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THE DEVELOPMENT OF WORKSHEET BASED ON GOOGLE MY MAPS WEB APPLICATION TO ATTAIN BASIC COMPETENCIES IN HIGH SCHOOL GEOGRAPHY LEARNING

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Abstrak: Penelitian ini dilakukan untuk mengembangkan dan mengujicobakan lembar kerja *WebGIS* dalam menunjang ketercapaian kompetensi dasar pada pembelajaran geografi kelas XI IPS di SMAK 3 Bina Bakti Bandung. Penelitian ini menggunakan model penelitian 4D. Instrumen yang digunakan dalam penelitian ini antara lain lembar validasi ahli (*expert appraisal*) melalui pengujian validasi konten dan media, uji keterlaksanaan lembar kerja, penilaian unjuk kerja, dan analisis hasil respon peserta didik. Hasil penelitian ini adalah tersusunnya sebuah Lembar Kerja Web-GIS *Google My Maps* yang dapat digunakan untuk menunjang ketercapaian KD 3.6 dan 4.6. Validitas konten sebesar 91.66% dan validitas media sebesar 92.5%. Persentase keterlaksanaan sebesar 93.75% dengan capaian skor peserta didik sebesar 87.83%. Melalui angket respon, didapatkan sebanyak 88.98% respon positif terhadap indikator pemenuhan syarat didaktik, konstruktif, dan teknik lembar kerja serta indikator ketercapaian kompetensi dasar. Hasil temuan dalam penelitian ini menunjukkan bahwa Lembar Kerja Web-GIS *Google My Maps* yang dikembangkan telah layak dan dapat secara praktis digunakan dalam pembelajaran geografi untuk mencapai kompetensi dasar pemetaan tematik sebaran budaya daerah.
Kata kunci: LKPD, Pembelajaran Geografi, Web-GIS

Abstract : This research was carried to develop and test Web-GIS worksheet to attain basic competences in geography learning as researched in Class XI IPS in SMAK 3 Bina Bakti Bandung. This research implemented 4D model. The instruments that were used are expert appraisal sheet through the validation of aspect of media and content, percentage of practicality, student performance test, and response questionnaire. The result of this study is the Web-GIS worksheet that is able to be implemented tp support the attainment of Basic Competencies 3.6 and 4.6. Validity of worksheet is indicated by content validity of 91.66% and media validity of 92.5%. Worksheet practicality is proven by 93.75% implementation percentage with students' performance score as many as 87.83%. Through response questionnaire, there are as many as 88.98% positive responses toward worksheet's didactic, constructive, and technical requirements, together with basic competencies attainment indicators. Findings from this research indicate that the developed Web-GIS worksheet is valid and practically able to be implemented in geography learning to attain basic competencies of local culture mapping.
Keywords: Geography learning, Worksheet, Web-GIS

A. INTRODUCTION

Learning oriented to the competency of processing and producing geospatial data is often found in higher education level (Kerski et al., 2019, p. 242). According to Meyer et al. (1992, p. 272), process of learning in this level needs to consider the readiness of teacher/instructor, students, and education institution on providing sufficient infrastructure. Certainly, this demands large enough

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budget and time allocation. In spite of that, the technological integration is not impossible to carry.

Geography learning is currently aimed to integrate geospatial technology in high school learning processes. The Regulation of Minister of Education and Culture No, 37/2018 on Core Competencies and Basic Competencies of The Curriculum 2013 in terms of geography learning already includes attainment of thematic mapping in number of topics (Jumardi et al., 2021, p. 292). The study of Wijaya et al. (2021., p. 380) indicated that The Curriculum 2013 itself as reference of teaching and learning process mandates the implementation of informatic content.

Despite of being the standard of learning objectives, application of geospatial technology in learning have not been mainstreamed. This was stated in the study of Santoso et al. (2021, p. 24), that difficulty on applying geospatial technology in learning is due to complicated access to GIS application along with teachers' inadequate skills. This finding is also in line with Baker (2015, p. 110) that GIS application itself needs to be supported by a device with large capacity and specification, as well as big data consumption.

Web-GIS application is an alternative that can be utilized to overcome troubles of using desktop-based GIS application. Through its ability to process data in a real-time manner, Web-GIS is often said as surpassing desktop-based GIS application (Baker, 2015, p. 106). Dekui et al. (2016, p. 2), stated that Web-GIS application does not need installation processes because of its ability to be accessed through web. The use of web system relies on internet connection that it does not require high capacity and specification,

Main components of Web-GIS consist of databases, web-services, and web-application (Charoenbunwanon, 2016, p. 32). Database component has the function to store geospatial data, web-services allows data processing through web system, meanwhile web-application shows results of processed spatial data on the web that can be accessed by user. There are several collaborative Web-GIS applications that have been massively used, namely Google My Maps, OpenStreetMap, and ArcGIS Online. Web-GIS works to run its functions to produce geospatial information such as web-map, through the workflow of GIS.

Web-GIS simple features and high accessibility makes it suitable for to be used as learning media. The study of Ivan and Glonti (2019, p. 9) indicated that the use of Web-GIS as learning media is seen to be more practical and

interactive. Furthermore, Gonzaléz and De Lazaro Torres (2020, p. 74) stated that Web-GIS applied on learning process could balance spatial and cognitive skills of geography learners.

Integration of Web-GIS in geography learning had to be bridged with a worksheet as reference both for teachers and students. Students' worksheet acts as direction in learning process (Bloomberg, 2021, p. 2014). It consists of students' activities in learning process aiming to reach standards of competency set in indicators of attainment (Trianto, 2009, p. 222). Web-GIS worksheet developed in this research seek to help students attain basic competency of thematic mapping.

The developed worksheet is evaluated through practicality test, performance-based assessment, and students' questionnaire. Worksheet evaluation is based on the fulfillment of didactic, constructive, and technical requirements (Darmodjo and Kaligis, 1992, p. 41), as well as basic competencies attainment. This research is carried to analyze basic competencies that can be attained through Web-GIS worksheet; designing Web-GIS to attain basic competencies of cultural mapping; and to conduct development test of Web-GIS worksheet on the attainment of basic competencies of national cultural distribution.

B. RESEARCH METHOD

This research focuses on the development of Web-GIS worksheet to support student attainment of basic competencies in geography learning. Subject of research is 40 students of Grade 11 in social science class 1 and 2 in SMAK 3 Bina Bakti (Bina Bakti 3 Christian High School) Bandung. This research implements Thiagarajan 4D development model. The 4D Model seek to develop student worksheet through detection of needs or problems of learning and developing a format of learning tools (Panggabean et al., 2020, p. 61; Prasmala and Tanggu, 2020, p. 93). Steps of development in 4D research consist of "define". "design". "develop", and "disseminate".

Worksheet was validated by two validators. Two aspects being measured are content and media (Riduwan & Sunarto, 2017, p. 23). Measurement of content aspect were carried through applying Aiken's V (content validity formula). Subsequently, validation of media is measured through percentage of media validity as follow :

$$V = \sum S/[n(c-1)] \quad \text{....(1)}$$

S : r - lo
r : score given by validators
lo : value of lowest score
n : number of validators
c : Value of highest score

The validated worksheet would then be tested through developmental testing. Two aspects being judged in development testing are the fulfillment of worksheet requirements in didactic, constructive, and technic aspect, as well as percentage of attainment of basic competencies observed from indicators in Basic Competency 3.4 and 4.6, namely "analysis of variety of national culture as national identity" and "thematic mapping of national culture distribution". Second aspect measured in the developmental testing is percentage of implementation within worksheet.

Subsequently, performance-based assessment was carried to analyze the practicality and measurability of worksheet in learning process. Activities that were assessed in this research were as follow

1. Identification of geographic-referenced data;
2. Build database in the tabulation format
3. Access and operate website
4. Inserting data on Web-GIS Google My Maps system
5. Attribution of map symbol
6. Customization of color representation on map
7. Uploading result of mapping with adequate information

Worksheet product were also tested through students' questionnaire with measurement aspects as mentioned above.

C. RESULT AND DISCUSSION

C.1. RESULT

Development of students' worksheet based on Google My Maps Web-GIS to attain basic competency in geography learning were carried in three phases, namely analysis of students' worksheet in learning process, design of Web-GIS Google My Maps students' worksheet to attain basic competency of cultural mapping, and worksheet development testing.

a. Analysis of Web-GIS Google My Maps student's worksheet to attain basic competency in geography learning

Urgency of worksheet development is found in front-end analysis seek to explain basic problems in learning, relation of learning process and the curriculum, and concrete problems as background of worksheet development (Luppiccini, 2007, p. 77). Study of the front-end analysis were also carried ensuring that development of Web-GIS Google My Maps is not merely a technological innovation, but is carefully formulated based on its suitability to learning objectives set in the national curriculum and actual problems faced in geography learning.

Generally, geography learning is less attracting for students due to a seemingly non-contextual content. This can be caused by the use of conventional

learning media. Students are stuffed by textual knowledge and forced to memorize names of places or phenomenon and its distribution without directly interacting to what is being studied. Based on observation carried in SMAK 3 Bina Bakti, learning condition is not much different with generally observed geography learning. Students showed low interest and motivation in learning. Activities tend to be passive and dominated by teachers.

Learning process of cultural distribution in Basic Competency 3.6 dan 4.6, low learning activity is related to the implemented strategy and media. Basic competency attainment aimed to students' ability on creating thematic maps. However, these objectives were reduced to the lower level, in which students were only asked to search for available maps in digital sources. Passive activity in classroom affects student learning interest and motivation.

Referring to the aforementioned problems, formulation of Web-GIS Google My Maps worksheet weighs on the increase in students' activity. This is indicated by assignment given in worksheet. Besides than achieving active learning, worksheet development seeks to help student attain basic competencies in learning process.

Learning strategy and media is the main problem in the learning of thematic mapping of cultural distribution. Solution given by the use of web-application Google My Maps is the developed media in the worksheet has the flexibility on devices used by students and minimum data consumption.

Other technical problem faced in learning is the difficulty on allocating time in project activities, particularly in remote learning where direct monitoring would have much barriers. However, in web-application, all the process were done through online system. Every step of the projects can be recorded in web. Therefore, teachers can monitor students' project without an obstacle of place and time. Students can also work autonomously through worksheet

b. Design of Web-GIS worksheet to attain basic competency in cultural distribution mapping

Process of designing Web-GIS worksheet to attain basic competency of cultural distribution mapping strongly linked to how Web-GIS Google My Maps is presented to students. Through features and workflow within the web-application, learning activities can be formulated. The flowchart below shows steps of activities that can be done by students on creating cultural distribution map based on the developed worksheet.

Development of student's worksheet is complemented with improvement of learning strategy. Previously, learning of cultural

distribution material implemented problem-based model with explainer video as its media.

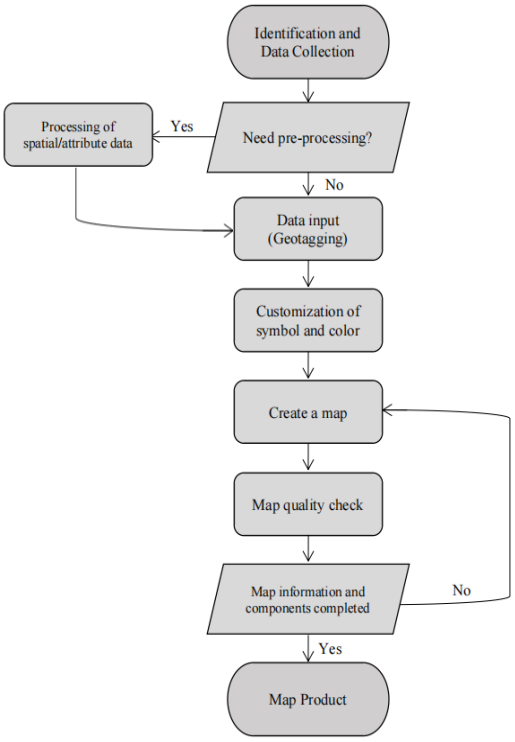

Figure 1. Flowchart of Web-GIS Google My Maps as media in cultural distribution mapping activity. Source: Data analysis, 2023

After the development, learning model that is used is project-based learning which oriented to thematic mapping project as part of objectives set in basic competency. Thus, what is attained by students through the use of worksheet is suitable to the learning process.

The flowchart above depicts the activities of students in completing their assignments. The initial activity begins with the identification of regional culture and data collection. Each data must have geographical references. In this stage, students provide a geographic database by selecting a basemap and focusing on the study location. Attribute data, such as cultural information, is entered into each location point through geotagging. Once a map is created, a quality check is then performed to confirm any errors or discrepancies in the display.

The further development of student activities in the flowchart is statistically tested through validity and reliability assessments. All included indicators are used to evaluate the completeness of data and the inclusion of expert assessment indicators into the map display. If any indicators are not met or incomplete, revisions or improvements are made. The same applies to student learning activities.

c. Development testing of Web-GIS worksheet to attain basic competency of cultural distribution thematic mapping

Development of student worksheet consist of expert validation/appraisal (content and media validation). After the worksheet validated, development testing can be initiated. This step consists of practicality test to each student activity that is guided by worksheet, performance assessment, and students' response analysis on the developed worksheet.

Table 1. Content Validation Result

Indicator	Item	V value	P value	Category
Didactic	1	0.875	0.40	valid
	2	1.000	0.40	valid
Constructive	3	1.000	0.40	valid
	4	1.000	0.40	valid
Technic	5	0.750	0.40	valid
	6	0.875	0.40	valid

Source: Data Analysis (2023)

The first step, namely expert appraisal, was carried by two validators. According to Aiken (1985, p. 134), when the validators consist of two experts and assessment is based on five categories, the p-value had to be passed is 0.40. In content validation, the assessment was done to the indicators of didactic requirement (suitability of worksheet to learning process), constructive requirement (suitability for students in specific grade), and technical requirement (design of worksheet). Through validator assessment, it can be concluded that the content aspect had already passed these requirements and becomes valid.

Table 1. content validity result indicated V-values have all passed p-values. Therefore, the developed students' worksheet is valid. Didactic indicator measured by the usability of worksheet to improve conceptual comprehension and media variation. Constructive indicator is measured by the use of appropriate narration and space for students to create a product. Technical indicator is measured by the display of students' worksheet and the use of suitable and adequate figures.

Table 2 result of media validation indicated the obtained scores in each indicator are already categorized as good to very good. Indicator of worksheet flexibility to be used in learning was measured by suitability of worksheet to basic competency, indicators of competency attainment, and learning objectives, as well as that worksheet is actual and easy to be assessed. Indicator of media engineering was measured by appropriate use of media in learning, media is practical to be implemented, media facilitates the attainment of basic competency, and worksheet contain steps of using media in learning.

Students' worksheet that has been validated was tested to students in order to calculate its practicality. Through practicality testing, practicality of worksheet or worksheet implementation can be determined. Aspects being

observed in practicality testing are activities that becomes the reference for performance assessment.

Each activity that becomes the basis for assessment has achieved percentage of practicality higher than 75%, or with the percentage average of 93.75%. This implies that the worksheet activities can be carried by students. Total of time being spent during the cultural distribution mapping is 78 minutes and 29 seconds. This work time is not exceeding the lesson hour duration allocated for a session, which is two lesson hours or equal to 90 minutes. Therefore, product of Web-GIS Google My Maps students' worksheet is practical and efficient for high school geography learning.

Table 2. Result of Media Validation

Indicator	Item	Total Score	% Score	Category
Flexibility to be used in learning	1	9.00	90.00	Very good
	2	9.00	90.00	Very good
	3	9.00	90.00	Very good
	4	10.00	100.00	Very good
Media engineering	5	10.00	100.00	Very good
	6	9.00	90.00	Very good
	7	8.00	80.00	Good
	8	10.00	100.00	Very good

Source: Data Analysis (2023)

Subsequent to the measurement of practicality of the developed student worksheet, students' task results were also analyzed through performance assessment. Scores obtained from the students' performance indicated how the given tasks could be completed. Furthermore, this also implied whether such work is considered easy is difficult.

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Results of students' performance assessment on cultural distribution mapping were analyzed. The data indicated that score obtained by students were higher than 80%. This score implies that each task step and activity instructed in the worksheet can be finely understood and followed by students. Result of performance assessment can be used as reference to analyze the measurability of worksheet in learning process that is adjusted to competence level, attainment indicators, and learning objectives.

The developed Web-GIS Google My Maps worksheet has three main parts, namely guidance of worksheet implementation and students' preparation. These parts consist of steps that can be followed by students in cultural distribution mapping and instruction for learning evaluation in form of mapping product criteria for assessment.

Completing mapping tasks instructed from the worksheet shows no significant obstacles. Highest score in the assessment were recorded in the activity of 'uploading result of mapping with adequate information'. The completion of this activity indicated that the previous steps were also well followed. Meanwhile, the lowest score was recorded in the activity of Inserting data on Web-GIS Google My Maps system. In this activity, students were firstly interacted with the web system, causing longer times needed for trials in using features until the process of inputting data can be done,

Analyzing the acceptability of worksheet by its user, which is the students themselves, response questionnaire was used. Indicators that were measured in the instrument are the fulfillment of worksheet development requirement, namely constructive, didactic, and technical requirement, as well as the attainment of Basic Competency 3.6 and 4.6 through the process of learning experienced by students.

The developed Web-GIS Google My Maps Worksheet is already fulfilling the didactic requirement, with the obtained scores of 86.5% to 91.5%. The fulfillment of didactic requirement implied that the developed worksheet is in accordance with the competency level, indicators of attainment, and learning objectives. The fulfillment of didactic requirement is indicated by the worksheet content that emphasized on concept understanding and variation media used in learning.

Students' responses on worksheet constructive requirement showed the obtained score of 88,5% to 92%. Therefore, the developed worksheet is

said to be appropriate for grade 11 high school geography learning. This is indicated by the ease of students in understanding the content of worksheet, suitability to the textbook as main reference in learning, clear instruction in carrying the assignment, and the steps of activity easy to be followed by students.

Technical requirement of Web-GIS Google My Maps Worksheet has been fulfilled as indicated by scores obtained as many as 85% and 92%. Positive responses on technical requirement indicated the worksheet have an interesting display and design. Fulfillment of technical requirement worksheet depicts appropriate use of figures suits the content. Visual components on worksheet supports the implementation of worksheet. These aspects were shown in the worksheet that has flexible access and based on multimedia.

Through the use of Web-GIS Google My Maps Worksheet in geography learning, the Basic Competency 3.6 analysis of local culture variety as national identity based on its uniqueness and distribution has been attained. This was proven by the obtained score of students' response questionnaire as many as 89% to 93.5% or categorized as very good. The attainment of Basic Competency 3.6 indicated by the ability of students to correlate geographic factors on cultural variety, ability to search information on type of local cultures, and ability to collect names or types of local culture and its location.

The attainment of mapping the cultural distribution by students, through the use of Web-GIS Google My Maps, is indicated by the percentage of score as many as 78.5% to 92.55% or categorized as very good. Lowest score was found in the statement of creating map that consist of at least three elements on the web-map, where not all students able to achieve this category. Regardless of that, students are able to use features in web-application relates to stages of creating cultural distribution map as well as using various kinds of symbol and color to represent information on the web-map.

C.2. DISCUSSION

The front-end analysis of Web-GIS Google My Maps students' worksheet is based on the need to: a) enhance students' activity in the teaching and learning process; b) develop mapping competency through Web-GIS platform; and c) provide alternative to desktop-based GIS software. These needs are in line with the study of Ivan & Glonti (2019, p. 6) and Deb Roy (2015, p. 75) in which Web-GIS as multimedia resources helps to increase students' interest towards the learning process and therefore enhance their activities. The use of Web-GIS such as Google Maps could foster mapping skills due to its

effectiveness as both instructional tool and learning sources (Landicho, 2022, p. 145).

Integrating technologies within the classroom still face obstacles. Desktop-based GIS software require huge budget, space, and even skills to be operated (Nur, et al., 2022, p. 2244). Meanwhile, Web-GIS is perceived as a simplified, open-source, and accessible for various devices (Rowland, et al., 2020, p. 4). Specifically in Indonesian schools, the development of Web-GIS instructional tool or worksheet is still not widely done. This is confirmed by the study of Purnomo, et al. (2021, p. 184) that there is still a common perception of desktop-based software as the only tool for GIS learning.

Instructional design of the worksheet product consists of content and students' activities (instruction) in creating cultural distribution map. There are three sequences of activities, namely: a) data collection; b) geotagging; and c) symbology. The similar sequencing was found in the study of Vernizzi & Bontempi (2020, p. 1106) where the workflow of creating a geoinformation through Google My Maps started from: a) planning and execution of survey; b) interactive mapping and live geolocation; and c) symbolizing. Through this web-based application, mixed textual and graphical information allows immediate and intuitive visualization.

This research provided statistical testing of a validated worksheet. Didactic validity of the worksheet product indicated its usability to develop conceptual comprehension and media variation. The Web-GIS worksheet product includes a hands-on activity assisting computer use. Such characteristics results better in students' conceptual comprehension due to its feasibility, attractiveness, and can be followed easily (Aji, et al., 2019, p. 1375). The study of Perugini & Bodzin (2020) mentioned that Web-GIS usage in classroom can promote the development of geospatial thinking skills, due to its ability to empower skills of data visualization in data visualization.

In compliance to the learning objective which is developing mapping competency, the worksheet product had to be validated in constructive indicator. Activities provided in the worksheet should be able to help student create a map through an effective instruction. Hands-on worksheet performs better in helping student create a product. This had been proven by the study of Kapici, et al. (2019) that combination of hands-on worksheet and virtual laboratories give significant improvement on students' achievement rather than virtual laboratory alone.

Using worksheet as instructional tool to teach mapping had been found to be helpful. The worksheet can provide a step-by-step instruction with concise and effective sentence supported by figures. The study of Han (2019, p. 105) stated that Web-GIS instruction can effectively develop geographical competencies. Cloud-based and open-source nature of web-based software gives resource-rich environment. In this aspect, students are encouraged to be able to transform various data into a meaningful geographic information.

Research on the use of geospatial technology in education has been found not only in America and Europe but also in Asia (González & Torres, 2020, p. 75). Learning approaches such as problem-solving activities and inquiry-based learning are implemented through the use of technology. In this study, learning using Web-GIS applications aims not only to enhance knowledge but also to develop process skills in map-making, making it a project-based learning approach. This approach can increase student engagement in learning (Sofias & Piarrekeas, 2012, p. 13).

The results of this research do not directly indicate students' learning outcomes. The aspect being examined is the achievement of students' activities in using the Web-GIS worksheet, Google My Maps. Common issues encountered in students' worksheets are tasks that lack direction, measurability, and time-bound requirements (Dewanti & Santoso, 2020, p. 105). Consequently, the learning process fails to achieve its intended goals. Moreover, the use of technology in education needs to consider its suitability to students' competency levels. Findings of Firomumwe (2022, p. 21) show that overly complicated instructions can hinder competency achievement, thus diminishing the meaningfulness of learning.

The use of Web-GIS in education encourages the achievement of learning objectives and enhances students' learning outcomes. Birsyada et al. (2023, p. 385) found that students are more likely to achieve learning objectives when given multimedia assignments that prioritize collaboration and engagement. This can stimulate increased interest and motivation among students (Cao et al., 2023, p. 5). The improvement of students' learning outcomes through the use of Web-GIS is demonstrated in Yan's research findings (2022), where students who are interested in the learning material exhibit a sincere commitment to learning, leading to improved learning outcomes.

D. CONCLUSION

Web-GIS Google My Maps worksheet present steps of mapping through web-system. The worksheet can be implemented in geography learning

process to attain basic competencies of thematic mapping. The validity of the developed Web-GIS worksheet was indicated by the result of expert validation. Result of content validation achieved the average score percentage of 91,66% or categorized as very good. Similarly, the category applies to the media aspect with the average score percentage of 92.5%.

Through the process of development testing in Grade 11 Social Science in SMAK 3 Bina Bakti Bandung, the conclusion taken was that 93.75% activities instructed in the worksheet can be practiced. Score obtained for performance of students during mapping project reached 87.38%. Through the students' response questionnaire, as many as 88.98% positive responses were given by students on the fulfillment of didactic, constrictive, and technical requirement of worksheet as well as to indicators of basic competency attainment.

Results of worksheet development can have positive impact on the development of geography learning in schools. The use of technology and habituation of computation on learning is a necessity in the 21st century learning. In the other hand, geography learning as regulated in the Curriculum 2013 mandates the implementation of geospatial technology to attain basic competencies of thematic mapping.

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