISAGREE	
		SA (3)	A (2)	D (1)	SD (0)
9	Objectives.	16	20	2	0
		42.1%	52.6%	5.3%	0%
		36		2	
		94.7%		5.3%	
10	Easy to understand what expected to do.	14	22	1	1
		36.8%	57.9%	2.6%	2.6%
		36		2	
		94.7%		5.3%	
11	Work through without much difficulty.	16	19	3	0
		42.1%	50.0%	7.9%	0%
		35		3	
		92.1%		7.9%	
12	Understand the ideas.	20	18	0	0
		52.6%	47.4%	0%	0%
		38		0	
		100%		0%	
13	Able to answer quiz questions.	15	19	4	0
		39.5%	50.0%	10.5%	0%
		34		4	
		89.5%		10.5%	
14	Able to response on the requested tasks.	11	22	5	0
		28.9%	57.9%	13.2%	0%
		33		5	
		86.8%		13.2%	
15	The ideas were interesting.	26	12	0	0
		68.4%	31.6%	0%	0%
		38		0	
		100%		0%	
16	Words were easy to understand.	17	17	3	1
		44.7%	44.7%	7.9%	2.6%
		34		4	
		89.5%		10.5%	
17	Writing style.	21	16	1	0
		55.3%	42.1%	2.6%	0%
		37		1	
		97.4%		2.6%	
18	Free with unfamiliar words.	12	24	2	0
		31.6%	63.2%	5.3%	0%
		36		2	
		94.7%		5.3%	
19	Made it easy for me to study this topic.	23	15	0	0
		60.5%	39.5%	0%	0%
		38		0	
		100%		0%	

**Table 4 (continued)**

No.	ITEM	AGREE		DISAGREE	
		SA (3)	A (2)	D (1)	SD (0)
		28	9	1	0
20	Enjoy.	73.7%	23.7%	2.6%	0%
		37		1	
		97.4%		2.6%	
	<b>Avarage</b>	<b>36</b>		<b>2</b>	
		<b>94.7%</b>		<b>5.3%</b>	
	<b>Overall Average (Format and Content)</b>	<b>32</b>		<b>6</b>	
		<b>84.2%</b>		<b>15.8%</b>	

## 6 CONCLUSION

Self-instructional modules are very useful to educators and students. By using this Thinking Skills Module, students are able to learn the six thinking skills and apply it in study especially while taking tests and examinations. Moreover, students could learn on their own pace by using this self-instructional module.

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