Vol. 8, No. 2, 2022, pp. 267-274
DOI: https://doi.org/10.29210/020221355

Contents lists available at Journal IICET

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print)ISSN: 2477-8524(Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jppi

Indonesian spatial intelligence for geography teachers

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Article Info

Article history:

Received Jan 06th, 2022
Revised Apr 12th, 2022
Accepted Jun 25th, 2022

Keyword:

Geography
Teachers
Spatial intelligence

ABSTRACT

Geography subjects study objects and spatial phenomena on the earth's surface; Therefore, in practice, they must understand the application of abstract concepts that include spatial perception. This research uses qualitative research methods in measuring the spatial intelligence of geography teachers. Measurements based on four indicators reflecting spatial intelligence are 1) Blind Map; 2) Natural Resources; 3) Icons or landmarks; and 4) Human resources. Based on the study results, it can be concluded that the spatial intelligence of geography teachers mostly has good spatial intelligence. This is indicated by the results of the analysis in 4 categories, namely 1) the results of the analysis show that the ability of geography teachers in blind map knowledge regarding regional locations in Indonesia is fairly good; 2) the ability of geography teachers in natural resource knowledge regarding the distribution of natural resource locations in Indonesia is quite good; 3) the ability of the geography teacher in knowledge of icons or landmarks regarding the icons or landmarks of districts/cities in Indonesia is fairly good; and 4) the ability of geography teachers in human resource knowledge regarding the distribution of ethnicities and cultures in Indonesia is fairly good.

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Introduction

Teachers as educators must have a professional work ethic because teachers are professional jobs. The spearhead of the success and progress of the next generation of quality human resources rests on the shoulders of the teacher (Suciana, 2018). In the 21st century, teachers with qualified scientific and technical competencies are needed as teaching staff. This is because the form of learning in the 21st century is currently widely supported by digital technology (Wijayanto et al., 2020). So that a teacher is not only required to master the material, but must be equipped with mastery of developing technology in order to achieve the success of students in the learning process. In addition, in this century, teachers are also required to be able to face the challenges of developments in the field of technology which also have an impact on the socio-cultural changes of students.

Professional teachers must have qualified scientific and technical competencies. These competencies are characterized by a high teaching spirit, competencies and skills that continue to develop and their ability to keep up with technological developments from time to time. According to Khofiatun & Ramli (2016) teachers who have pedagogical competence with good categories tend to be successful in learning and vice versa. Therefore, various efforts are needed to improve and develop the professional teachers of teachers, such as

mastery of the material, the selection of methods in learning activities, and the learning media used (Tanama et al., 2016).

Competence is the meaning of the teacher's ability to carry out his profession which must be accompanied by knowledge, skills and attitudes that are full of responsibility. As explained by Yasin, I. (2021) teacher competence is the ability of teachers as educators to carry out their obligations with a full sense of responsibility. Teachers as educators are also required to have five kinds of intelligence, namely, intellectual intelligence, moral intelligence, emotional intelligence, social intelligence, and motor intelligence. These intelligences are characteristics of the ideal teacher because the intelligence of the teacher will have an influence on the activities of delivering information from the teacher to the students.

According to Gardner dalamRimbatmojo et al., (2017) suggests that intelligence is divided into 8 types known as MI, namely Multiple Intelligence, namely 1) verbal-linguistic intelligence, 2) logic-mathematics, 3) visual-spatial, 4) music, 5) kinesthetic-physical, 6) interpersonal, 7) intrapersonal, and 8) naturalistic. Of the eight intelligences, visual-spatial intelligence is the most important intelligence for geography teachers to have. According to Desti (2014) visual spatial intelligence is a person's ability to understand, process, think, change, and even recreate various aspects in visual form. In another sense, according to Rimbatmojo et al., (2017) visual-spatial intelligence is an ability to capture and understand the world, especially spatial space. Geography as a science that studies objects and spatial phenomena on the earth's surface requires a fairly high intellectual understanding, because visual-spatial understanding is an abstract concept that includes spatial perception. Spatial intelligence has always been a fundamental cognitive skill and is the most important factor determining competence in spatial disciplines such as geography Putra, et al. (2021), Choo et al (2021) Wai et al (2021) Kiernan (2021). A number of studies have found a significant correlation between spatial thinking and success in solving spatial tasks, and persistence in a career in science and space (Anderson & Leinhardt, 2002; Black, 2005; Kali & Orion, 1996). Based on this, spatial intelligence is a field of intelligence that must be possessed by teachers of geography subjects.

The ability that needs to be achieved by students in geography lessons is the ability to analyze and understand geosphere phenomena in spatial concepts. The concept of space is a form of declarative knowledge that serves as the basis for building spatial thinking (Metoyer et al., 2015). Concepts such as location, dimension, continuity, pattern, spatial association, network, and proximity are examples of spatial concepts that are explicitly recognized by researchers (Janelle & Goodchild, 2009). The ability to understand geosphere phenomena in spatial concepts is formed by means of spatial thinking, geospatial thinking and geographical thinking (Bednarz, 2015 dalamAliman et al., 2018). In the process of planting national integration, spatial thinking plays an important role in determining the appropriate regional modeling, as well as solving regional problems nationally in a spatial context. In addition, spatial thinking can also increase one's knowledge and attitudes about the situation in their area.

The role of geography teachers in educating students to have spatial intelligence is important to note. Spatial intelligence is very much needed by a teacher in providing understanding to students for better transfer of knowledge. Spatial intelligence that supports spatial learning competence is a geography teacher's professional competence to be able to present material spatially. This competency is a measure of the professionalism of the geography teacher in educating to recognize and understand the interrelation, interconnection, and interdependence between Geography material objects. The formation of spatial knowledge for students will be created if the teacher has spatial competence because the teacher acts as a tool and technique needed by students to learn to think spatially (Lee & Bednarz, 2012). A geography teacher who has spatial competence will have the right analytical skills in the geography learning process in the classroom (Susilawati & Sunarhadi, 2017).

The situation as presented illustrates the importance of spatial intelligence possessed by geography teachers in Indonesia. Mastery of these skills will make it easier for teachers to develop spatial awareness so that students' spatial character is built. Based on this phenomenon, the general purpose of this study is to analyze the spatial intelligence of geography teachers in Indonesia with a focus on knowing the level of knowledge of geography teachers on the Indonesian blind map, knowing the level of knowledge of geography teachers about the location of the distribution of natural resources in Indonesia, knowing the level of knowledge of geography teachers about icons or landmarks from regions in Indonesia, and knowing the level of knowledge of geography teachers about human resources in the form of ethnicity and culture spread throughout Indonesia.

Method

The situation as presented illustrates the importance of spatial intelligence possessed by geography teachers in Indonesia. Mastery of these skills will make it easier for teachers to develop spatial awareness so that students'

spatial character is awakened. This research uses qualitative research methods in measuring the spatial intelligence of geography teachers. Based on this phenomenon, the researchers conducted research on spatial intelligence :

Table 1. Spatial intelligence indicator

Spatial Intelligence Indicator	Question Number	Number of Questions
Blind Map	1 - 15	15
Natural resources	16 - 30	15
Icons or Landmarks	31 - 40	10
Human Resources (Ethnic and Culture)	41 - 50	10

Results and Discussions

Based on the results of filling out questions addressed to 205 geography teacher respondents, the results showed quite diverse results, both from blind map indicators, natural resources, icons/landmarks, and human resources (ethnic and cultural). For more details, an indicator will be presented.

Blind Map Indicator

This indicator aims to determine the spatial knowledge of geography teachers in recognizing regions in Indonesia only with a blind map. The results show that 50.26% of geography teachers are able to recognize regions in Indonesia only from blind maps.

Table 2. Scores of respondents' answers to blind map indicators

Spatial Intelligence Indicator	Question Number	Percentage of Correct Answers (%)
Blind Map	1	51
	2	55
	3	70
	4	34
	5	33
	6	66
	7	38
	8	32
	9	58
	10	64
	11	31
	12	50
	13	64
	14	63
	15	45
Average		50,26

The question item with the highest percentage of correct answers is question number 3 with a percentage of 70%. This question contains a map of part of the island of Sumatra in which each area has been assigned a number. Respondents were asked to determine which number is the City of Sabang. While the least is question number 11 with a percentage of 31% where the question is about the island of Papua.

Natural Resources Indicator

This indicator is used to measure the understanding of the potential of natural resources and their location in Indonesia. Based on the tests carried out, 50.06% of geography teachers were able to show the location of resources or the potential of natural resources in a specified area. For more details, see the following table 3.

The question with the most correct answers was question 18 in the form of "the main reason for the development of livestock in Nusa Tenggara" where respondents were able to answer that Nusa Tenggara is one of the areas with a large grassland area.

Table 3. Scores of respondents' answers on natural resources indicators

Spatial Intelligence Indicator	Question Number	Percentage of Correct Answers (%)
Natural Resources	16	57
	17	68
	18	89
	19	37
	20	41
	21	67
	22	43
	23	39
	24	44
	25	31
	26	60
	27	45
	28	31
	29	46
	30	53
Average		50,06

Indicator Icon or Landmark

For indicators of icons or landmarks in Indonesia, the following are the results obtained

Table 4. Respondents' answer scores on natural resources indicators

Spatial Intelligence Indicator	Question Number	Percentage of Correct Answers (%)
Natural Resources	31	61
	32	83
	33	51
	34	25
	35	35
	36	51
	37	43
	38	75
	39	71
	40	41
Average		53,6

From the results above, it can be seen that the percentage of correct answers has an average of 53.6% which is higher than the previous two indicators which are only around 50%. The question with the most answers is number 32 with a percentage of 83% where this question contains a picture of the Ampera Bridge and respondents are asked to determine the area with the icon/landmark. While the question with the least correct answer is number 34 with a percentage of 25%. Question number 25 contains an image of the tallest statue on the island of Bali, namely the Garuda WisnuKencana Statue located in Badung Regency.

Human Resources Indicators (Ethnicity and Culture)

The last indicator is an indicator of human resources consisting of ethnicity and culture. This indicator can show the socio-cultural spatial knowledge of geography teachers in Indonesia. Based on the results of the analysis, the average score for this indicator is 61.4%, which means that this indicator has the highest value compared to other indicators.

From the table 5, it can be seen that the lowest percentage is question number 45 with a value of 29% and the highest is question number 41 with a percentage of 90%. The high percentage is influenced by the general knowledge of the Ngaben traditional ceremonies held in Bali.

The results of the data analysis in the previous explanation concluded that the assessment of spatial intelligence in as many as 205 respondents, as many as 31 respondents were at a low level of spatial intelligence and as many as 132 people with a moderate level, while 42 people with a high level of spatial intelligence.

Table 5. Scores of respondents' answers on human resource indicators

Spatial Intelligence Indicator	Question Number	Percentage of Correct Answers (%)
	41	90
	42	56
	43	46
	44	39
Human Resources	45	29
(Tribe and Culture)	46	78
	47	70
	48	51
	49	67
	50	88
Average		61,4

Table 6. Categories of Geography Teachers' Spatial Intelligence Levels

Spatial Intelligence Level	Value Interval	Amount	Percent (%)
Low	0 - 16	31	15
Currently	17 - 33	132	64
Tall	34 - 50	42	20
Amount		205	100

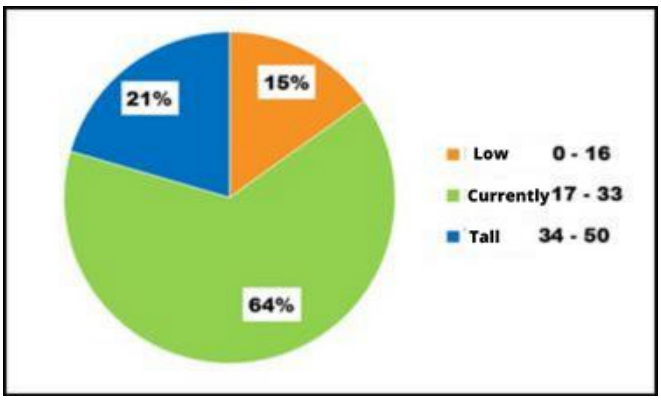

Figure 1. Geography teacher's spatial intelligence category percentage

These three class categories come from the difference in the highest value, namely 50 and the lowest, namely 0 which is then divided into 3. The value of 3 here is the desired interval class. The selected interval value is 3 to make it easier to categorize the level of intelligence. After this step, the interval value is 17.

Based on the results of research that has been carried out, it can be obtained information that spatial intelligence is an ability to provide images and images, as well as a person's ability in the form of transforming the visual-spatial world, which includes the ability to imagine and recreate the visual world (Wijayanto et al., 2020). Spatial intelligence is closely related to the ability to communicate spatially. This intelligence is represented into three abilities, namely cognitive maps, cognitive collage, and mental spatial. These three abilities represent the human ability to be able to explore phenomena that exist on the earth's surface by converting various types of information that they have obtained from the environment into spatial information (Urfan, 2017).

Cognitive maps are the ability to take action in location analysis based on knowledge and experience in analyzing a phenomenon or a symptom. Cognitive collage is an ability that represents actual and dynamic location, so this ability is used to complement the first ability, namely cognitive map. Mental spatial is indicated by the ability of the mind to convey the processes that occur in the environment in the mind. The function of this mental spatial ability is to explain the causes of a phenomenon and even predict the impact of the phenomenon. If someone has a high mental spatial understanding, the higher his ability to predict a phenomenon in the context of space.

In learning geography subjects there is spatial intelligence, namely an ability to describe or describe, convey and transform phenomena in visual spatial form. Geography as a subject that studies spatial objects and

phenomena on the earth's surface requires a fairly high intellectual understanding, because visual-spatial understanding is an abstract concept that includes spatial perception. In geography there is a projection process, namely the interpretation of shapes such as from 3 dimensions to 2 dimensions and vice versa, one of the applications is in the mapping system. This process is considered to be able to increase a person's ability or spatial intelligence as stated by Stieff et al., (2016) and Lazear (2004) that representation activities can improve spatial intelligence. In a study of spatial-based learning, it is shown that this learning model has a significant influence on students' critical thinking skills (Manek et al., 2019).

Geography teachers as educators must master four competencies, namely pedagogic, personality, social, and professional competencies. Geography teacher by Ningsih et al., (2016) must have relevant academic qualifications and professional competencies above average. Professional competence is contained in six aspects of ability, namely making lesson plans, mastery of materials, media and learning resources, learning methods, carrying out pre-test and post-test and interaction patterns of the learning process. Geography teachers are strategic assets in shaping human resources that excel in their fields.

Spatial intelligence for geography subject teachers is needed to support the learning process and to achieve learning objectives. Spatial intelligence in learning geography is also a basic ability that must be possessed by students because it is related to their ability to analyze and understand spatial phenomena of the geosphere. So it can be concluded that this spatial intelligence is an important thing in geography learning, both owned by teachers as educators and also by educated students.

Spatial intelligence in individuals provides the ability to determine orientation and mobilization. This is in accordance with the statement Milner-Bolotin & Nashon (2012) that spatial intelligence is very important to understand a phenomenon. According to Kell et al., (2013) Spatial intelligence has a unique role in the development of creativity so as to encourage creative thinking and innovation.

The results of the analysis of this study indicate that the ability of geography teachers in blind map knowledge regarding regional locations in Indonesia is fairly good. Based on the questions with the blind map category as many as 15 questions, filled out correctly with an average of 53%. Questions with correct scores below the average are on items number 1, number 4, number 5, number 7, number 8, number 12, and number 15. Respondents are most familiar with blind maps with areas with characteristics that are generally well known as in number 3 is the city of Sabang which is located on the north side of the island of Sumatra, with PulauWeh as the largest island. The city of Sabang which is one of Indonesia's free economic zones and is often referred to as the northernmost point of Indonesia.

The results of the analysis on the ability of geography teachers in natural resource knowledge regarding the distribution of natural resource locations in Indonesia are quite good. The questions that are filled in correctly are based on 15 questions regarding this category as many as 50% of the respondents answered correctly. Questions with scores below the average in this category are spread out on items number 19, number 20, number 22, number 23, number 24, number 25, number 27, number 28, and number 29. Respondents are the most knowledgeable about natural resources. related to biomes as in number 18, that Nusa Tenggara is best for use as livestock because there is a lot of grass as a source of livestock food. Nusa Tenggara is best used for livestock because abundant food sources are found in the savanna biome, namely broad grasslands.

The results of the analysis show that the ability of geography teachers in knowledge of icons or landmarks regarding the icons or landmarks of districts/cities in Indonesia is fairly good. In this category as many as 55% of respondents answered with the correct answer from a total of 10 questions. Items with correct scores below the average are found in questions number 33, number 34, number 35, number 36, number 37, and number 40. Respondents have the most control on icons or landmarks of cities that are already famous for their icons as in number 32 and 38 because in these two numbers the respondent filled in the correct answer with a percentage above 75%.

The results of the analysis show that the ability of geography teachers in human resource knowledge regarding the distribution of ethnicities and cultures in Indonesia is fairly good. On average, 62% of respondents answered correctly out of 10 questions in the category of human resources, namely about ethnicity and culture. There are 5 questions with correct scores below the average, namely on items number 42, number 43, number 44, number 45, and number 48. Most of the respondents have the most control in this category and are the most knowledgeable about culture, namely ceremonies as in number 41 and 46. In these two numbers, respondents who answered correctly were above 78% on each of the questions.

Based on the conclusions obtained from the results of research that has been carried out on 205 respondents with the number of questions representing spatial intelligence as many as 50 questions, it was found that at least 1 person did not provide an answer so that the score became 0. The results of filling out questions, as

many as 56 questions with the highest percentage of each item that corresponds to the answer key, while there are 4 questions with the highest percentage of answers on each item with incorrect answers.

The items with the highest percentage of choosing the wrong option are number 11, number 34, number 35, and number 45 with the highest number of percentages compared to other options. There are only 31% correct answers on number 11, number 34 have 25% correct answers, number 35 with 27% correct answers, and number 45 with 29% correct answers.

Based on the results of observations, the number of questions with the percentage of correct answers with the percentage value of correct answers above 50% on each item there are as many as 28 items. Items with the correct answer percentage above 50% are found in question numbers 1, 2, 3, 6, 9, 10, 12, 13, 14, 16, 17, 18, 21, 26, 30, 31, 32, 33, 36 , 38, 39, 41, 42, 46, 47, 48, 49, and the number 50.

Conclusions

Based on the results of the study, it can be concluded that the spatial intelligence of geography teachers based on the results obtained from the research sample, most of the geography teachers have good spatial intelligence. This is indicated by the results of the analysis in 4 categories, namely 1) the results of the analysis show that the ability of geography teachers in blind map knowledge regarding regional locations in Indonesia is fairly good; 2) the ability of geography teachers in natural resource knowledge regarding the distribution of natural resource locations in Indonesia is quite good; 3) the ability of the geography teacher in knowledge of icons or landmarks regarding the icons or landmarks of districts/cities in Indonesia is fairly good; and 4) the ability of geography teachers in human resource knowledge regarding the distribution of ethnicities and cultures in Indonesia is fairly good. In these 4 categories, the highest value is represented by the knowledge ability of human resources regarding the distribution of ethnicities and cultures in Indonesia.

Spatial intelligence for geography teachers is important because teachers with a high level of spatial intelligence have a great opportunity in delivering broad information about spatial phenomena and objects that are scattered in Indonesia. In geography learning, spatial intelligence is also a basic ability that must be possessed by students because it is related to students' ability to assess a phenomenon spatially.

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