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Research paper

Validity of Module Geographic Information System-Spatial Thinking Skills (GIS-STS)

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Abstract

Technological advancement in the realm of education is the process of transitioning from traditional Learning and Facilitation (L&F) to the 21st Century L&F. Geographic Information System (GIS) integration in Geography subjects is crucial in Malaysia to uphold and revive Geography subjects. Ergo, the Geographic Information System-Spatial Thinking Skills Module (GIS-STS) was developed as an intervention intended in improving the Spatial Thinking Skills (STS) and attracting students to Geography subjects. This study aims to analyze the validity of the content of the GIS-STS module. The content validity analysis utilizes the consensus assessment of seven experts. The findings exhibit that the value of the coefficient of the validity of the content is .930 and based on the sub module and the activity is .870. Hence, this proves that the GIS-STS module has a high content validity and is therefore suitable for implementation in secondary schools for Geography Form two students.

Keywords: *GIS-STS module; 21st century learning; Interest; Validity of content.*

1. Introduction

Geographic Information System (GIS) is an evolution of a critical mapping system in the 21st century globalization era. This system works in a way that it combines expertise in Geography, especially mapping with computers. The knowledge of GIS method is progressively important in one nation's development process. The integrating GIS into learning and Facilitation (L&F) geography is now a core element in designing the 21st century education system. Most schools in Malaysia only a priority in core subjects such as Malay, English, Mathematics and Science. On the other hand, Geography subjects frequently regarded by others as a difficult and humdrum subjects remain with conventional way of teaching. Integration of GIS in L&F has not yet been implemented in Malaysia [24].

Preceding studies have also reflected that the utilization of GIS in L&F Geography heightened student achievement and motivation to learn Geography [1]. In actuality, various studies have also proven that the use of GIS in Geography L&F improves spatial thinking skills [2-3, 5-6]. Thus, it is evident that the integration of GIS in Geography L&F in Malaysia is imperative in line with the objective of the Ministry of Education Malaysia towards 21st century education.

2. Literature Review

2.1. The Importance of GIS

Geography subjects in Malaysia are one of the subjects that faces less involvement of technology integration in comparison with other subjects such as science and mathematics. Therefore, this situation resulted in the lack of interest in Geography subjects [10]. In Malaysia, the use and importance of GIS in school is still reflected only in papers, articles and proceeding papers.

Spatial thinking becomes the major cognitive skills in Geography subjects [3-4, 11-12]. As a consequent, students' interest and motivation are expected to boost. According to [7], it proves that GIS is an efficient teaching aid in the classroom.

2.2. Geographic Information System Module - Spatial Thinking Skills (GIS-STS)

The module is defined as a set of teaching and learning that attends to a particular topic systematically and eventually to help the learners to be independent in order to master a learning unit easily and accurately [16, 20]. The GIS-STS module will be developed based on the Sidek Model which is a more comprehensive integration model in the creation of the module [16].

The cognitive Theory approach highlights mental processes and thoughts. This means that the information received, will be processed through selection, comparison and unification with other information contained in memory. Geospatial thinking is a cognitive process that occurs in the human mind. GIS technology will appreciate space-thinking skills among students [1, 14].

Constructivism Theory is also highly related to teaching and learning. According to Constructivism Theory, knowledge is actively synthesized by the thinker and not passively acquired knowledge from the teacher. Students will adapt any new information with their existing knowledge to create new knowledge in their minds with the support of social interaction with friends and teachers [18].

Meanwhile, Bloom's Taxonomy Theory is divided into three core affiliates which are cognitive domain, affective domain and psychomotor domain. Cognitive domains concern the thinking of students who emphasize on the intellectual elements that include knowledge, comprehension and thinking skills. Generally, the Cognitive Theory, Theory of Constructivism and Bloom's Taxon-

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omy Theory are highly interrelated to each other [6, 21]. These three theories can be adopted in the integration of GIS in Geography subject.

The module is defined as a set of L&F that deals with a particular systematic and sequential topic to promote being independent and able to master a learning unit easily and accurately [16, 22]. The GIS-STS module has thirteen activities. All activities are developed with the integration of the GIS in L&F Geography subjects. The operation of GIS software in L&F is a step taken in order to create Spatial Thinking Skills (STS) by using modules among students of form 2. The STS level is low among the current geography student. Furthermore, students' interest in geographical subjects is considerably low.

The GIS-STS module consists of four sub modules: Geography Skill Sub-modules, Physical Geography Sub-modules, Human Geography Sub-modules and Geography Sub-modules. The geography skills sub-modules consist of two units of scale and topographical maps. Meanwhile, the physical geographic Sub-module has two units, the unit of influence of earth's movements on weather and climate in Malaysia. The human geography sub-module has one unit of transport in Malaysia. The last sub-module is the geographical area of one unit of climate importance and its effect on human activity in Asia. Sub-module details and units divided into 13 activities are shown in Table 1.

Table 1: Summary of GIS-STS Module Content

Sub Modules	Units	Activities
Geography Skill	1. Scale and Distance 2. Topographic Map	1. Straight Distance 2. Curved Distance 3. Width 4. East Line and North Line 5. Physical Landscape (PL) and Human-made Landscape (HL)
Physical Geography	3. Movement Effects of Earth on weather and climate 4. Weather and Climate in Malaysia	6. Effects of Earth Rotation 7. Four seasons Occurrence 8. Area with High Concentration of Rain Annually 9. Area with Low Concentration of Rain Annually
Human Geography	5. Malaysian Transportation	10. Land Transportation 11. Air Transportation 12. Water Transportation
Area Geography	6. Importance of Climate and its Influence on Human Activities in Asia	13. Identifying four climate zones in Asia

2.3. Research Objective

Generally, this study aims to measure the validity and reliability of the GIS-STS Module. The specific objectives of this investigation are:

1. To determine the validity of the GIS-STS module content holistically.
2. To determine the validity of the content of the GIS-STS module for each sub module and its activities.

3. Methodology

All designated experts have evaluated the validity of the entire module's contents, using a questionnaire [16, 20]. Table 2 shows the consensus of experts with the minimum percentage obtained is 86% of the contents of this module can be implemented. While, maximum 94% of the contents of this module increase STS. While, experts believe 97% increase interest among students of Geography. Therefore, the overall score obtained for all items is 93% equivalent to the validity coefficient of .93 > .70 and proves that this module has a high and good content validity.

The validity of the module content is identified through a consensus assessment of seven designated experts based on the standards such as experience in developing modules, learning and Geography facilitating, GIS teaching experience, and experience in the management of the Geography curriculum. Five experts have been appointed among lecturers of The National University of Malaysia (UKM) and Malaysia Pahang University (UMP). On top of that, two other experts have been selected from the Ministry of Education Malaysia (KPM).

The data were analyzed descriptively to obtain the percentage of expert consensus and the validity coefficient of content. The process of deciding whether the validity of the content is good or is not based on the opinion. It describes that achievement of 70% and above is considered high achievement. On the other hand, if the score is below 70%, it is said that the validity of the content is not good. Additionally, experts also contribute their opinions and comments to further improve the contents of the module [16].

Content validity questionnaires were questionnaires modified by previous study [16, 20]. The questionnaire consists of five items that are the module content that is suitable for the targeted population. Module content can be implemented successfully, module content can improve the Spatial Thinking Skills (STS), and module content also enhances students' interest and improves GIS skills. The choice of answers is 5 Likert scale points with (5) strongly agree, (4) agree, (3) uncertain, (2) disagree, and (1) strongly disagree. The questionnaire for the validity of the content for each sub module and activity was compiled based on the format created [22]. The questionnaire was modified according to the requirements of the GIS-STS module which has four sub modules which are Geography Skill, Physical Geography, Human Geography and Area Geography.

4. Results and Analysis

4.1. The Validity of the Content of the GIS-STS Module Holistically

All dedicated experts have evaluated the validity of the entire module's contents, using a questionnaire [16, 20]. Table 2 shows the consensus of experts with the minimum percentage obtained is 86% of the contents of this module can be implemented. While, maximum 94% of the contents of this module increases STS. While, experts conclude 97% increase interest among students of Geography. Hence, the overall score achieved for all items is 93% equivalent to the validity coefficient of .93 > .70 and proves that this module has a high and good content validity.

Table 2: GIS-STS Module Content Validity

No.	Statement	Percentage	Coefficient of Content Validity	Opinion Amongst Experts
1	The content of this module fits the target of its population	97%	.971	Accepted
2	The content of this module can be implemented perfectly	91%	.912	Accepted
3	The content of this module fits with the allocated time	86%	.861	Accepted
4	The content of this module will intensify the Knowledge of GIS and Spatial Thinking Skills (STS)	94%	.943	Accepted
5	The content of this module can attract more interest of students in Geography subjects.	97%	.971	Accepted
	Total	93%	.931	Accepted

4.2. Analysis of Sub Modules and Validity of Activity Content

The expert group has assessed the validity of sub-module contents and activities using modified questionnaires [15, 18]. Table 3 presents the validity of sub modules and activities. The findings reflect that the validity coefficient of activity content is .870 which exceeds the minimum value .70. Comparative analysis by subcategory shows that the sub modules of Geography skills are .864, the Physical Geography sub module is .847, the Geographical subdivision module is .893 and the human geography sub module gained the highest validity coefficient of .860. Amongst the activities, the land transport option obtained the highest coefficient of .900.

At the same time, the activity that obtains the lowest coefficient of value is the activity of calculating the area, marking a high annual average rainfall area and marking a low average annual rainfall area with the coefficient of value of .823. This proves that there is no difference in the value of the validity of the coefficient between the maximum and minimum, the overall value of GIS-STS based on the assessments performed by the experts in each sub module and activity expresses that the expert consensus is above the minimum value of .70 these findings prove that the GIS-STS module has a high and good content coefficient of validity.

Table 3: Content and Activity Validity of Module GIS-STS

Sub Modules and Activities	Percentage	Coefficient of Content Validity
Sub Module of Geography Skill	86.4%	.864
Activity: 1 Straight distance	89.0%	.890
Activity: 2 Curved distance	87.0%	.870
Activity: 3 Width	83.0%	.830
Activity: 4 East Line and North Line	86.0%	.860
Activity: 5 Physical Landscape (PL) and Human-made Landscape (HL)	87.0%	.870
Sub Module of Physical Geography	84.75%	.847
Activity: 6 Effects of Earth Rotation	89.0%	.890
Activity: 7 Four seasons Occurrence	86.0%	.860
Activity: 8 Area with High Concentration of Rain Annually	83.0%	.830
Activity: 9 Area with Low Concentration of Rain Annually	81.0%	.810
Sub Module of Human Geography	89.3%	.893
Activity: 10 Land Transportation	90.0%	.900
Activity: 11 Air Transportation	89.0%	.890
Activity: 12 Water Transportation	89.0%	.890
Sub Module of Area Geography	86.0%	.860
Activity: 13 Identifying four climate zones in Asia	87.0%	.860
Total value of GIS-STS	87%	.870

5. Discussion

There are a total of thirteen L&F activities using GIS and this will lead to the exploration of new knowledge in Geography subjects that match both form two students. A good module should measure three key elements of content validity, reliability and effectiveness. All these three aspects can heighten the strength and quality of the module [16]. The study found that GIS-STS, sub modules and activities had high content validity. The findings are in line with the research conducted by other researchers who developed the module in these three aspects. Many previous studies use the same validity test procedures as the study suggests [13, 15]. Apart from that, the previous studies also suggest that the effectiveness of new interventions need to undergo follow-up tests after a period of termination of certain interventions. This is to measure the stability and consistency of certain interventions to variables depending on the study (DV) [9, 15].

6. Conclusion

The expansion of the GIS-STS module is an analysis of past studies related to the synthesis of the module. The cognitive theory, constructivism theory and the theory of Bloom's taxonomy are among the right theories to be used as a framework for the development of this module. The theory too introduces concepts that can be translated into intervention implementation [19]. There are thirteen activities developed under the four sub modules directly related to Geography subjects in form two. Conclusively, this study has proven that the high content of validity after getting the approval from the experts. It is hoped that this module will contribute to new knowledge in the implementation of the 21st Century L&F in Geography subjects.

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