AN EXPLORATION OF FACTORS ASSOCIATED WITH GEOGRAPHYSTUDENTS AND PRE-SERVICE SOCIAL STUDIES TEACHERS' CONCEPTIONS OF GEOGRAPHY IN COSTA RICAN PUBLIC UNIVERSITIES

by

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DEDICATION

For Tatiana Martinez Loria,

Your love and support have been the source of inspiration for achieving this goal.

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LIST OF ABBREVIATIONS

Abbreviation	Description
UCR = Universidad de Costa Rica	
UNA = Universidad Nacional	
STAT = Spatial Thinking Ability Test	

I. INTRODUCTION

An objective of geographic education is to prepare students to become citizens by making them aware of the current political, environmental, social and economic issues (Bednarz, Heffron and Hyunh 2012). In addition, a geographic education prepares people for everyday decision-making tasks which will impact their lives and the places where they live. Finally, a geographic preparation fosters the development of geographic knowledge and skills demanded by several professions nowadays (Bednarz, Heffron and Hyunh 2012). Thus, benefits of good geographic education are evident for students in order to become a well-prepared citizen in today's world.

Current and future geographers and geography teachers are primarily responsible for developing and disseminating geographic knowledge and creating awareness for the students in grades K-12 as well as higher education. Therefore, college students need a thorough geographic training in order to promote the importance of geography in society. This learning process may be developed using multiple approaches to improve students' knowledge levels and skills (Bednarz, Heffron and Huynh 2012; Wertheim and Edelson 2013; Rutherford 2015). In this way, there are different ways of thinking and doing geography that eventually will change students' perspectives of the discipline.

The achievement of these objectives in geographic education require the analysis of how geography students and pre-service teachers are currently developing geographic knowledge and practices (Bednarz, Heffron and Huynh 2012). It also involves an understanding of how students develop and internalize all their geographic experiences and, consequently, how they form their own conceptions of the discipline which,

ultimately, will affect the way that geography will be practiced and taught (Catling 2004). However, it is important to approaches vary the development of geographic knowledge, skills and conceptions because of differences in perspectives of geographic curriculum around the world. Presently, there is no consensus about what geography students should know and be able to do (Solem, Cheung and Schlemper 2008). The diverse nature of the discipline is reflected in myriad differences among geography departments in the United States, as well as, countries of Latin America.

Higher education geography in Latin American countries—like Costa Rica—responds to the interaction of diverse historical, political, economic, social, and physical factors in a country producing dissimilar perspectives or conceptions of what the discipline is about (Muñiz 2009; Negro 2009). There are specific geography undergraduate programs, but also undergraduate programs oriented towards future geography teachers. In this case, it is very common to find programs of Social Studies that combine history, geography, and pedagogy for training students for teaching at the middle and high school levels.

In this context, the student's geographic preparation tends to have similarities and differences due to variations of goals in each undergraduate program. Consequently, the student's development of knowledge and skills, as well as, their conceptions about the discipline will exhibit differences. Thus, research on undergraduate students' conceptions should acknowledge these particular characteristics.

The research aims to understand how Costa Rican undergraduate students internalize, interpret, and express their conceptions about geography. For this purpose, the study examines the effects of students' levels of career satisfaction and geographic

knowledge by understanding how students define geography as a discipline. In this way, the study explores the nature of geographic preparation and students' level of motivation in Costa Rican higher education and how it is transformed into their particular visions of geography. With this, the research explores how the development of geographic knowledge and skills, as well as, students' geographic experiences in middle school, high school, and college modify the way students conceive and perceive the discipline.

Objectives

The purpose of this research is to analyze the effects of first and fourth year geography students and pre-service social studies teachers' levels of satisfaction with their undergraduate program and their geographic knowledge and its relationships with their conceptions of geography, in Costa Rican public universities. Thus, the research objectives are:

1. To determine the different conceptions of geography expressed by first and fourth year geography students, as well as, pre-service social studies teachers.

2. To analyze the similarities and differences of geography students and pre-service social studies teachers' conceptions of geography according to the year level.

3. To determine relationships between students' conceptions of geography and their satisfaction with their career selection, as well as, their decisions to stay in the undergraduate program.

4. To examine the differences of pre-service teachers and geography students' perceptions about their geographic preparation and spatial thinking abilities according to their year level.

5. To determine the relationships between students' conceptions of geography with their spatial thinking abilities and perceptions about their geographic preparation.

Research Questions

The following research questions were addressed in order to achieve the research objectives:

1. In general, what are the conceptions of geography of first and fourth year geography students and pre-service social studies teachers in Costa Rican public universities?

2. Does year and level of students' undergraduate geography programs affect their overall conceptions of geography?

3. To what extent do students' conceptions of geography affect their levels of satisfaction with selected undergraduate programs?

4. To what extent do students' conceptions of geography affect their decisions to remain in their undergraduate program?

5. To what extent do year and levels of students' undergraduate programs affect their perceptions of geographic preparation, as well as, spatial thinking abilities?

6. To what extent do undergraduate students' conceptions of geography affect their spatial thinking abilities, as well as, their perceptions of their geographic preparation?

II. LITERATURE REVIEW

The pre-service social studies teachers' and geography students' conceptions of geography reflect the nature and characteristics of the discipline in Costa Rica's educational system. Research on the preparation of pre-service geography teachers has been referred to as being relevant for improving the quality of geographic education, students' levels of geographic literacy, as well as, the development of effective undergraduate programs (Bednarz, Heffron and Huynh 2012; Schell, Roth and Mohan 2013). A similar perspective may be applied for the preparation of geography students.

Undergraduate geography students and pre-service social studies teachers enter college with a similar secondary education background; however, each has different goals and expectations for undergraduate programs. Consequently, differences arise in how students and teachers define the discipline. Therefore, this research focuses on pre-service teachers' and geography students' conceptions of geography and how these different views affect factors such as, students' levels of satisfaction with their undergraduate program selection and geographic knowledge.

The Nature of the Conceptions of Geography

The multiplicity of geographic perspectives for interpreting our world are a consequence of the constant changes that the discipline has undergone during the 20th and 21st centuries (Golledge 2002). Consequently, there is no single definition of geography core concepts given the diverse nature of the discipline (Preston 2014; Alkis 2009). This

diversity in geographic knowledge provides evidence that there is more than just one simple way to understand geography (Brooks and Hopwood 2006). Thus, it is important to identify ways that students form their conceptions of geography along with the development of knowledge and skills, as these factors will become an integral part of future professional geography practices and geography teaching (Seow 2009).

The conceptions of geography may be defined as ways of understanding, comprehending or conceptualizing geographic experiences, and includes how a person internalizes the meaning of the discipline (Bradbeer, Healey and Kneale 2004). Thus, a person forms a conception of geography based on their geographic experiences usually developed in the educational system.

Students' conceptions of geography may experience transformations from the beginning to the end of their undergraduate programs because they are embedded with a series of shifting perspectives, approaches and traditions (Seow 2009). Therefore, it is possible to obtain different possible outcomes depending on the way students internalize multiple academic, personal, and learning factors throughout their years of education.

Understanding the Different Conceptions of Geography

There are different ways to describe students' conceptions of geography. One approach consists of students' identification of the purpose or nature of geography; however, there are multiple arguments about what geography means. As a result of the broad areas that it covers—the scientific paradigms and methodologies (Alkis 2009)— it

is almost impossible to define geography with a narrow or single statement of what the discipline should be.

Researchers suggest different methods, procedures, and techniques to address this issue. Qualitative approaches predominant though quantitative and mixed method approaches have also been used for similar topics. Qualitative techniques such as, focus groups, in-depth interviews, and survey protocols are those most commonly used by researchers. While surveys usually cover a larger population by obtaining a snapshot of students' views, other techniques such as, focus groups provide more in-depth understanding and detailed information (Preston 2014).

Phenomenographic studies in particular allow the understanding of different ways people experience, perceive and understand the conceptions of geography and the world that surrounds them (Bradbeer, Healey and Kneale 2004). Usually, this research method focuses on the definition of a set of categories describing different conceptions. These categories then capture the essence of students' beliefs, by identifying particular characteristics (Bradbeer, Healey and Kneale 2004).

Most of the research concerning conceptions of geography have applied a phenomenographic approach, using a classification system (Walford 1996; Martin 2000; Catling 2004; Walshe 2007; Alkis 2009; Morley 2012). Generally, it is common to use survey protocols with open questions, including the elaboration of short statements or paragraphs regarding the conception of geography. For instance, Walford (1996) and Catling (2004) developed the first categorization of students' statements with the potential of being applied in different contexts (Tables 1 and 2). These categories were constructed through several readings and interpretations of the information provided by

students. Although the numbers and types of categories were slightly different, they covered a range of different perspectives. Catling's (2004) system has been used more extensively in different geographic contexts (Alkis 2009; Morley 2012).

Table 1. Conceptions of Geography as defined by Walford (1996).

Category	Geography as the study…
Interactionist	…of the interdependence of and interaction between people and their environment and between peoples over the Earth's surface, i.e., linking human and physical environments in the study of geography.
Synthesizer	…that draws from a variety of disciplines knowledge and understanding about people, places, cultures, the physical world and their interactions to develop a sense of global responsibility for managing human engagement with the Earth, i.e., synthesizing the range of perspectives from within the discipline and beyond.
Spatialist	…of the spatial distribution, relations and processes and consequences of the interaction of physical and human phenomena over the surface of the Earth, i.e., geography as spatial analysis.
Placeist	…that locates, describes and theorizes about places in terms of why places are where they are, why they are like they are, and what that means, in order to foster a sense and appreciation of place, i.e., concerned with information and characteristics of places, regions and countries.

Source: Catling (2004) based on Walford's examples (1996, 73-76).

In both systems of categorization, the Interactionist (Walford 1996) and Globalist perspectives (Catling 2004) are the most common perspectives. Comparable findings have been identified in other studies using similar approaches (Walshe 2007; Alkis 2009; Morley 2012). Some studies also exhibited students' environmentalist conceptions, perhaps, associated with social responsibility given to the discipline (Catling 2004) or to the context in which geographic curriculum has been developed (Alkis 2009).

Table 2. Conceptions of Geography as Defined by Catling (2004).

Category	Geography is about…
Globalist	…the study of the variety of environments and countries in the world; it has a global interest. The emphasis is in the global awareness of the Earth, its features and countries as entities, to be informed
Earthist	…examining, describing and explaining the features and processes of the Earth through human and physical thematic studies. It is concerned with knowledge and understanding about how the World works.
Interactionist	…the emphasis on impacts and effects that result from the interrelationships within and between social and natural processes, with a concern particularly for human impact on the environment.
Placeist	…understanding places and developing a sense of place, in which the emphasis is more on understanding people's lives in a cultural and community context at local and national levels.
Environmentalist	…focusing on environmental concerns, issues and sustainability. This group might be described as holding more clearly a "social agenda" in their perceptions of geography; it is for the environment rather than the world

Source: Catling (2004).

Another approach used for categorizing students' conceptions of geography makes the distinction between relational or non-relational perspectives, the former being more common among students (Bradbeer, Healey and Kneale 2004). In this approach, researchers aim to explore relational perspectives, since they are more desirable as an outcome of higher education preparation in geography.

Different categories are added or reduced depending on the details of the data provided or the way that researchers interpret the statements (Table 3). For instance, Morley's research (2012) suggested that the globalist perspective could be divided into global "fact-finder" and "processor" in order to gain deeper understanding. In addition, outdoor experiences also might produce an effect on students' conceptions of geography

as a discipline. Finally, when students' statements are very complex for interpretation, it becomes necessary to improve or adapt the categories of the conceptions of geography.

Table 3. Conceptions of Geography Developed by Morley (2012).

Category	Geography as the study…
Globalist "fact-finder"	…of knowledge and understanding the world, its human and physical features and environments and of the countries of the world.
Globalist "processor"	…of the Earth, its physical and human features and environments and of the forces and processes that shape them.
Interactionist	…of the interactions between and the interdependence of people and their natural and social environments, of the processes that sustain these interrelationships, and of their effects and influences as outcomes.
Facilitator	…that facilitates opportunities to engage with the environment, explore the outdoors and gather evidence/information.
Placeist	…of people's lives and activities in places, communities and cultures to understand what they are like, why they are as they are, what this means for them and how they relate to others.
Synthesizers	…that draws from a variety of disciplines, knowledge and understanding about people, places, cultures, the physical world and their interactions to develop a sense of global responsibility for managing human engagement with the Earth, i.e. synthesizing the range of perspectives from within the discipline and beyond.

Source: Morley (2012, 129).

In sum, the students' conceptions of geography may be classified using different statements or arguments about how they conceptualize geography as a discipline. The outcome is the final stage of a process in which students internalize their academic, personal, and social experiences. For this purpose, a systematic understanding of the process of interpretation is required in order to delineate the different categories used to classify students' conceptions of geography.

How do Students Develop a Conception of Geography?

Even though there has been a significant amount of research about the classification of students' of geography, there still remains a lack of theoretical and methodological background, as well as, empirical evidence on how students develop their conceptions of geography. The majority of research refers to hypotheses and suggestions from researchers about what should be investigated regarding how the students form their conceptions of the discipline.

Some researchers hypothesize that factors such as, content-knowledge and academic background, expertise in the subject, ideology, experience or the development of professional training, skills, and values are important in developing one's conception of geography, although empirical evidence is lacking (Barret-Hacking 2006; Martin 2000; Walshe 2007). In addition, researchers hypothesize that student seem to develop a deeper understating of geography as they go from an initial and unconnected knowledge level about the subject to a more detailed coherent perspective of the discipline (Hopwood 2011).

The conceptions of geography may also be linked to students' prior experiences, such as, places where they studied before, personal motivations and their satisfaction (Bradbeer, Healey and Kneale 2004; Seow 2009). Nevertheless, research suggests that students' appreciation or satisfaction with geography as a discipline might change after geography courses have been taken (Bowlick and Kolden 2013). Thus, students' conceptions of a subject like geography may be modified throughout their participation in geography courses.

Research involving pre-service teachers identified the role of curriculum philosophy and ideological traditions in the acquisition of geographic knowledge, as well as, how students define their own conceptions of geography; both, eventually, become part of professional practices (Walshe 2007; Brooks and Hopwood 2006). The role of pedagogical knowledge as part of students' preparation might also be another important factor changing students' beliefs about the subject (Brooks 2010; Walshe 2007).

The informal geographic knowledge that students bring into their undergraduate programs also might modify how geography is experienced. These ethnogeographies or own personal geographies consisting of experiences, appreciation for other cultures and knowledge banks of different places around the world might also contribute to shape different perspectives about a discipline (Martin 2005). However, students' informal levels of knowledge will change as long as there is formal instruction in geography, generally provided by the academic setting that include outdoor experiences (Golledge 2002; Bennetts 2005). These interactions shape students' conceptions of geography from an initial perspective to another conception as the combination of formal-informal knowledge grows.

The role of geography professors in undergraduate programs is another factor that might affect how students conceive geography. Research suggests that students with low self-confidence usually consider observed practices as more relevant than their own learning processes (Morley 2012). In this way, students develop different geographic conceptions based on the professor's learning methods, teaching strategies, and ideas about the discipline (Walshe 2007).

There is some empirical evidence about the role that geographic context plays in the students' conceptions of geography. For instance, environmentalist conceptions of geographic education may be linked with the curricular reforms in Turkey, where the environmental approach constitutes a core idea (Alkis 2009).

In this way, several factors have been suggested as relevant for understanding students' geographic conceptions, although it is necessary to collect empirical evidence about how they modify possible personal images of the discipline. The interpretation and analysis of findings in different contexts will contribute to the understanding of factors that foster students' conceptions of geography.

This research intends to explore two factors that might influence students' conceptions of geography: the students' satisfaction with their undergraduate program selection—as a way to identify students' commitment with their undergraduate program and levels of motivation—and students' levels of geographic knowledge. However, it is important to acknowledge that there might be multiple elements influencing students' conceptions. Thus, the research aims to be an exploratory analysis of some of these causes rather than looking for a total explanation of how students define a subject.

Spatial Thinking as a Way to Assess Geographic Knowledge

Geography is a diverse discipline with multiple knowledge levels, skills and perspectives in constant change (Golledge 2002). As a result, there are no methods, single or specific, for assessing students' learning processes. Therefore, this research uses spatial thinking abilities as a way to measure the differences among students, based on

the characteristics of each undergraduate program. This approach is grounded on the concept of spatial thinking, which corresponds to a mode of thinking accessible for different ages and contexts. The concept of spatial thinking is based on three elements: space, tools of representation, and processes of reasoning (National Research Council 2006).

Spatial thinking may be determined on four different scales: 1) micro or body scale, 2) tactile domain, 3) environmental scale and, 4) geographic scale (Golledge, Marsh and Battersby 2008a). The latter has been mostly used by geographers for research, based on their interests in spatial relations, associations and spatial patterns (Huynh and Sharpe 2013; Golledge, Marsh and Battersby 2008b; Ishikawa 2013).

Spatial thinking may be improved through formal education, which leads to a more effective application of spatial concepts for solving problems with a geographic component. Consequently, better spatial thinking abilities may be developed as long as students learn a sequence of geospatial concepts that fosters the progression in the analysis of multiple geographic topics (Golledge, Marsh and Battersby 2008b).

It is common to apply tests linked to spatial tasks ontologies (Table 4). These tests are based on conceptual frameworks for understanding geospatial skills and processes (Golledge, 2002; Gershmel and Gershmel 2006, 2007; Golledge, Marsh and Batersby 2008b). Several conceptual frameworks share common skills and reasoning processes, but it have been criticized for lack of empirical evidence (Lee and Bednarz 2012).

Table 4. Comparison of Examples of Geospatial Thinking Skills and Processes.

Author (s)	Geospatial Thinking Skills and Processes Involves…
Golledge (2002)	Comprehending scale transformation, superordinate and subordinate relations and frames of reference, problems of spatial alignment, distance effects, orientation and direction, spatial association, spatial classification, clustering and dispersion, spatial change and spread, non-spatial and spatial hierarchy, densities and distance decay, spatial shapes and patterns, locations and places, overlay and dissolve, integration of geographic features represented as points, networks and regions, spatial closure, proximity and adjacency, spatial forms and finally, being able to transform perceptions, representations and images from one dimension to another and the reverse
Gersmehl and Gersmehl (2006, 2007)	Assessing location, describing conditions, tracing spatial connections, making a spatial comparison, inferring a spatial aura, delimiting a region, fitting a place into a spatial hierarchy, graphing a spatial transformation, identifying a spatial analog, discerning spatial patterns, assessing a spatial association, designing and using a spatial model and mapping spatial exceptions.
Golledge, Marsh and Battersby (2008b)	Understanding hierarchy of spatial concepts: - Primitive: identity, location, magnitude, space-time. - Simple: arrangement, distribution, line, shape, boundary, distance, reference frame, sequence. - Difficult: Adjacency, angle, classification, coordinate, grid pattern, polygon - Complicated: Buffer, Connectivity, gradient, profile, representation, scale. - Complex: Areal association, interpolations, map projection, subjective space, virtual reality.

Source: Golledge 2002; Gersmehl and Gersmehl 2006, 2007 and Golledge, Marsh and Battersby 2008b.

Assessing spatial thinking abilities has been based on such conceptual frameworks in Table 4. For instance, Huynh and Sharpe (2013) developed a geospatial assessment instrument in order to classify participants into novice, intermediate and expert levels of geospatial concepts understanding, while Lee and Bednarz (2012) created the "Spatial Thinking Ability Test" (STAT) to assess students' development of spatial thinking skills. This approach is based on the use of several geospatial thinking conceptual frameworks (Golledge 2002; Golledge, Marsh and Battersby 2008b;

Goodchild 2009; Gersmehl and Gersmehl 2007), adapted and applied into different geographic contexts (Tomaszewski et al. 2015; Verma 2014; Ishikawa 2013).

In this way, this research aimed to analyze geographic knowledge in two different ways. First, students gave their opinions about the quality of their geographic preparation. Second, a spatial thinking test was administered to measure different spatial reasoning levels among students. The test constitute a validated instrument that provide a way to understand the effects of formal geographic education on students' geographic knowledge, although it did not assess thematic geography content.

III. RESEARCH DESIGN

Site and Situation

Since 1954, Costa Rica has prepared social studies teachers in higher education with a combination of geographical, historical and pedagogical knowledge and skills. These teachers usually work in middle school and high school (Vargas 2012). Along with undergraduate geography students, pre-service social studies teachers take most of the geography courses in the Costa Rican public higher education system, although the course load is different (Table 5).

Two Costa Rican universities have a social studies teaching undergraduate program. The *Universidad de Costa Rica*—UCR—has two different programs, one at its main campus in San José—the capital city—and the other at the regional "Occidente-San Ramon" campus, while the *Universidad Nacional* (UNA) has only one program at their main campus. Only the UCR and the UNA have geography departments, where the faculty members are completely in charge of all students' geographic learning. The UCR and the UNA are different from any other university in the country, where geography courses exist but geographers do not necessarily teach them.

Table 5. Number of Geography Courses Taken by Undergraduate Students of Geography and Social Studies at UCR and UNA.

Year level	Geography		Social Studies Teaching		
	UCR Main Campus	UNA Main Campus	UCR Main campus	UCR San Ramon campus	UNA main campus
First	3	4	1	2	2
Second	8	10	1	3	2
Third	9	9	2	3	2
Fourth	7	10	3	3	0
Percentage of total credits	65	70	14	23	13

Source: Author, based on the undergraduate programs curriculum.

Study Participants

Participants for the study came from two groups: 1) all first and fourth year pre-service social studies teachers and, 2) geography students at the UCR and the UNA in 2015. The students represented a captive sample of 228 students, with 42 geography students in their first year and 46 in their fourth year. In addition, there were 74 pre-service social studies teachers in their first year and 66 in their fourth year.

First year students were defined as those registered in at least one first-year geography course in both geography or social studies undergraduate program. Fourth year students were those registered in at least one course of their final semester in the geography and the social studies undergraduate program.

Second and third year students were omitted from this research because they have not finished their geographic course load. Fifth year students were also excluded in order to reduce possible bias in the results, as they might have had professional experiences that affected their attitudes toward, and/or conceptions of the discipline.

Data Collection

This research employed a mixed method approach, combining different quantitative and qualitative techniques; however, quantitative techniques predominated. Qualitative techniques—analysis of "worded data"—enriched and facilitated analysis of the quantitative results. As a result, the complementary techniques of analysis fostered the achievement of research objectives (Bryman 2007; Burke, Onwuegbuzie, and Turner 2007; Teddlie and Yu 2007; Hesse-Biber 2010).

Several phases of data collection were developed for addressing the research questions. The first phase called for a survey to the first and fourth year geography students, as well as, the pre-service social studies teachers at the UNA and the UCR during July and August of 2015. For this purpose, a questionnaire was developed to achieve the research objectives (Appendices 1 and 2).

The survey questionnaire consisted of three sections; the first corresponded to the participants' general information such as, gender, major, geographic area of origin, year-level. This section also included an open-ended question about the student's conception of geography, which was answered using short statements.

The second section included three questions that each participant answered using a Likert-type scale, where one represented the lowest value that a participant could assign and 10 represented the highest value. The questions addressed topics such as, the satisfaction level with their undergraduate program selection, the disposition to stay in the undergraduate program and perception about the quality of their geographic preparation.

The third section corresponded to an adapted version of the, "Spatial Thinking Ability Test" (STAT), which measured the student's level of spatial thinking. The test had 16 items measuring different components of spatial thinking (Table 6).

Table 6. Description of Question Types and Spatial Thinking Components.

Type	Component (Item description)
I	Comprehending orientation and direction (Questions 1 and 2)
II	Comparing map information to graphic information (Question 3)
III	Choosing the best location based on several spatial factors (Question 4)
IV	Imagining a slope profile based on a topographic map (Question 5)
V	Correlating spatially distributed phenomena (Questions 6 and 7)
VI	Mentally visualizing 3-D images based on 2-D information (Question 8)
VII	Overlaying and dissolving maps (Questions 9,10, 11 and 12)
VIII	Comprehending geographic features represented as point, line, or polygon (Questions 13, 14, 15 and 16)

Source: Adapted from Lee and Bednarz (2012, 18).

Data Management: Survey Codification

The second phase of the research corresponded to the data codification. The information collected in the first section of the survey was transformed into numerical values for the purpose of statistical analysis.

The short statements about the conceptions of geography were analyzed and catalogued using content analysis, with the purpose of looking for explicit and implicit meanings expressed by the students (Bradbeer, Healey and Kneale 2004; Flowerdew and Martin 2005). In this way, all the geographic conceptions were analyzed five times in random order. Each statement was matched to a pre-existing conception of geography (Table 7). These categories were based on a framework developed from the definitions provided by Catling's (2004) and Alkis's (2009) research.

Table 7. Framework Used to Classify Participants' Conceptions of Geography.

Category	Definitions used as a reference for content analysis
Interactionist	Geography is the study of the interaction between people and their environment and between people over the Earth's surface, i.e. linking human and physical environments in the study of geography.
	Geography as the study of the interaction between and the interdependence of people and their natural and social environments, of the processes that sustain these interrelationships, and of their effects and influences as outcomes.
Synthesizer	Geography as the study that draws from a variety of disciplines knowledge and understanding about people, places, cultures, the physical world and their interactions to develop a sense of global responsibility for managing human engagement with the Earth, i.e., synthesizing the range of perspectives from within the discipline and beyond.
Spatialist	Geography as the study of the spatial distribution, relation, processes and consequences of the interactions of physical and human phenomena over the surface of the Earth, i.e., geography as spatial analysis.
Placeist	Geography as the study that locates, describes and theorizes about places in terms of what places are, where they are, why they are like are and what that means, in order to foster a sense and appreciation of place, i.e., concerned with information and characteristics of places, regions and countries.
	Geography as the study of people's lives and activities in places, communities and cultures to understand what they are like, why they are there, what this means for them, and how they relate to others.
Environmentalist	Geography is focused on environmental concerns, issues and sustainability. This group might be described with a more "clearly social agenda" in their perception of geography, i.e., it is for the environment rather than the world.
Earthist	Geography as the study of the Earth, its physical and human features, environments and of the forces and processes that shape them.
Globalist	Geography as the study that develops an informed knowledge and understanding of the world, its human and physical environments, and of the countries of the world.

Source: Catling (2004), Alkis (2009).

The students' statements were analyzed for explicit words or meanings associated with a specific category, i.e., interactionist, globalist or spatialist. The five readings of students' conceptions helped to clarify doubts about whether or not the statements needed

to be classified according to a specific category. Once all the opinions were matched with a given category, a nominal value was assigned for the subsequent statistical analysis.

Answers from the STAT were also transformed into numerical values. In this case, a correct answer was assigned with a value of 1 and the incorrect question a value of 0. Thus, a total score was obtained for each student to facilitate comparisons and the consequent analysis.

Data Analysis

The third phase corresponded to the statistical analysis of the surveyed information. A database was created using Microsoft Excel where the variables were transformed into numerical values. The database was then transferred to the Statistical Package for Social Sciences software (SPSS), where the statistical procedures were performed.

Findings about students' conceptions of geography were represented through descriptive statistics. Additionally, pre-service social studies teachers' and geography students' exemplars were shown with the purpose of clarifying some of the statements provided in the survey questionnaire. The overall results were compared to the answers in Catling's (2004), Alkis's (2009) and Morley's (2012) research, with the aim of identifying similarities and differences. In addition, several chi-square tests looked for statistical significant differences in the students' conceptions of geography according to their year level.

Thereafter, a statistical analysis aimed at understanding the relationships of students' conceptions of geography and the satisfaction with the undergraduate program selection. Four Mann-Whitney U tests explored for statistical significant differences on students' satisfaction levels according to their year level and undergraduate program. Then, four Kruskal-Wallis tests looked for statistical significant relationships in the first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and their satisfaction levels with the undergraduate program selection.

Another statistical analysis explored for statistical significant relationships of the first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and the disposition to stay in the undergraduate program. For this purpose, four Mann-Whitney U test tested for statistical significant differences of the first and fourth year pre-service social studies teachers' and geography students' proclivity to change to another program. In addition, four Kruskal-Wallis tests were performed with the goal of identifying statistically significant relationships between first and four year pre-service social studies teachers' and geography students' conceptions of geography and the disposition to stay in the undergraduate program.

A third process involved the analysis of statistical significant relationships of first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and their geographic knowledge. In this research, students' levels of geographic knowledge was explored through two indicators: the students' perception of the quality of their geographic preparation—from now on referred as geographic preparation—and their spatial thinking abilities.

In this way, four Mann-Whitney U tests explored for statistical significant differences on student's geographic preparation according to their year level and undergraduate program. Then, four Kruskal-Wallis tests looked for statistical significant relationships of first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and their geographic preparation. After that, six Mann-Whitney U tests looked for statistically significant differences among the first and fourth year pre-service social studies teachers' and geography students' spatial thinking abilities. In addition, four Kruskal-Wallis tests were performed with the purpose of looking for statistical significant relationships between the first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and their spatial thinking abilities.

Finally, the research analyzed the relationships of geographic preparation and spatial thinking abilities of the first and fourth year pre-service social studies teachers and geography students, as well as, its contribution towards understanding whether or not students defined geography according to a given category. All the tests were performed at a significance level of 0.05.

Institutional Revision Board Management

The Texas State Institutional Revision Board approved an exemption from full or expedited review of this research (Appendix 3).

IV. LIMITATIONS OF THE STUDY

Students' conceptions of geography represent one of many perspectives about the meaning of the discipline. Any interpretation of such information should take into account the difficulties in understanding the provided statements. For instance, students' opinions might be confusing or too short to be categorized. In addition, there is always a possibility to introduce bias in the categorization of each statement, even though the methodology selected aimed to reduce any mistake to its minimum expression.

The use of a survey as a method for collecting larger sets of data was appropriate for the research objectives. Nevertheless, this technique did not allow the analysis of detailed information from undergraduate students. Thus, other qualitative research methods such as, interviews and focus groups were recommended for the researcher to gain more in-depth perspectives about why students conceptualize geography in different ways.

The research was a cross-sectional study in which there was a limited time frame available for collecting the data. Thus, participants in study in the first and fourth year were not the same; however, they were part of the same undergraduate program, which had characteristics that did not change from one year to another. In this way, the research explored possible factors influencing students' conceptions in first and fourth year, as they represented starting and finishing populations in the undergraduate program. A different methodology would be required if a researcher wanted to develop a longitudinal study.

The time frame available also implied the exploration of a limited number of factors that might explain how students conceptualize geography. Therefore, the researcher chose the students' satisfaction with their undergraduate program because it may be easily assessed with a survey. Other types of students' satisfaction—for instance, personal satisfaction or satisfaction with their geography professors—might require alternative qualitative techniques, which usually needs more time.

Due to limited time available for assessing multiple factors at once, just two indicators were used to explore students' geographic knowledge: geographic preparation and spatial thinking abilities. Nonetheless, this should not be considered as the only way to measure students' knowledge. Other researchers are encourage to use different approaches or indicators to explore students' geographic knowledge. In the case of the spatial thinking abilities, the use of the STAT test is one of many ways for assessing differences among students' geographical knowledge. Other types of spatial thinking tests are available that might also be useful.

V. RESULTS AND DISCUSSION

Costa Rican Undergraduate Students' Conceptions of Geography

Conceptions of geography were reported by the 228 participants from first and fourth year in Social Studies and Geography undergraduate programs, and cataloged into six different categories (Table 8). The classification was based on reference frameworks developed by Catling (2004) and Alkis (2009), in which each created a set of categories for analyzing statements or definitions about the nature of geography.

Table 8. Pre-service Social Studies Teachers' and Undergraduate Geography Students' Conceptions of Geography in Costa Rican Public Universities.

Conception (categories)	Students (n)	Percentage
Interactionist	80	35.09
Globalist	65	28.51
Earthist	52	22.81
Spatialist	16	7.02
Synthesizer	10	4.39
Placeist	5	2.19
TOTAL	228	100

Source: Author.

Over 86 percent of students reported conceptions of geography related to interactionist, earthist or globalist perspectives. Examples of students' responses about their conceptions of geography are shown below[1]. The statements are displayed according to different categories and based on an open-ended question about the meaning of geography as a discipline:

[1] The original answers were written in Spanish. For the purposes of this research, all answers have been translated into English.

Interactionist perspective:

- Respondent #29: *"It is the study of the interaction between the environment and human beings."*

- Respondent #68: *"It is the study of the relationships between society and territory, according to different social, physical, biological, social, economic and cultural aspects."*

- Respondent #119: *"It is the relationship between human beings and their environment, based on human beings and their interactions with their social and natural environment."*

- Respondent #138: *"It is the study of existing relationships between people and the environment where they live."*

Earthist perspective:

- Respondent #35: *"Geography is the science that studies the development of human beings in a given space, based on the changes and evolution of physical space."*

- Respondent #55: *"It is the study of relief and landforms surrounding us, as an essential part of human's development."*

- Respondent #97: *"Science that studies the Earth, its landscapes and physical processes."*

- Respondent #99: *"Science that studies the physical space in which human beings develop, considering social and territorial elements."*

- Respondent #185: *"Science that studies the physical space, considering the geomorphology, landscapes, soils, etc."*

Globalist perspective:

- Respondent #38: *"It is the study and knowledge about everything that is on Earth."*

- Respondent #53: *"Science that studies the development of each region, whether it is social, economic or political."*

- Respondent #60: *"It is the discipline that studies the different spaces that make up the Earth such as landscapes, climate, social elements, etc."*

- Respondent #110: *"Science that studies location and the characteristics of different geographic spaces on Earth."*

- Respondent #167: *"Area of study that covers different elements such as Earth formations, social, economic, political and cultural elements."*

Spatialist perspective:

- Respondent # 188: *"It is the science that studies different areas in which human beings develop spatially."*

- Respondent # 211: *"It is the study of different events occurring on Earth using a spatial perspective."*

Synthesizer perspective:

- Respondent # 11: *"Science that covers a lot of fields and topics such as politics, culture, among others, as part of the study of geographic space."*

- Respondent #18: *"Geography is the combination of different sciences such as geomorphology, hydrology, etc."*

- Respondent #148: *"It is a complex science that needs the support of other areas of science (History, Economy, and Sociology) to complete research in the discipline."*

Placeist perspective:

- Respondent #54: *"I think it is fundamental, not only for helping us to locate a place, but also to understand why the place where we are is the way it is."*

- Respondent #172: *"It allow us to be identified with a place, and at the same time it allow us to create it."*

The number of responses from each category followed similar trends to Catling's (2004), Alkis's (2009) and Morley's (2012) research. The globalist, interactionist and earthist perspectives were the most representative of students' opinions in Catling's (2004) research. They represented 36.2, 30.3 and 14.7 percent respectively. Alkis's (2009) study indicated conceptions of geography more oriented toward an interactionist and earthist perspective. These two categories made up around 90 percent of all responses. Although Morley's research (2012) had a different methodology for collecting

data, which complicates comparisons, the results pointed to conceptions of geography focused on a globalist perspective –around 75 percent of all responses– followed by interactionists, with seven percent of total participants.

The results of this research, as well as, Catling's (2004), Alkis's (2009) and Morley's (2012) studies, suggest the predominance of three main perspectives regarding college students' conceptions of geography: interactionist, globalist and earthist. Nonetheless, the comparative perspective also showed differences in the percentage of students who stated a particular conception. For instance, the interactionist conception of geography was mentioned by 35.04 percent of students in this research, while in Catling's (2004) and Alkis's (2009) research represented 36.2 and 52.2 percent respectively; it accounted for only seven percent of participants in Morley's (2012) study.

Although these three categories were the most frequent, there exists a need to understanding why the predominance of a given category changes from one study to another. A possible explanation of this situation might be related to the geographic context. While this research was performed in Costa Rica, Alkis's study was conducted in Turkey, while Catling's (2004) and Morley's (2012) research was performed in England. Therefore, the characteristics of geographic curriculum and geographic learning in each country might have an influence in the way students conceptualize the discipline. Consequently, the responses in students' conceptions suggest that there are different views of geography in different countries.

Differences in the Conceptions of Geography According to the Year Level and Undergraduate Program

The disaggregated data according to the year level and the undergraduate program showed the differences in the way students conceptualize the discipline. The categories obtained from first year students' responses and their relative frequency vary according to the undergraduate program (Table 9).

Table 9. First Year Pre-service Social Studies Teachers and Geography Students' Conceptions of Geography in Costa Rican Public Universities.

Conception (categories)	Pre-service social studies teachers (n)	Percentage	Geography students (n)	Percentage
Interactionist	16	21.62	19	45.24
Globalist	23	31.08	10	23.81
Earthist	26	35.14	6	14.29
Spatialist	6	8.11	2	4.76
Synthesizer	2	2.70	3	7.14
Placeist	1	1.35	2	4.76
TOTAL	74	100	42	100

Source: Author.

Fourth year students' responses also exhibited a similar results (Table 10). While geography students still conceptualize geography from an interactionist perspective, pre-service social studies teachers' conceptions were mainly distributed among the interactionist, globalist, and earthist categories.

Table 10. Fourth Year Pre-service Social Studies Teachers and Geography Students' Conceptions of Geography in Costa Rican Public Universities.

Conception (categories)	Pre-service social studies teachers (n)	Percentage	Geography students (n)	Percentage
Interactionist	21	31.82	24	52.17
Globalist	22	33.33	10	21.74
Earthist	15	22.73	5	10.87
Spatialist	3	4.55	4	8.70
Synthesizer	2	3.03	3	6.52
Placeist	2	3.03	0	0
TOTAL	66	100	46	100

Source: Author.

Five chi-square tests were performed with the aim of testing for statistical significant relationships among the conceptions of geography grouped into four categories: interactionist, globalist, earthist and others. This last group represented the spatialist, synthesizer, and placeist conceptions—which had a very low response among students—facilitating the statistical analysis. The conceptions were analyzed according to the year level and undergraduate program (Table 11).

Table 11. Chi-square Tests Performed Looking for Statistical Significant Differences Among Students' Conceptions of Geography.

Chi-square tests	Results
1) Conceptions of geography among first and fourth year pre-service social studies teachers	Not statistically significant difference, $\chi 2=3.261$; p=.353; N=140
2) Conceptions of geography among first and fourth year geography students	Not statistically significant difference, $\chi 2=.492$; p=.921; N=88
3) Conceptions of geography among students' in the fourth year	Not statistically significant difference, $\chi 2=6.399$; p=.094; N=112
4) Conceptions of geography among students' in the first year	Statistically significant difference $\chi 2=10.067$; p=.018; N=116
5) Conceptions of geography between the first year pre-service social studies teachers and fourth year geography students	Statistically significant difference $\chi 2=15.508$; p< 0.001; N=120

Source: Author.

According to the tests' results, first year pre-service social studies teachers were not likely to have conceptions of geography different from those in the fourth year, a similar situation with first and fourth year geography students. In addition, fourth year geography students were not likely to conceptualize geography different from the fourth year pre-service social studies teachers.

The tests also showed that first year pre-service social studies teachers were more likely to conceptualize geography according to a globalist, earthiest, and other conceptions than geography students. Finally, first and fourth year undergraduate geographers were more likely to define geography according to an interactionist perspective than first year pre-service social studies teachers were.

The combined results of the chi-square tests revealed patterns that were worth exploring. First and fourth year geography students tended to conceptualize geography from a more interactionist perspective than the first-year pre-service social studies teachers. In addition, the lack of a statistically significant difference between first and fourth year geography students supported the notion that the interactionist perspective was common in Costa Rican undergraduate programs in geography.

Pre-service social studies teachers had a different perspective. Pre-service teachers indicated having a more globalist, earthist, or other conceptions than geography students did in the first year. In addition, there was no statistically significant difference in the conceptions of geography reported by this group of students in the first and fourth year levels.

The descriptive statistics from Tables 9 and 10 contribute to understanding the differences among the groups. First year pre-service teachers' responses were concentrated on the earthist, globalist and interactionist conceptions. Fourth year pre-service teachers also shared a similar response distribution. However, there was a slight change, as the interactionist perspective increased while earthist decreased; the globalist conception did not exhibit major changes, and remained as a common response among pre-service teachers.

Many factors are relevant in understanding differences among students' conceptions of geography, which makes it harder to explain the nature of such changes. It is important to understand that this research did not attempt to find a definitive answer rather it explored factors that contribute to creating such differences. Thus, possible causes require further analysis to explore with deeper detail the reason why these changes exist.

One way to understand results is by exploring reasons of such differences among students according to year level and undergraduate program. In this scenario, a first reason might be related to a students' undergraduate program selection. In Costa Rican public universities, students select their program prior to entering college, a decision that requires them to search for information about different programs. In this case, there is the chance that those students who aspire to enter into the geography program searched for more information about the discipline rather than pre-service teachers, whose interest is broader and not directly oriented to geography. Therefore, different conceptions about the discipline –especially the interactionist perspective– may emerge among geography students rather than pre-service teachers.

Another possible explanation of changes in the conceptions of geography among groups might be the quantity and quality of courses taken during college (Table 5). In particular, fourth year geography students received more geography courses during their higher education. In addition, the interactionist conception of geography was the most predominant among them. In the case of fourth year pre-service teachers, fewer geography courses were taken as compared to geography students. Pre-service social studies teachers also showed responses related to the interactionist perspective, even though other perspectives like globalist and earthist also predominated among this group.

Although deeper analysis of such changes might be needed, a hypothetical cause might be related to the geographic preparation received in college. While fourth geography students receiving more geography courses kept an important percentage of answers categorized as interactionist, the fourth year pre-service social studies teachers who had less geography preparation also increased the number of responses according to an interactionist perspective, but not at the same rate as geography students having a more focused vision of the discipline.

Another way of exploring results is by looking for some reasons producing changes in the conceptions of geography within first and fourth geography students as well as first and fourth pre-service social studies teachers. In this way, the following pages will address two possible explanations. The first is related to students' motivations expressed in the students' levels of satisfaction with the undergraduate program selection and the disposition to stay in the program. The second explores possible links between the conceptions of geography and students' geographic knowledge, expressed in their

perceptions of the geographic preparation received until the day of the survey and the results of a spatial thinking ability test.

The Conceptions of Geography and the Satisfaction with the Undergraduate Program Selection

The students were asked to evaluate –in a scale from 1 to 10, where one represented the worst response and ten the best possible option- how satisfied they were with the selection of the undergraduate program. Overall, the students indicated a higher level of satisfaction among all groups (Table 12).

Table 12. Levels of Satisfaction with the Undergraduate Program Selection among First and Fourth Year Students in Geography and Social Studies.

Groups	Mean (scale 1 to 10)
First year pre-service social studies teachers	8.60
First year undergraduate geographers	8.39
Fourth year pre-service social studies teachers	9.09
Fourth year undergraduate geographers	8.57

Source: Author.

Four Kruskal-Wallis tests were performed with the purpose of looking for relationships first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and the levels of satisfaction with the undergraduate program selection (Table 13)

Table 13. Kruskal-Wallis Tests Performed between Students' Conceptions of Geography and Levels of Satisfaction with the Undergraduate Program Selection.

Kruskal-Wallis tests looked for…	Results
1) Differences among first year geography students	No statistically significant difference, $\chi 2=2.785$; p=.426; N=42
2) Differences among fourth year geography students	No statistically significant difference, $\chi 2=2.056$; p=.561; N=46
3) Differences among fourth year pre-service social studies teachers	No statistically significant difference, $\chi 2=4.272$; p=.234; N=66
4) Differences among first year pre-service social studies teachers	Statistically significant difference $\chi 2=9.783$; p=.021; N=74

Source: Author.

Only the fourth Kruskal-Wallis test found statistically significant differences among the different conceptions of geography held by first year pre-service social studies teachers on the satisfaction of the undergraduate program selection. The proportion of variability in levels of satisfaction accounted for the conceptions of geography was 13.4 percent, indicating a moderate relationship between the conceptions of geography and the satisfaction levels of the undergraduate program selection.

Follow up Mann Whitney U tests were conducted to evaluate pairwise differences among the four groups. The results of these tests indicated a statistically significant difference between the interactionist and globalist perspective, where higher levels of satisfaction with program selection were greater for those students who defined geography more in a globalist perspective than an interactionist one (U= 101.5, p=0.017). In addition, a significant difference was found between the globalist and earthist perspective. Higher levels of satisfaction were more likely in those students who defined geography in a globalist perspective than an earthist one (U= 179, p=0.012).

The results indicated that higher levels of satisfaction have an influence on first year pre-service teachers. First year pre-service teachers who define geography in a globalist perspective seemed to be more satisfied with their programs when compared to other conceptions.

Four Mann-Whitney U tests complemented the analysis, in order to look for statistically significant differences between the levels of satisfaction, the year level and undergraduate programs (Table 14).

Table 14. Mann-Whitney U Tests Performed Looking for Statistically Significant Differences between Students' Levels of Satisfaction.

Mann-Whitney U tests looked for…	Results
1) Differences among first year pre-service social studies teachers and first year geography students	No statistically significant difference, U=1324; p=.171
2) Differences among first and fourth year geography students	No statistically significant difference, U=914; p=.653
3) Differences among first and fourth year pre-service social studies teachers	No statistically significant difference, U=2064; p=.097
4) Differences among fourth year pre-service social studies teachers and fourth year geography students	Statistically significant difference U=1056; p=.004

Source: Author.

In this case, there was found a higher level of satisfaction with the selected undergraduate program in the fourth year for pre-service social studies teachers (Median= 9) than for geography students (Median= 8.5). The previous Kruskal-Wallis tests showed no connections between the levels of satisfaction in both groups and the conceptions of geography that were reported in the survey.

In this way, the research suggested a partial connection between the satisfaction level of the undergraduate program selection and conceptions of geography, which is evident in the first year pre-service social studies teachers, but not for geography student participants. In addition, there are almost no statistically significant differences in the satisfaction levels among students; the only exception is between the fourth year students in geography and pre-service social studies teachers, which did not have a statistically significant relationship with students' conceptions in both groups.

Conceptions of Geography and the Students' Inclination to Stay in Their Undergraduate Program

Participants were asked—on a scale from 1 to 10, where one represented no inclination at all and ten total disposition to—if they would change to another undergraduate program given the opportunity. The results indicated reduced interest in changing to another program in pre-service social studies teachers, while geography students showed a moderate interest (Table 15).

Table 15. Inclination to Change to another Undergraduate Program.

Group	Mean (scale 1 to 10)
First year pre-service social studies teachers	3.95
First year undergraduate geographers	5.26
Fourth year pre-service social studies teachers	2.96
Fourth year undergraduate geographers	4.02

Source: Author.

Four Mann-Whitney U tests looked for statistically significant differences of the inclination to changing to another undergraduate program between pre-service social studies teachers and geography students (Table 16).

Table 16. Mann-Whitney U Tests Performed Looking for Statistically Significant Differences between Students' Inclinations to Changing to Another Undergraduate Program.

Mann-Whitney U tests looked for…	Results
1) Differences among first and fourth year pre-service social studies teachers	Statistically significant difference, U=1911.5; p=.021
2) Differences among first year pre-service social studies teachers and first year geography students	Statistically significant difference, U=1153; p=.024
3) Differences among fourth year pre-service social studies teachers and fourth year geography students	Statistically significant difference, U=1153; p=.026
4) Differences among first and fourth year geography students	No statistically significant difference, U=742.5; p=.077

Source: Author.

The Mann-Whitney U test indicated that pre-service social studies teachers inclination to change to another undergraduate program was greater in the first year (Median = 2.5) than the fourth year (Median = 1). In addition, the tests showed that the inclination to change to another undergraduate program in the first year was greater for geography students (Median= 5.26) than for pre-service social studies teachers (Median = 3.946), while it is greater for fourth year geography students (Median = 3.5) than for pre-service social studies teachers (Median = 1). Finally, there was no statistically significant difference in the inclination to change to another undergraduate program among first year geography students (Median= 5) and fourth year geography students (Median= 3.5).

In addition, four Kruskal-Wallis tests were performed looking for relationships between the first and fourth year pre-service social studies teachers' and geography

students' conceptions of geography and the inclination to change to another undergraduate program (Table 17).

Table 17. Kruskal-Wallis Tests Performed between Students' Conceptions of Geography and the Inclination to Stay in the Undergraduate Program.

Kruskal-Wallis tests looked for…	Results
1) Differences among first year pre-service social studies teachers	No statistically significant difference, $\chi 2=6.839$; p=.077; N=74
2) Differences among fourth year pre-service social studies teachers	No statistically significant difference, $\chi 2=2.066$; p=.559; N=66
3) Differences among first year geography students	No statistically significant difference, $\chi 2=5.882$; p=.117; N=42
4) Differences among fourth year geography students	No statistically significant difference $\chi 2=3.593$; p=.309; N=46

Source: Author.

The results showed that there are differences in the inclination to change to another undergraduate program among students. Overall, there is a low interest on changing in fourth year than first year students. Fourth year pre-service social studies were more satisfied with their undergraduate program selection than fourth year geography students or first year pre-service social studies teachers. Of particular interest to this study, fourth year pre-service teachers were the group with the lowest inclination to change to another program.

Future research might profitably explore the reasons of higher interest in changing into another program on geography students. Some hypothetical explanations might include the uncertainty about the program or their future in the case of first year students, the need for more specialization in fields related to geography, as well as, the search for a complementary perspective from other disciplines in the case of fourth year students.

The evidence suggested the lack of relationships between the inclination to change to another program and the students' conceptions of geography. This means that variations in the inclination to change to another program does not constitute a factor that affects how students' conceptualize the discipline.

Conceptions of Geography Affected by Geographic Knowledge

The study explored whether or not there are any relationships between the students' conceptions of geography and the geographic knowledge of first and fourth year geography students and pre-service social studies teachers. For this purpose, two variables were analyzed: the geographic preparation and the students' spatial thinking ability.

For the first variable (geographic preparation), students were asked about how they would grade—on a scale from 1 to 10—their preparation received in geography. This could have included middle school, high school for first year students, and middle school, high school and college geography courses for fourth year students. The results showed some differences in the groups in the study (Table 18).

Table 18. Students' Perceptions about the Quality of the Geographic Preparation Received.

Groups	Mean (scale 1 to 10)
First year pre-service social studies teachers	8.36
First year undergraduate geographers	8.52
Fourth year pre-service social studies teachers	6.36
Fourth year undergraduate geographers	7.59

Source: Author

Four Mann-Whitney tests were conducted in order to explore relationships between the students' perception about the quality of their geographic preparation—from now on referred as geographic preparation—among first and fourth year geography students and pre-service social studies teachers (Table 19).

Table 19. Mann-Whitney U Tests Performed Looking for Statistically Significant Differences between Students' Levels of Geographic Preparation.

Mann-Whitney U tests looked for…	Results
1) Differences among fourth year geography students and fourth year pre-service social studies teachers	Statistically significant difference, $U=909.5$; $p< 0.001$
2) Differences among first and fourth year geography students	Statistically significant difference, $U=1911$; $p< 0.001$
3) Differences among first and fourth year pre-service social studies teachers	Statistically significant difference, $U=928$; $p< 0.001$
4) Differences among first year geography students and first year pre-service social studies teachers	No statistically significant difference, $U=1530$; $p=.889$

Source: Author.

The tests results indicated that students' geographic preparation in the fourth year was greater for geography students (Median= 7.5) than for pre-service social studies teachers (Median= 6). In addition, the Mann-Whitney U tests showed that the geographic preparation of first year geography students had a more positive perception year (Median= 9) than those in the fourth year (Median= 6), while it also was more positive among in first year pre-service social studies teachers (Median= 8.365) than those in the fourth year (Median= 6). Finally, there was found no statistically significant difference between first year pre-service social studies teachers (Median= 8.365) and first year geography students (Median= 8.524).

As a complement of the analysis, four Kruskal-Wallis tests were performed looking for relationships between first and fourth year pre-service social studies teachers' and geography students' conceptions of geography and their geographic preparation (Table 20).

Table 20. Kruskal-Wallis Tests Performed between Students' Conceptions of Geography and their Geographic Preparation.

Kruskal-Wallis tests looked for…	Results
1) Differences among first year pre-service social studies teachers	No statistically significant difference, $\chi 2=1.998$; p=.573; N=74
2) Differences among fourth year geography students	No statistically significant difference, $\chi 2=.917$; p=.821; N=46
3) Differences among first year geography students	Statistically significant difference, $\chi 2=8.154$; p=.043; N=42
4) Differences among fourth year pre-service social studies teachers	Statistically significant difference $\chi 2=10.153$; p=.017; N=66

Source: Author.

In this case, the third test found statistically significant differences among the different conceptions of geography held by first year geography students and their geographic preparation. The proportion of variability in the geographic preparation accounted for the conceptions of geography was 19.8 percent, indicating a strong relationship between the conceptions of geography and the geographic preparation.

Follow up Mann-Whitney U tests were conducted to evaluate pairwise differences among the four groups. The results of these tests indicated a statistically significant difference between the earthist and the interactionist perspective, as well as the earthist and other perspectives –spatialist, placeist, and synthesizers–. Lower geographic preparation expressed by first geography students were more likely in those who defined

geography from an earthist perspective than interactionist (U=20.5, p=0.017) or other perspectives (U=3.5, p=0.008).

In addition, the fourth test also found statistically significant differences among the conceptions of geography and the geographic preparation of fourth year pre-service social studies teachers. The proportion of variability in the geographic preparation accounted for the conceptions of geography was 15.62 percent, indicating strong relationship between the conceptions of geography and the geographic preparation.

Follow up Mann-Whitney U tests were conducted to evaluate pairwise differences among the four conceptions. The results of these tests indicated a statistically significant difference between the globalist and the interactionist perspective (U=152, p=0.050), the globalist and earthist perspective (U=8605, p=0.017), as well as, the globalist and others perspectives (U=30, p=0.005). A positive perception of the geographic preparation were more likely in fourth year pre-service teachers who defined geography from a globalist perspective than any other group.

The Mann Whitney U tests performed suggest that positive perceptions of geographic preparation is more likely to be found more in first year students—although no significant differences were found between geography students and pre-service teachers—. Nevertheless, fourth year students tended to believe they are less knowledgeable about geography than first year students, and the fourth year pre-service social studies teachers felt even less prepared.

The Kruskal-Wallis tests also suggested statistically significant relationships in two different groups between the geographic preparation and the conceptions of

geography reported by the students. In this way, the geographic preparation is a factor that influences the way fourth year pre-service teachers think about the subject, where positive perceptions of the geographic preparation in pre-service social studies teachers relates to a globalist perspective about geography. In addition, less positive perceptions of their geographic preparation is related to an earthist conception of the subject, while positive geographic preparation is usually associated with an interactionist and other perspectives for first year geography students.

In the case of the spatial thinking abilities, the application of the STAT allowed the identification of students' level of spatial thinking abilities. The results of the test pointed out differences between the groups in the study (Table 21).

Table 21. Students' Mean STAT Scores.

Group	Score (0 to 100)
First year pre-service social studies teachers	46.45
First year undergraduate geographers	43.15
Fourth year pre-service social studies teachers	49.05
Fourth year undergraduate geographers	63.31

Source: Author.

Four Kruskal-Wallis tests were performed looking for statistical significant differences between the conceptions of geography and the STAT scores among first and fourth year geography students, as well as, pre-service social studies teachers. (Table 22). In these tests results, there was no statistical significant relationship between the students' STAT scores and their reported conceptions of geography.

As a complement, six Mann-Whitney U tests were performed to explore statistical significant differences in students' STAT scores (Table 23).

Table 22. Kruskal-Wallis Tests Performed between Students' Conceptions of Geography and their Geographic Preparation.

Kruskal-Wallis tests looked for…	Results
1) Differences among first year pre-service social studies teachers	No statistically significant difference, $\chi 2=1.506$; p=.681; N=74
2) Differences among fourth year geography students	No statistically significant difference, $\chi 2=.811$; p=.847; N=46
3) Differences among first year geography students	No statistically significant difference, $\chi 2=3.807$; p=.283; N=42
4) Differences among fourth year pre-service social studies teachers	No statistically significant difference $\chi 2=3.038$; p=.386; N=66

Source: Author.

Table 23. Mann-Whitney U Tests Performed Looking for Statistically Significant Differences between STAT Scores.

Mann-Whitney U tests looked for…	Results
1) Differences among first and fourth year students overall	Statistically significant difference, U=4123; p< 0.001
2) Differences among fourth year geography students and fourth year pre-service social studies teachers	Statistically significant difference, U=673; p< 0.001
3) Differences among first and fourth year geography students	Statistically significant difference, U=300; p< 0.001
4) Differences among fourth year geography students and first year pre-service social studies teachers	No statistically significant difference, U=642; p< 0.001
5) Differences among first year geography students and first year pre-service social studies teachers	No statistically significant difference, U=1395; p=.355
6) Differences among first and fourth year pre-service social studies teachers	No statistically significant difference, U=2101.5, p=.151

Source: Author.

The results of these tests indicated that STAT scores were greater in the fourth year (Median= 50) than the first year (Median= 43.75), while four year geography students STAT scores were higher in fourth year geography students (Median= 62.625) than pre-service social studies teachers (Median= 50).

The tests results also indicated that fourth year geography students STAT scores were higher (Median= 62.625) than those obtained by first year geography students (Median= 43.75). In addition, the STAT scores were greater in fourth year geography students (Median= 65.625) than first year pre-service social studies teachers (Median= 43.75)

The results obtained in the STAT scores were similar to Lee and Bednarz's (2012) findings, in which the spatial thinking ability increased as the students advanced from high school to University. In the case of Costa Rican students, those in the first year level reported the lowest STAT scores. However, only fourth year geography students achieved a significant higher score than first year students, because fourth year pre-service social studies teachers did not show a different score from first year students.

A possible explanation of such differences might be related to the students' level of preparation in geography. First year students acquired geographic knowledge only from secondary education geography. Their low level of spatial thinking were similar to high school students in Lee and Bednarz (2012) research.

In the case of fourth year students, there is a difference in the number of geography courses taken in college (Table 5). Geography students took more courses than pre-service social studies teachers, a factor that might change STAT scores, as they have had more opportunities to develop an in-depth knowledge.

The student's opinion about the test difficulty and their perception about how well prepared they were to perform the test contribute to understanding differences on STAT scores. For this purpose, students were asked—on a scale from 1 to 10, where one

represented no difficulties doing the test and ten represented a lot of difficulties solving the test—to describe the STAT test difficulty level, as well as, how well prepared they were to answer the test questions. Two Mann-Whitney U tests were performed looking for statistical significant differences in both variables in fourth year students. The results suggested a difference between pre-service social studies teachers and geography students (Table 24).

Table 24. Fourth Year Students' Perceptions—on a Scale from 1 to 10—of the STAT Difficulty as well as How Prepared They Were to Answer the Test.

Group	STAT test difficulty (Mean)	Geographic preparation (Mean)
Fourth year pre-service social studies teachers	7.15	5.46
Fourth year undergraduate geographers	6.28	7.48

Source: Author.

The first Mann-Whitney U tests showed that the STAT test difficulty level in the fourth year was greater in pre-service social studies teachers as compared to geography students, $U=1132$, $p= 0.020$. The other Mann-Whitney U test indicated that the fourth year geography students' felt they were more prepared to answer the test than fourth year pre-service social studies teachers, $U=696.5$, $p<0.001$.

Fourth year geography students got higher STAT scores and lower difficulty level to complete the test. This group also reported a good opinion about their capacity to solve the test questions. Fourth year pre-service social studies teachers had lower STAT scores, more difficulty in answering the STAT test and they reported an inadequate geographic preparation for solving the test. On the other hand, the results of the Kruskal-Wallis tests

suggested there is no relationship in the way students define geography in Costa Rican public universities with their spatial thinking ability level. In this way, the geographic knowledge of a student—measured through a spatial thinking ability test—was not a factor that changed student's conceptions of geography.

The combined data of the perceptions about geographic preparation and spatial thinking abilities variables showed a more detailed perspective about geography students and pre-service social studies teachers. Overall, there is a statistical significant difference only between students' conceptions of geography and the geographic preparation of pre-service social studies teachers, while there is no relationship with geography students. In addition, the STAT scores did not have an effect in the way the students conceived geography as a discipline.

The statistical significant differences between geographic knowledge and the conceptions of geography did not mean that there was no differences among students. Overall, lower spatial thinking abilities and positive perceptions of their geographic preparation were common to first year students, independently of the undergraduate program. Thus, better geographic preparation perceptions might not be associated to higher levels of spatial thinking abilities.

On the other hand, there were differences between geography students and pre-service social studies teachers in the fourth year level. Although lower perception of the geographic preparation was found in all fourth year students, the results suggested an even lower perception in pre-service social studies teachers, as compared to geography students, which is also the case for STAT scores.

There are different conclusions for each group. In the case of geography students, less positive geographic preparation perceptions and high STAT scores suggest that there might be different factors making a disconnection between the students' spatial thinking skills and how well prepared they think they are. This situation might be worth exploring in future research, looking at possible causes like the stress of being in the fourth year level, which includes a need for job search, personal motivation issues, as well as the pressure of being well prepared at the end of college.

In the case of fourth year pre-service social studies teachers, less positive perceptions about their geographic preparation and low STAT scores suggested a problem in the way students are being prepared in geography, which produces an important difference with other students that have a deeper preparation in the discipline.

VI. CONCLUSIONS

Costa Rican geography students and pre-service social studies teachers in public universities reported six different conceptions of geography. The interactionist, globalist and earthist perspectives were the most prevalent. The findings were similar to other research in countries like Turkey and England; however, the prevalence of each conception varied in each study. The geographic context and the characteristics of the geographic curriculum in each country might influence how students think of geography as a discipline. Future comparative research on student's conceptions could confirm such variations.

The prevalence of the interactionist, earthist, and globalist conceptions of geography changed according to the year level and undergraduate program. Geography students, independently of the year level, tended to define geography from an interactionist perspective more than first year pre-service social studies teachers. On the other hand, first year pre-service social studies teachers expressed a definition of geography using a globalist and earthist perspective more than the geography students.

Fourth year pre-service social studies teachers showed a divided vision about what geography means. The globalist and earthist conception were the most common responses in this group. In addition, there was an important increase in the number of fourth year students defining geography from an interactionist perspective, which indicated a variation from first year pre-service social studies teachers' conceptions but not from geography students.

The student's geographic course load could be a factor that explains the slight difference in pre-service social studies teachers' conceptions of geography. Fourth year pre-service social studies teachers received several geography courses during college, but not in the same number as the geography students. It is possible that as students receive more geography courses, the interactionist perspective becomes predominant, although future research must address the effect of the quantity and quality of courses in student's conceptions of geography in order to confirm this assumption. What seems to be very relevant to this study is the existence of two different visions about what geography should be about, one for geographers and the other for pre-service social studies teachers, even though is being taught by the same professors.

The research explored possible factors that cause variation in student's conceptions of geography. For this purpose, the research evaluated the students' satisfaction with and the disposition to stay in the undergraduate program. In addition, the student's geographic knowledge was analyzed to consider the student's perception of the geographic preparation and their spatial thinking ability. Pre-service social studies teachers and geography students exhibited different relationships with these factors.

There was a partial connection of pre-service social studies teachers' conceptions of geography with only two of the factors. The satisfaction with the undergraduate program selection had a moderate influence the conceptions of geography exclusively in first year pre-service social studies teachers. In this case, the students who defined geography from a globalist conception stated the highest levels of satisfaction with the selected program.

In addition, the geographic preparation was a strong factor influencing first year geography students and fourth year pre-service social studies teachers' conceptions of geography. First year geography students tended to define geography more in an interactionist, globalist, and other perspectives when they had a better perception of their geographic preparation. Fourth year pre-service social studies teachers who defined geography in a globalist perspective expressed the most positive opinion about their geographic preparation.

Pre-service social studies teacher's conceptions of geography did not have any association with the disposition to change to another undergraduate program and the students' spatial thinking abilities. Therefore, how students defined the subject is completely independent from the proclivity to stay in the program or their spatial thinking abilities.

First and fourth year geography students' conceptions of geography did not have any association with any of the factors in the study (except for the perception about their geographic preparation on first year students). The lack of statistical significant relationships might suggest a need for alternative explanations. For example, there are other factors not explored in this research that could be influencing the way students define geography as a discipline. Personal motivation issues, the effect of particular professors on student's attitudes, job opportunities, among other causes may be factors that modify student's responses and could be addressed in future research.

Another explanation could be the need for a different research approach. The survey allowed reaching hundreds of students at the same time at the beginning of the semester, which makes the collection of data equal to all students and easy for the

researcher. Nonetheless, the use of a survey as a way to analyze student's conceptions did not allow a deeper exploration of student's beliefs and perceptions. In this way, future research might require the use of qualitative methods like focus groups to analyze with more detail the reasons why Costa Rican students consider geography from different perspectives, especially among geography students.

The application a spatial thinking ability tests allowed the examination of a possible relationship between student's conceptions and their spatial thinking skills. The research demonstrated that the STAT is a good way to measure these kind of skills, even though it does not indicated a connection between the two variables.

The factors explored in the research may have a limited connection with student's conceptions of geography. However, statistical analysis showed some differences in such factors among students. First year geography students exhibited a high level of satisfaction with the undergraduate program selection, moderate disposition to change to another program, a good opinion about their geographic preparation, but they had low STAT scores. On the other hand, first year pre-service social studies teachers also showed a high level of satisfaction with the program selection, a positive opinion about their geographic preparation, and had low STAT scores. However, they reported a high disposition to stay in the selected undergraduate program. ´

In the case of fourth year pre-service social studies teachers, they reported the highest level of satisfaction with the undergraduate program selection, and the highest inclination to stay in the undergraduate program. However, the results on geographic knowledge showed significant low STAT scores and were less confident about their geographic preparation. On the other hand, fourth year geography students stated the

lowest level of satisfaction with the program selection and a moderate disposition to change into another program. In addition, this group of students had the highest STAT score, even though they expressed a low value in the perception about the geographic preparation when compared to other groups.

In conclusion, the research indicated that there are differences in first and fourth year geography students and pre-service social studies teachers, expressed in different levels of satisfaction with the undergraduate program and geographic knowledge. However, knowledge and satisfaction are not necessarily related to the students' conceptions of geography.

A relationship between student's conceptions and satisfaction with the undergraduate program selection, as well as the perception of the geographic preparation was only present in first and fourth year pre-service social studies teachers. Therefore, future research should address others factors that might influence the way students think of geography as a discipline, using detail qualitative perspective to gain deeper details of student's perspectives.

There are some implications of this research in the development of curricular changes on the Costa Rican undergraduate programs in Geography and Social Studies. The conceptions of geography reflects the way in which geography students internalize a series of academic, personal and social experiences throughout college. Therefore, the undergraduate programs should be aware of how students conceive the discipline because this could contribute to develop possible changes in the way students are being prepared. This means that undergraduate programs could use the results of this research to explore possible efforts for maintaining or changing desired students' conceptions, according to

their goals regarding the preparation of future professionals in geography and geography teaching.

APPENDIX SECTION

APPENDIX 1

Encuesta de estudiantes de grado en Estudios Sociales y Geografía en Costa Rica.

El propósito del cuestionario es la recolección de información para el proyecto "*El conocimiento geográfico de los Estudiantes de Estudios Sociales y Geografía en las Universidades Públicas de Costa Rica".*

La información recolectada tiene un carácter confidencial y anónimo. Como tal, ningún dato personal o violatorio a la intimidad será preguntado. Los datos que se recolecten serán utilizados exclusivamente para fines académicos, y no serán utilizados de forma individual. Al completar el siguiente cuestionario, el participante otorga su consentimiento para participar del proyecto. Gracias por su tiempo y colaboración.

I. **Información general:**

1. Carrera en la que se encuentra (en caso de estar registrado a ambas, seleccione en la que actualmente lleve más cantidad de cursos)

( ) Enseñanza de los Estudios Sociales y Cívica ( ) Geografía

2. Año del programa en el que se encuentra matriculado

( ) Primer año ( ) Cuarto año.

3. Género:

( ) Masculino ( ) Femenino

4. Cantón de residencia antes de entrar a la Universidad:

_____

II. **Perspectivas generales:**

5. ¿Por qué motivo escogió la carrera seleccionada?

6. Del 1 al 10, siendo 1 el valor más bajo y 10 el más alto ¿Qué tan satisfecho está con la selección efectuada?

1	2	3	4	5	6	7	8	9	10

7. Del 1 al 10, siendo 1 el valor más bajo y 10 el más alto, ¿Optaría por cambiar de carrera si tuviese la oportunidad de hacerlo?

1	2	3	4	5	6	7	8	9	10

8. Del 1 al 10, siendo el 1 el valor más bajo y el 10 más alto, ¿Cómo calificaría la formación recibida hasta el momento en geografía?

1	2	3	4	5	6	7	8	9	10

II. **Opinión: En los siguientes cuadros, responda por medio de un breve párrafo las siguientes preguntas**

A. ¿Qué es la Geografía?

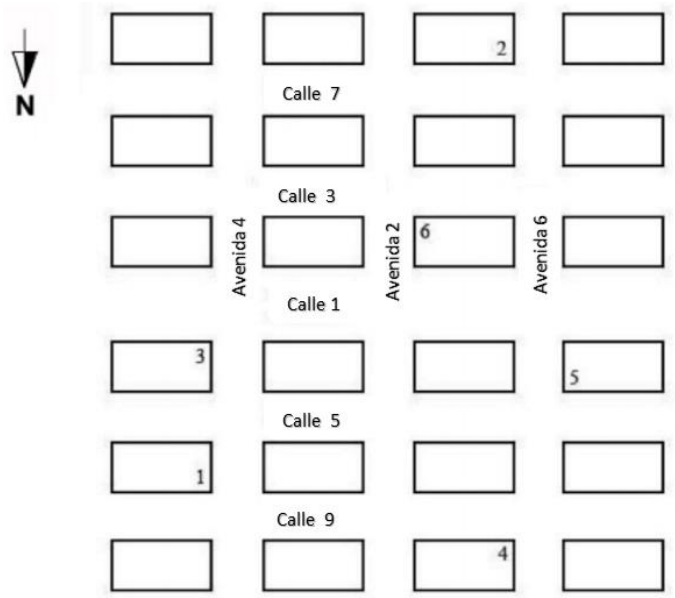
B. **<u>SÓLO para estudiantes de Enseñanza de los Estudios Sociales y Cívica:</u>**

- En mi opinión, el propósito de enseñar geografía en educación secundaria es

III. Prueba de habilidades de pensamiento espacial[2] (STAT por sus siglas en inglés)

A continuación se le presenta 16 preguntas de selección única. Por favor seleccionar únicamente la casilla que considera sea la respuesta correcta.

Observe y utilice la siguiente figura para responder la pregunta 1 y 2



1. Si usted se encuentra en el punto 1 y viaja hacia el norte una cuadra, luego gira hacia el oeste y viaja tres cuadras, y luego gira hacia el sur viajando dos cuadras, usted estará cerca del punto:

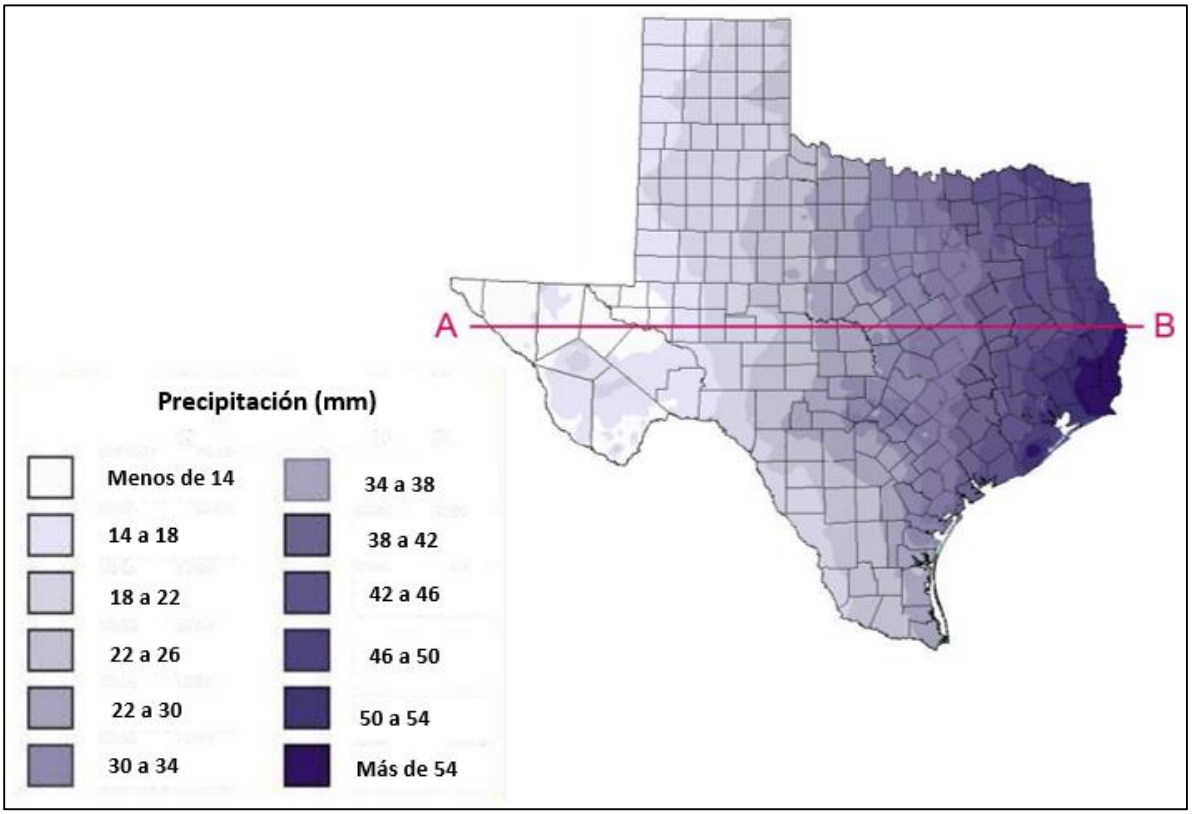
A) 2 B) 3 C) 5 D) 5 E) 6

2. Si usted está localizado en el punto 1 y viaja hacia el este una cuadra, luego gira a la izquierda y viaja tres cuadras; luego gira al oeste y viaja una cuadra, para luego girar a la derecha y viajar cuatro cuadras, usted estará cerca del punto:

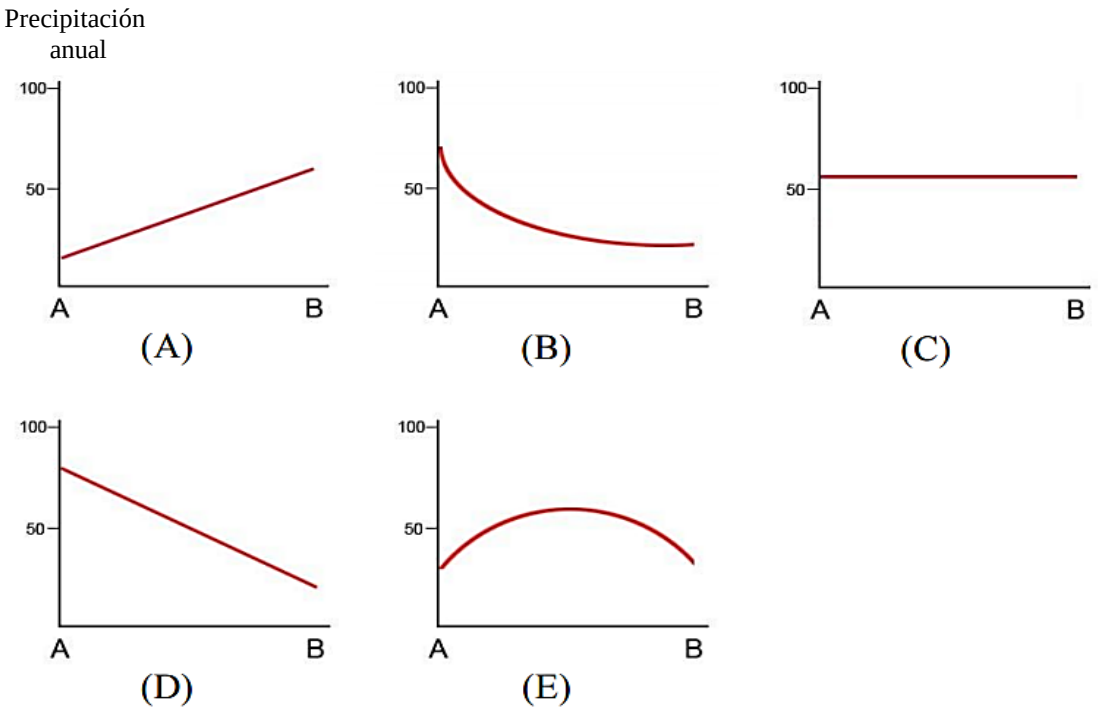
A) 2 B) 3 C) 5 D) 5 E) 6

[2] Reconocimiento: La siguiente prueba se efectúa con el consentimiento de la Asociación de Geógrafos Americanos (AAG), y el reconocimiento del Dr. Jongwon Lee como su autor. Prohibida la reproducción o modificación sin el consentimiento expreso de la AAG y el Dr. Lee.

3. El siguiente mapa representa la precipitación anual en un área geográfica determinada.

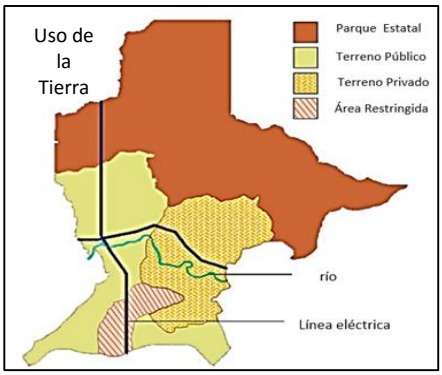


Si usted dibuja un gráfico mostrando el cambio de la precipitación anual entre el punto A y B, el gráfico sería:

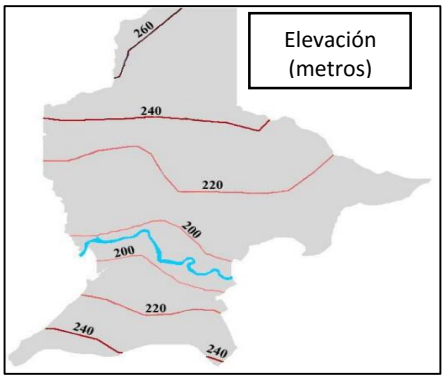


4. Encuentre el mejor sitio para la creación de instalaciones para la gestión de inundaciones, basado en las siguientes condiciones:

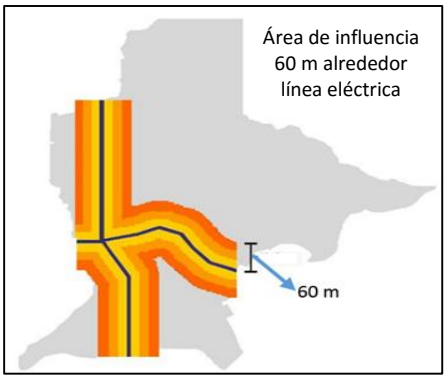
La instalación debe estar en un terreno público



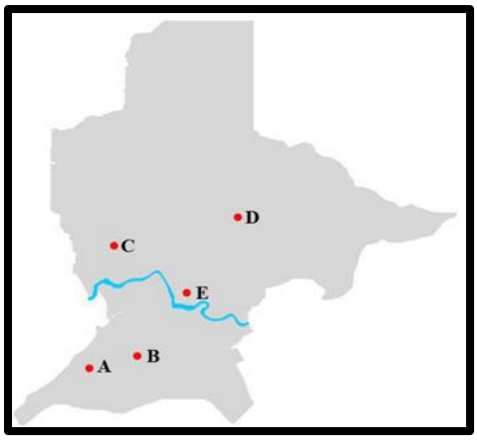
La instalación debe estar una elevación menor a los 220 m



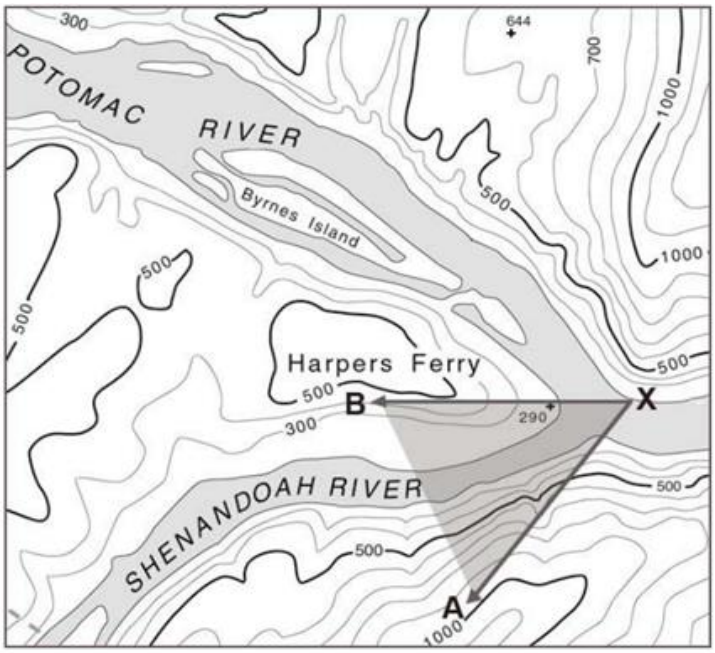
El centro debe estar a 60 m de una línea eléctrica



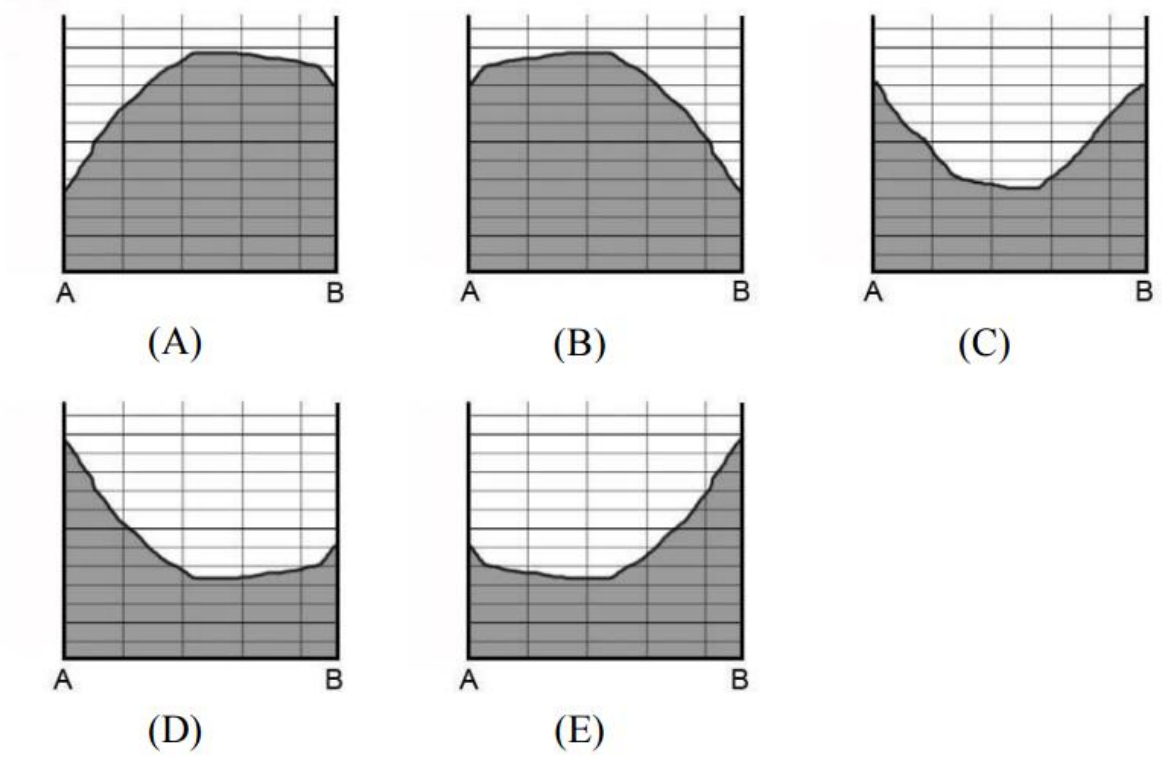
Encierre en un círculo el mejor sitio (escoger entre letras A, B, C, D, E) para las instalaciones de gestión de inundaciones en el mapa de la derecha.



5. Imagine que se encuentra en la ubicación X, y usted está mirando en dirección del punto A y B. Entre los 5 perfiles de elevación (del A al E) que verá a continuación, ¿Cuál es el perfil que representa más fielmente lo que está viendo?

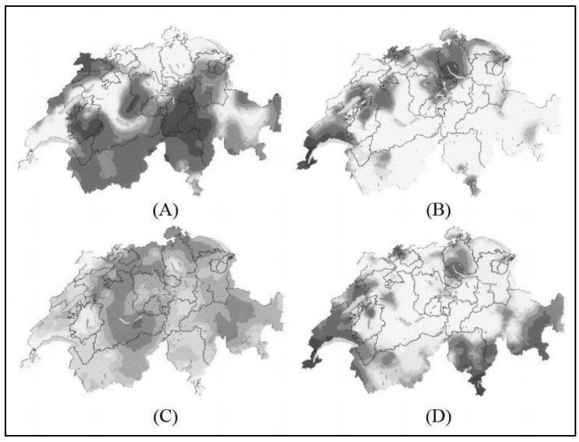


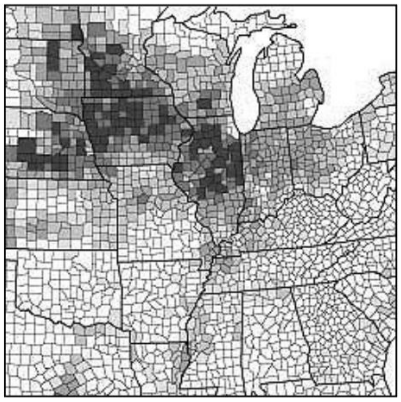
Elevación



6. En este ejercicio, su labor es la de encontrar mapas que tienen correlaciones espaciales. Por ejemplo, el mapa “B” y el mapa “D” tienen correlación positiva (patrones similares).

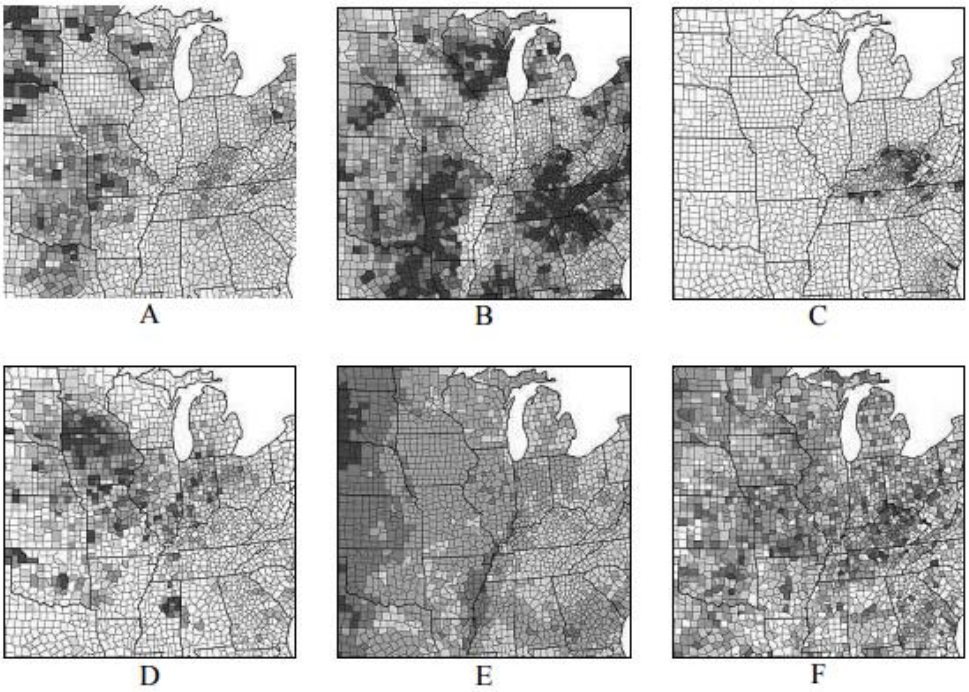
Ejemplo.



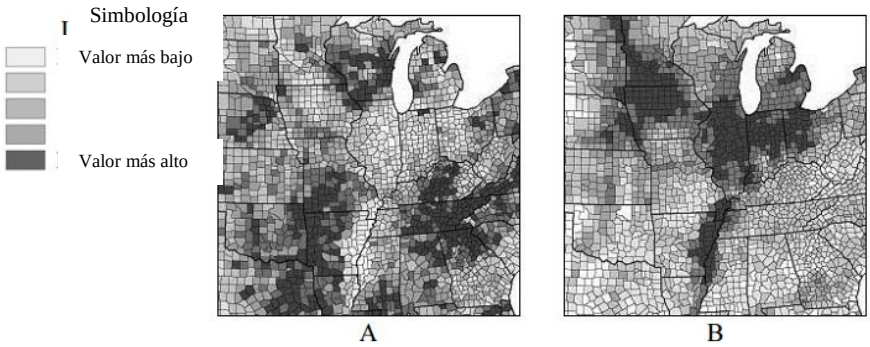


Seleccione un mapa (Del A al F) que tenga una fuerte correlación positiva con el **mapa de la izquierda.**

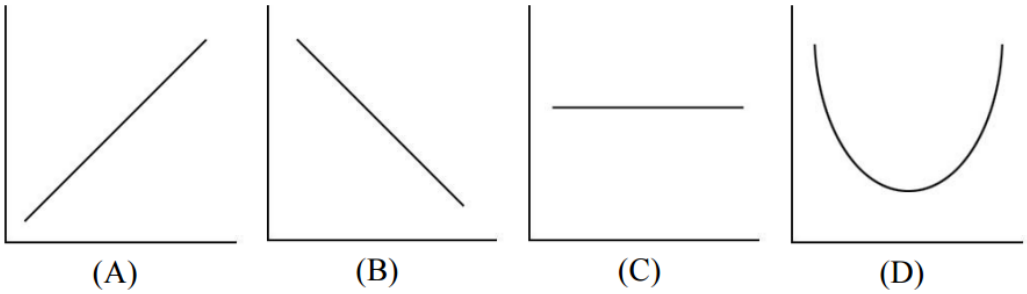
Encierre en un círculo la respuesta correcta.



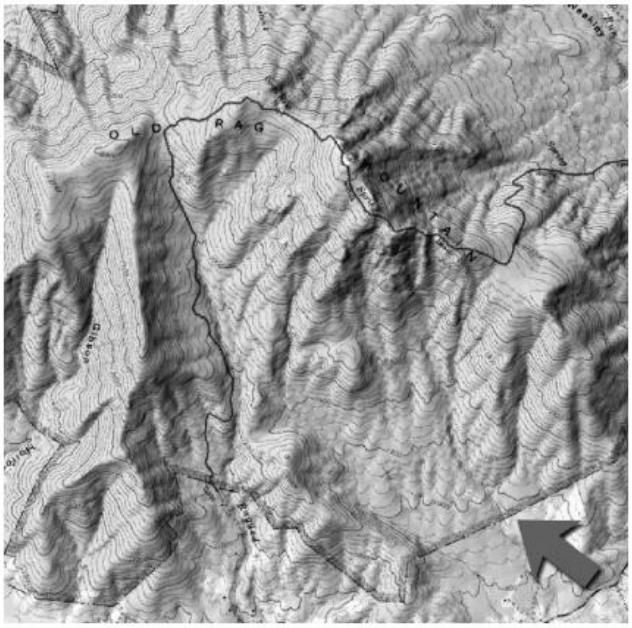
7. Los siguientes dos mapas muestran (A) Hectáreas de producción de maíz y (B) Valor de los cerdos como un porcentaje del total de los productos agropecuarios vendidos.

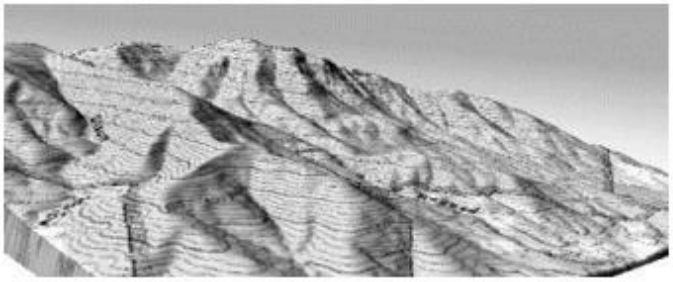


Si usted dibuja un gráfico mostrando la relación entre el mapa “A” y “B”, el gráfico sería: (seleccione uno de los siguientes gráficos)

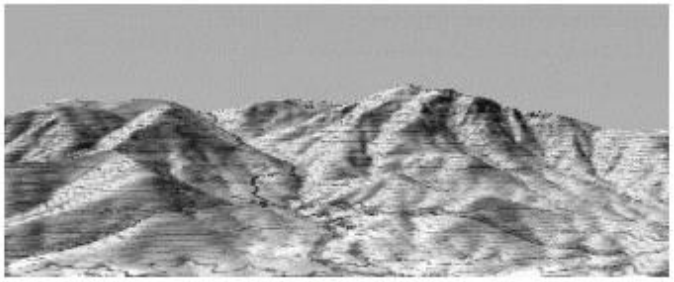


8. Si usted mira en la figura de abajo, en la dirección que indica la flecha, ¿cuál vista de terreno (opciones A a la E) representa fielmente lo que usted vería?

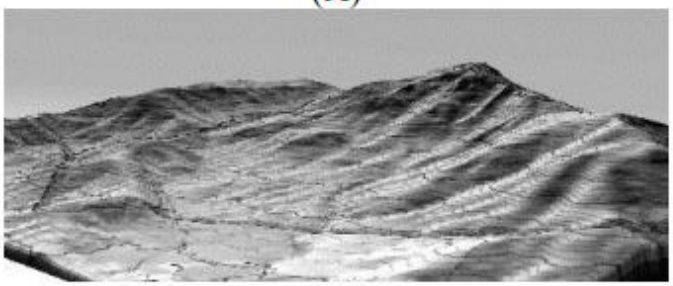




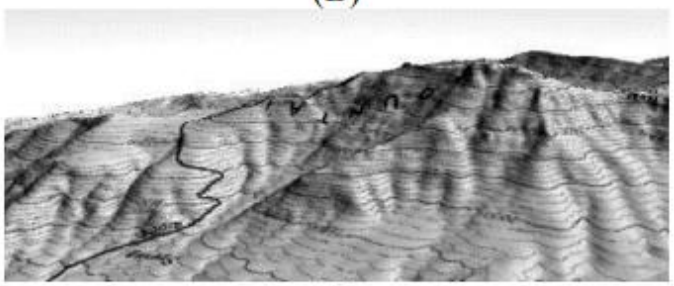
(A)



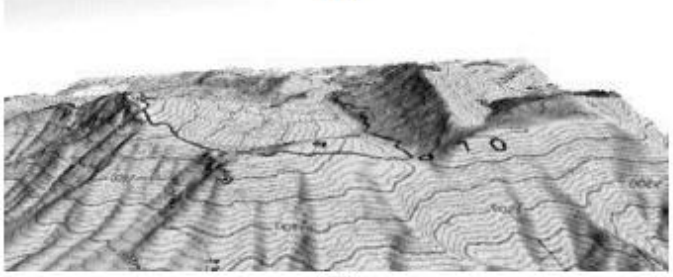
(B)



(C)



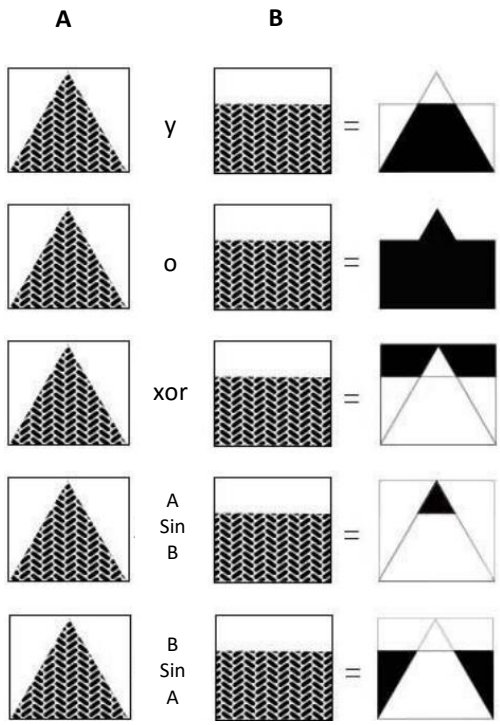
(D)



(E)

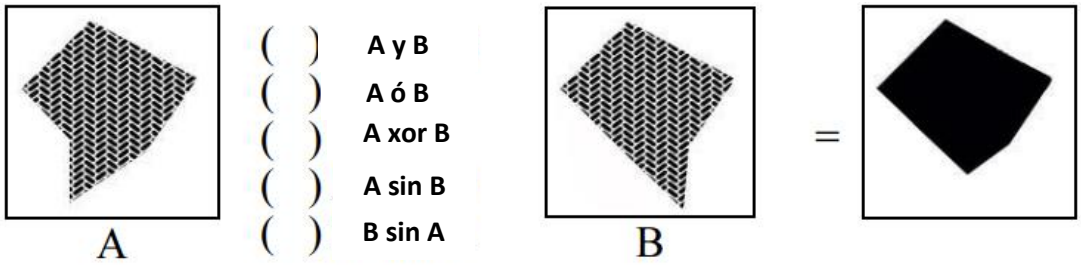
Resuelva las siguientes preguntas (9 y 10) basado en el siguiente ejemplo.

Ejemplo.

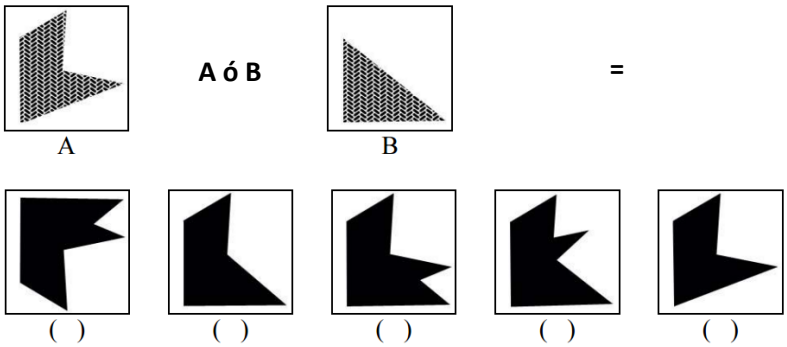


Xor = excluidos en solución final

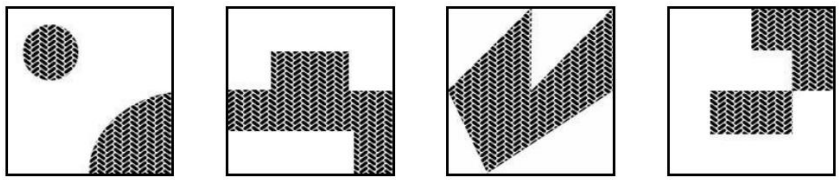
9. Seleccione una opción:



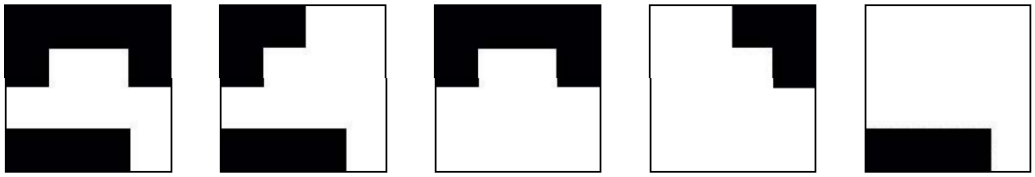
10. Seleccione una opción:



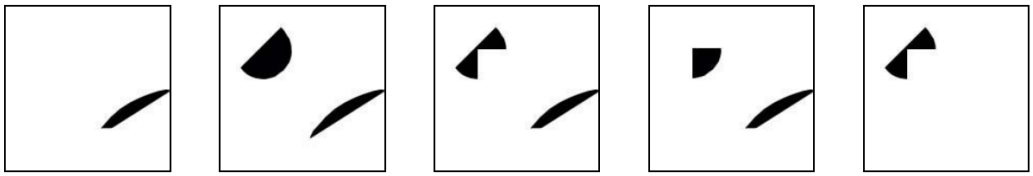
Resuelva las siguientes preguntas (11 y 12) basado en el siguiente diagrama:



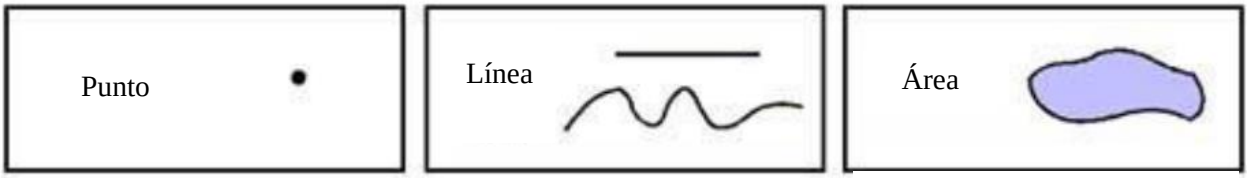
11. “D” sin “B” (seleccione una opción)



12. “A” y “B” y “C”



Los objetos del mundo real pueden ser representados explícitamente por un punto, línea y un área (polígono), como se muestran en los siguientes ejemplos.



Ejemplos: Un árbol, un banco

Ejemplos: calles, ríos

Ejemplos: el área de un continente o un lago.

Seleccione el tipo de objeto (punto, línea o área) que se puede usar para representar los elementos descritos en las preguntas 13-16 (escoja una sola opción en cada pregunta).

13. La localización de estaciones meteorológicas en el cantón de Cartago.

(A) Línea
(B) Área
(C) Puntos y líneas
(D) Puntos y área

14. Los tributarios del río Tempisque y sus cuencas.

(A) Líneas
(B) Área
(C) Puntos y líneas
(D) Líneas y área

15. Ruta de un bus inter-urbano:

(A) Puntos
(B) Área
(C) Puntos y líneas
(D) Puntos y área

16. Lugares a los que puede llegar una ambulancia desde la estación central en Alajuela en 5 minutos o menos.

(A) Puntos
(B) Líneas
(C) Área
(D) Puntos y líneas

Del 1 al 10, siendo 1 extremadamente fácil y 10 extremadamente difícil, ¿Cómo califica la dificultad de la prueba efectuada?

1	2	3	4	5	6	7	8	9	10

Del 1 al 10, siendo 1 el valor mínimo y diez el valor máximo ¿Cómo considera que la preparación académica recibida hasta el momento le permite resolver adecuadamente los ejercicios anteriores?

1	2	3	4	5	6	7	8	9	10

¡Muchas gracias!

Sin duda su colaboración es muy importante para lograr los objetivos de la investigación. Si posee interrogantes sobre la encuesta o la temática desarrollada, por favor envíe un correo electrónico al investigador Jose Alejandro Cascante Campos:

Correo electrónico: jacc1987@txstate.edu

APPENDIX 2

Survey of undergraduate geography students and pre-service social studies teachers in Costa Rica.

The survey's purpose is to collect information for the project called "geographic knowledge of pre-service social studies teachers and geographers in Costa Rican public universities"

The information provided is anonymous and confidential. Thus, personal data that violates privacy is not going to be asked. The data will be used exclusively for academic purposes and it will be treated in a general way. By completing the following questionnaire, the participant acknowledges its consent for participating in the project. Thanks for your contribution and time.

I. General Information:

1. Bachelor program (if you are registered in both, please select the one where you have more courses registered)

( ) Social studies and civics teaching ( ) Geography

2. In which level are you registered?

( ) First year ( ) Fourth year

3. Gender

( ) Male ( ) Female

4. Place of residence before entering the University:

_____

II. **General perspectives:**

5. Why did you choose your bachelor program?

6. From 1 to 10, being 1 the lowest value and 10 the highest value ¿How much satisfied are you with the chosen bachelor program?

1	2	3	4	5	6	7	8	9	10

7. From 1 to 10, being 1 the lowest value and 10 the highest value, would you change your major if you have the chance to do it?

1	2	3	4	5	6	7	8	9	10

8. From 1 to 10, being 1 the lowest value and 10 the highest value, ¿How do you grade the academic preparation received until now in geography?

1	2	3	4	5	6	7	8	9	10

II. Opinion: In the following boxes, answer with a small paragraph the following questions:

A. What is geography?

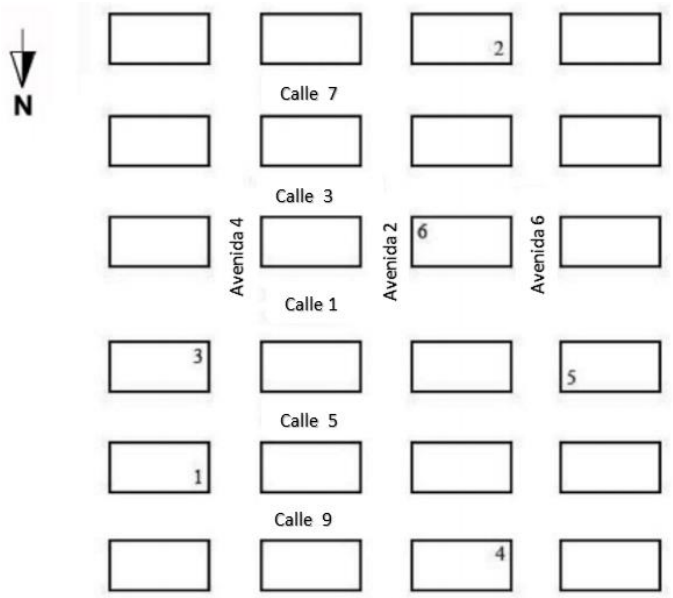
B. **JUST for pre-service social studies teachers.**

- In my opinion, the purpose of teaching geography in secondary education is

III. Spatial Thinking Ability Test[3] (STAT)

The test consists of 16 multiple choice questions. Please select the option you consider is the correct answer.

Use the following figure to answer questions 1 and 2



1. If you are located at point 1 and travel north one block, then turn west and travel three blocks, and then turn south and travel two blocks, you will be closest to which point:

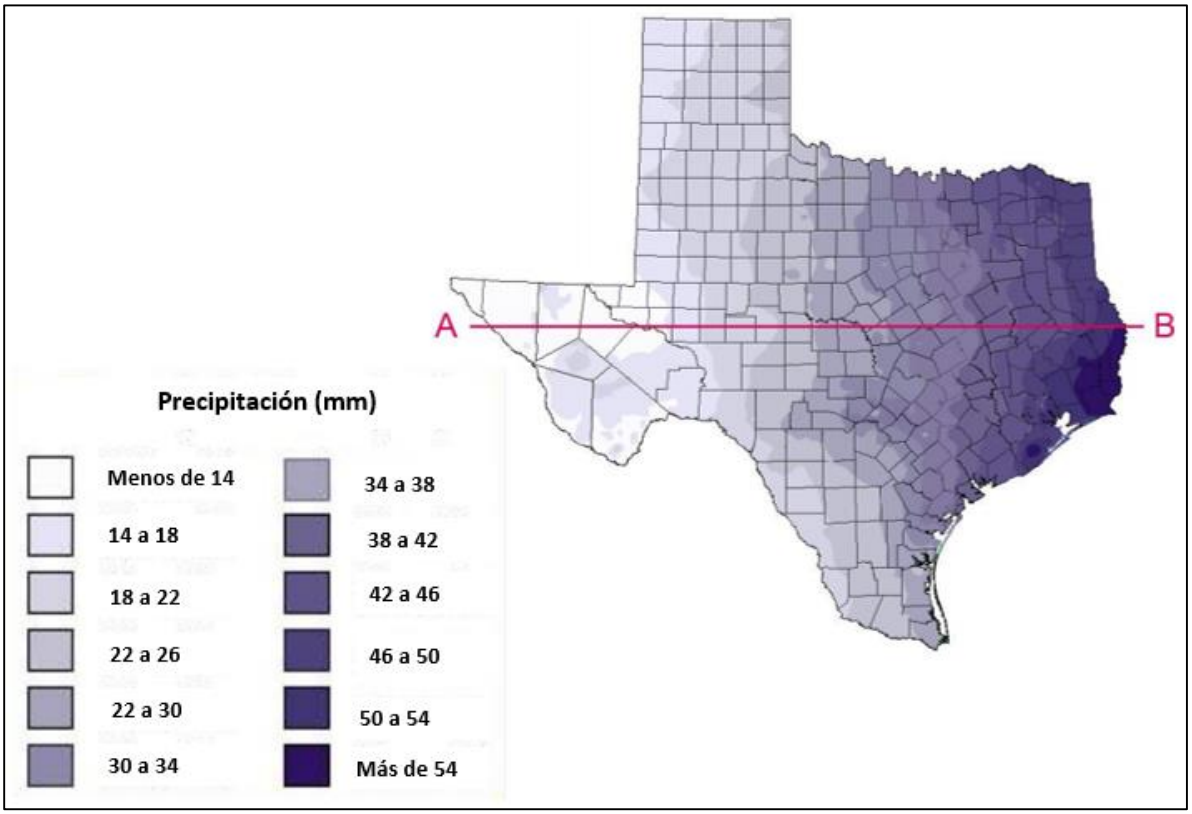
A) 2 B) 3 C) 5 D) 5 E) 6

2. If you are located at point 1 and travel west one block, then turn left and travel three, then turn west and travel one block, and then turn right and travel four blocks, you will be closest to which point:

A) 2 B) 3 C) 5 D) 5 E) 6

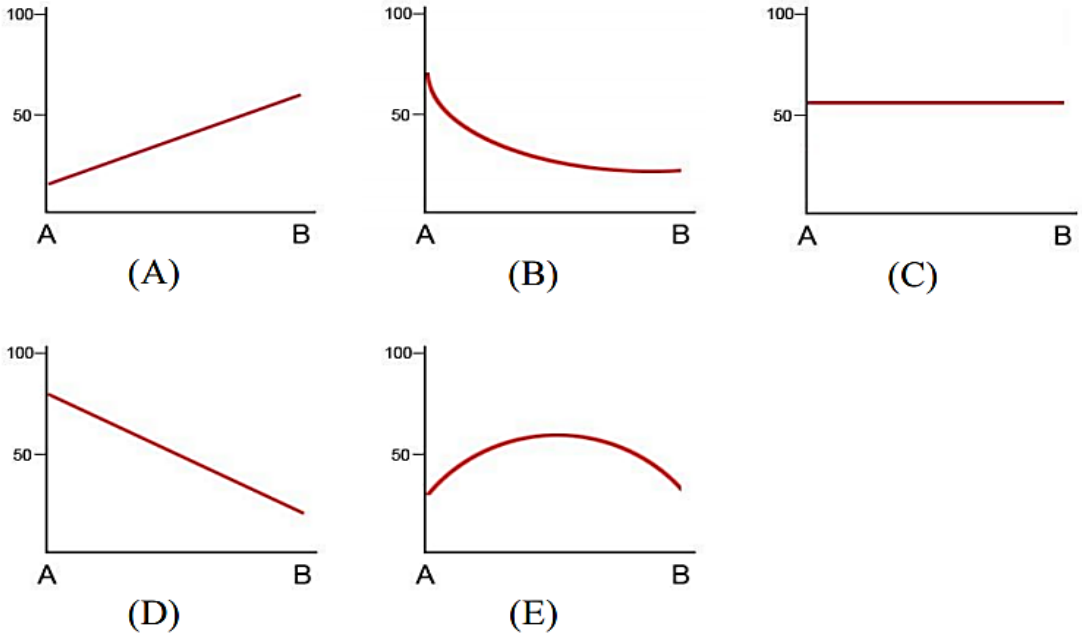
[3] Acknowledgement: The following test is applied with the consent of the Association of American Geographers (AAG) and with the recognition of Dr. Jongwon Lee as its author. The test can't be reproduced or executed without consent from the AAG or Dr. Lee.

3. The following map represents the annual precipitation in a particular geographic area.



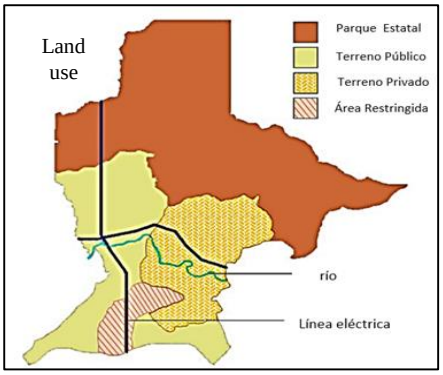
If you draw a graph showing change of Texas annual precipitation between A and B, the graph will be:

Annual precipitation

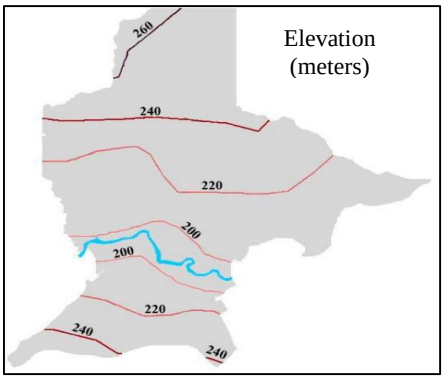


4. Find the best site for a flood management facility based on the following conditions

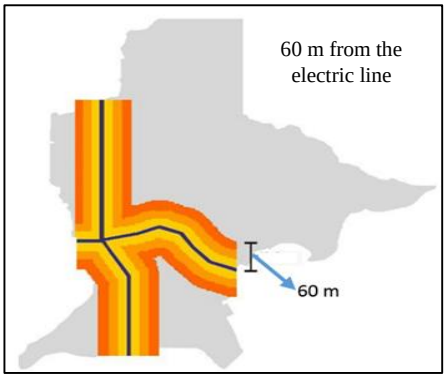
The facility must be in a public land



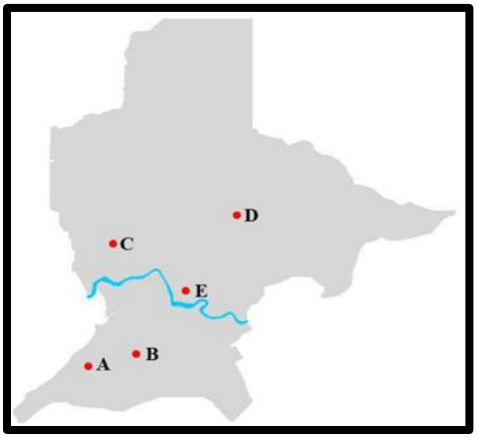
The site must be located less than 220 meters elevation



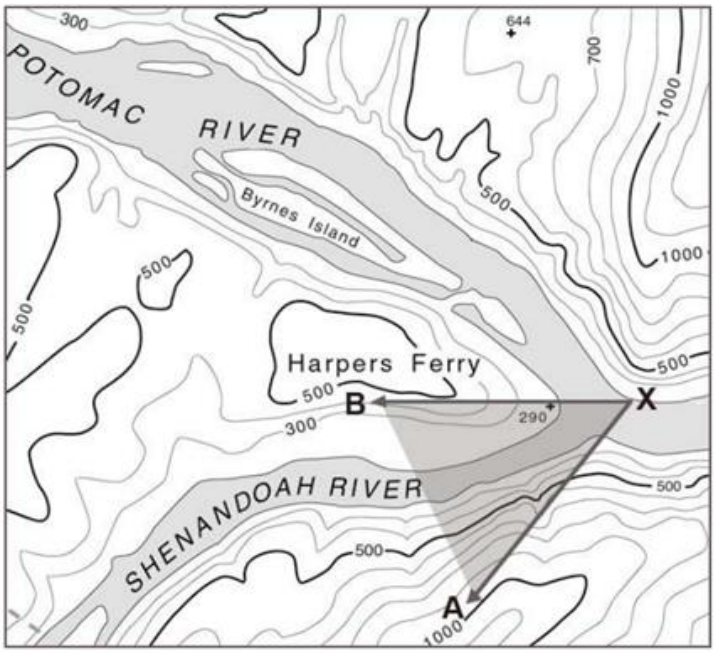
The site must be within 60 meters of an existing



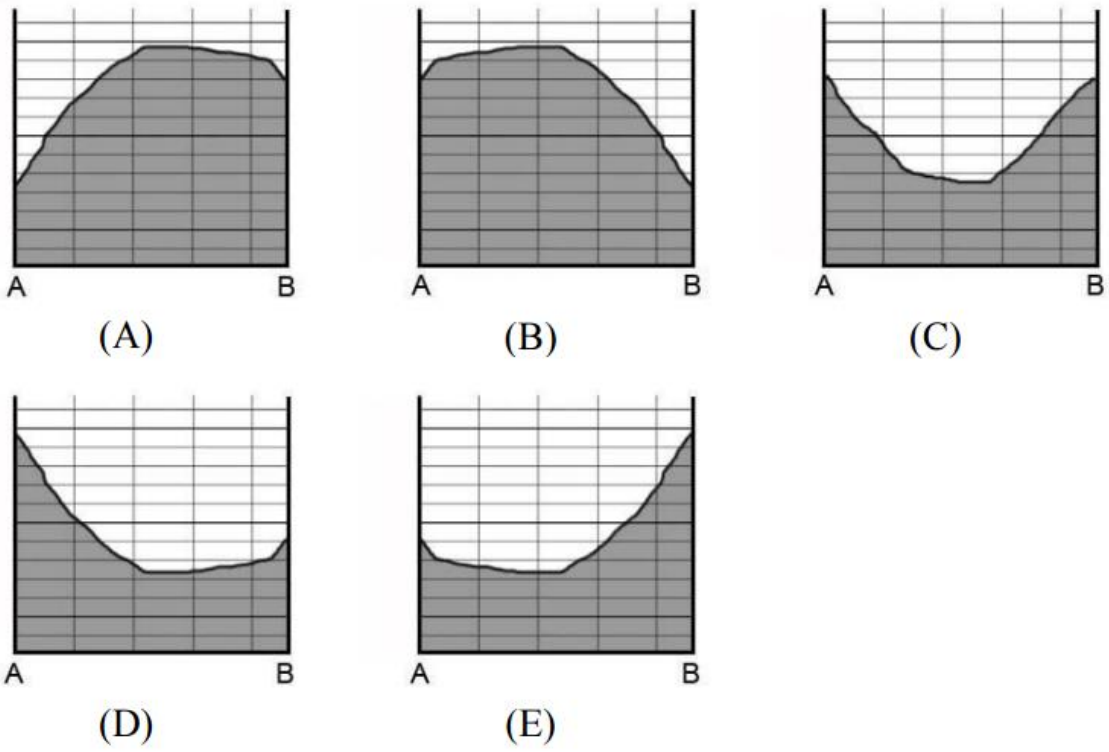
Circle the best site (Choose from letters A, B, C, D, E) for the flood management facility in the map to the right



5. Imagine that you are standing at location X and looking in the direction of A and B. Among 5 slope profiles (A~E), which profile most closely represents what you would see?

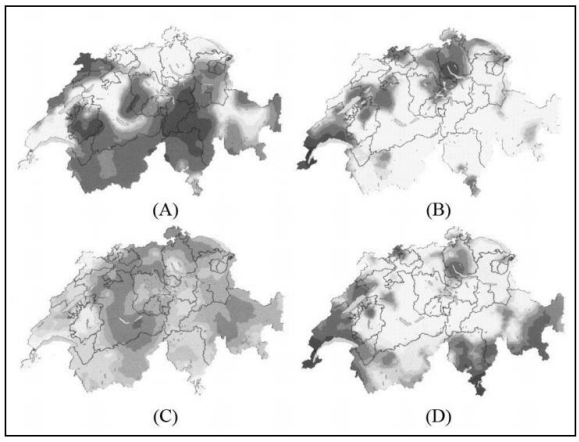


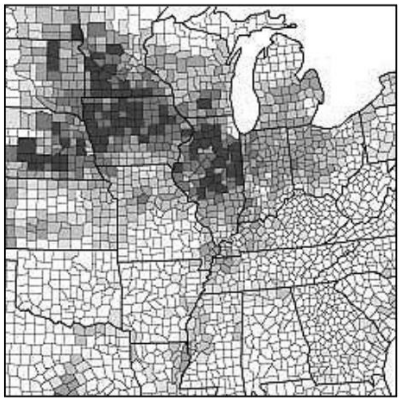
Elevation



6. In this exercise, your job is to find maps that have spatial correlations. For example, map (B) and map (D) have positive correlation (similar patterns).

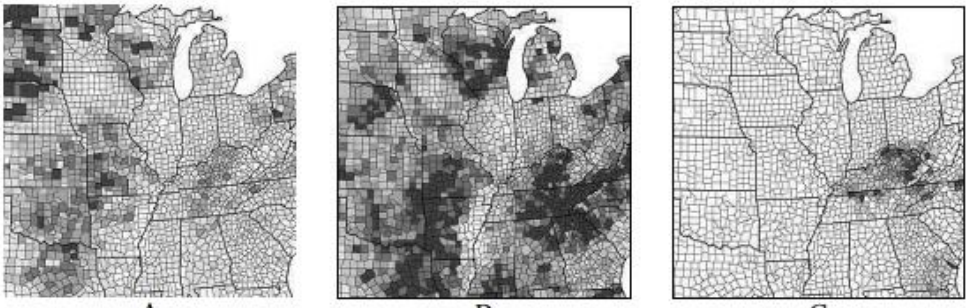
Example.

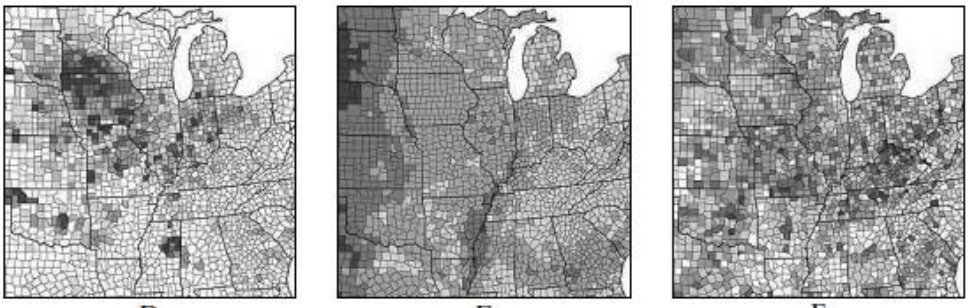




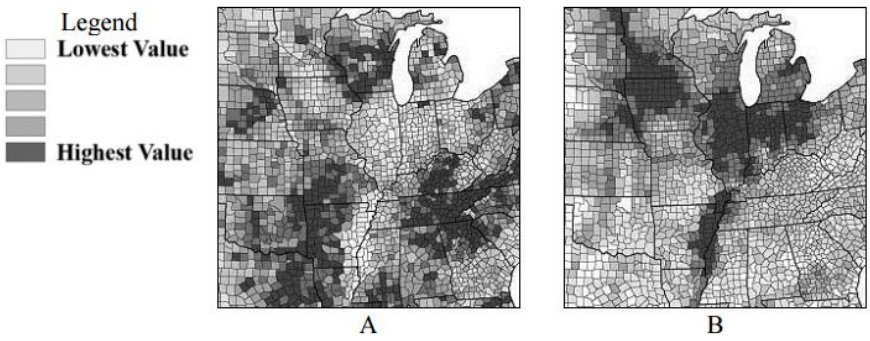
Select the map (From A to F) having a strong positive correlation with the map on the left.

Circle the correct answer.

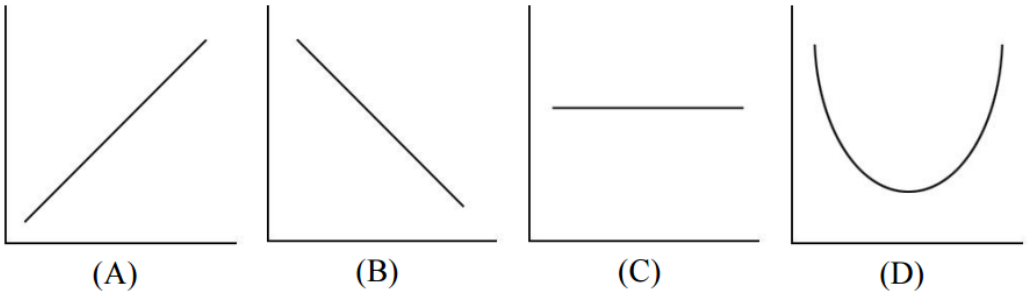




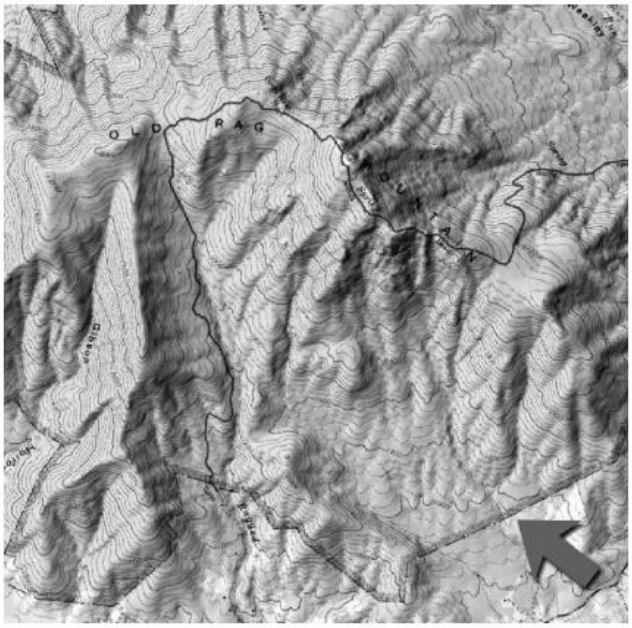
7. The following two maps show (A) Acres of corn production and (B) Value of hogs and pigs as percent of total market value of agricultural products sold.

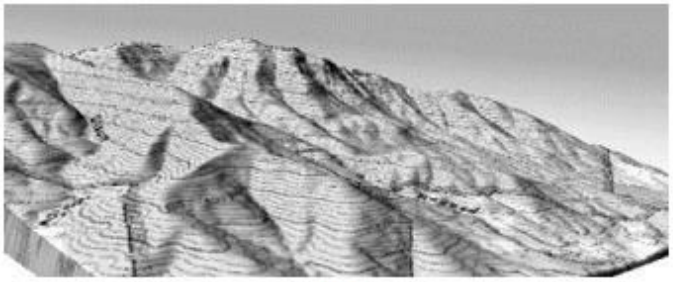


If you draw a graph showing the relationship between map (A) and (B), the graph will be (choose one of the following graphs):

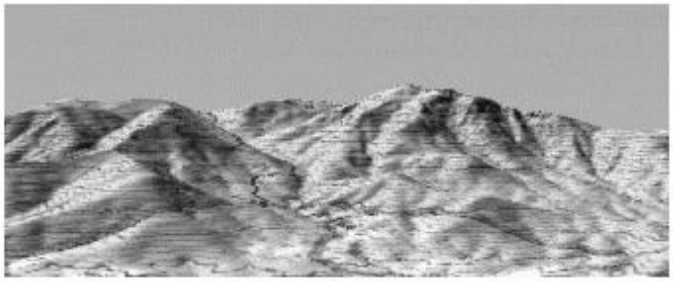


8. If you look at the area below in the direction of arrow, which terrain view (A~E) most closely represents what you would see?

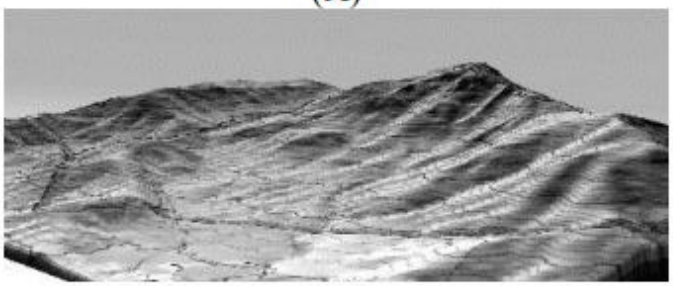




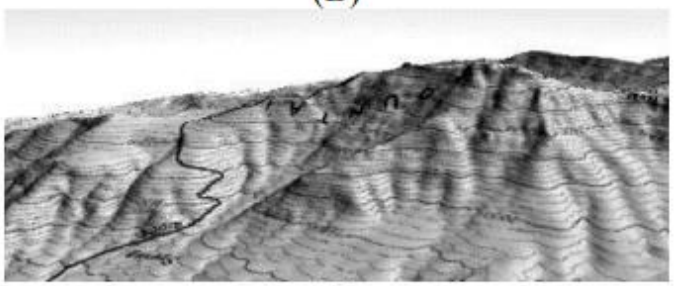
(A)



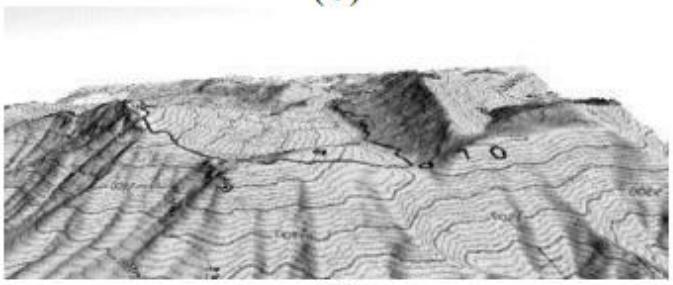
(B)



(C)



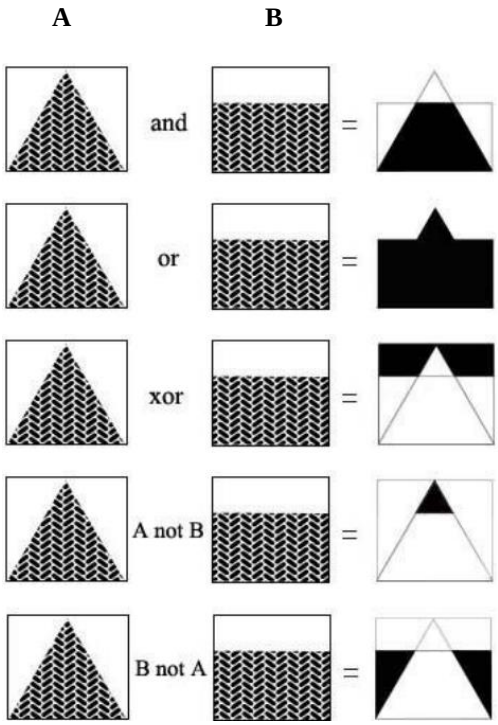
(D)



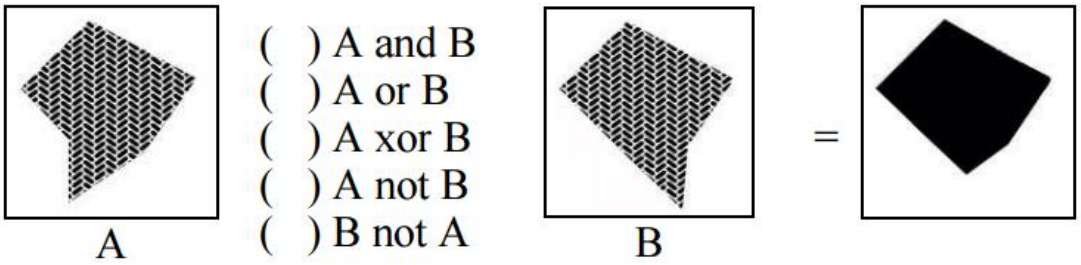
(E)

Solve questions (9 and 10) based on the following figures.

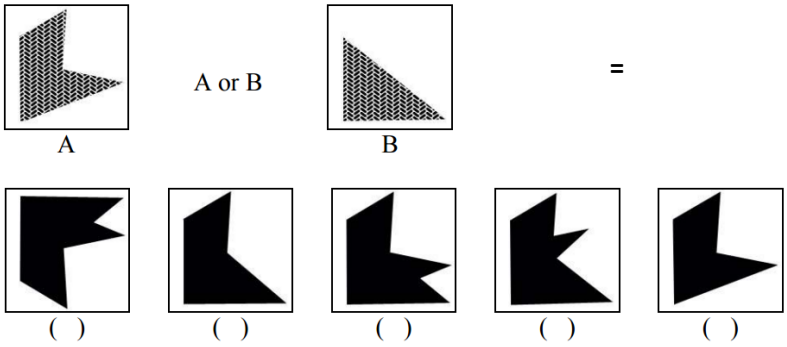
Example.



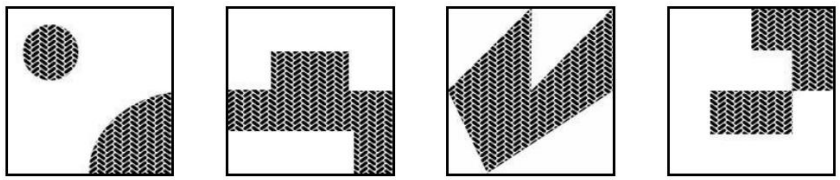
9. Select an option:



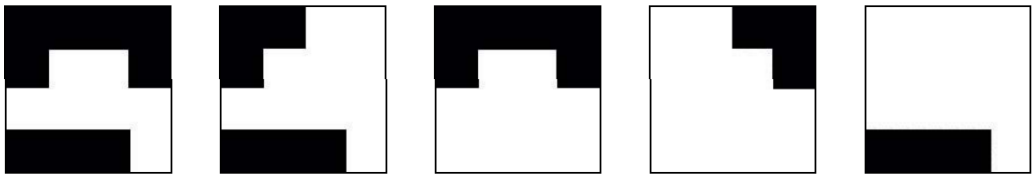
10. Select an option:



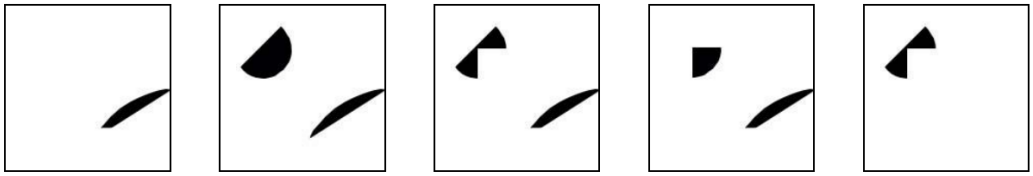
Solve questions 11 and 12 based on the following diagram:



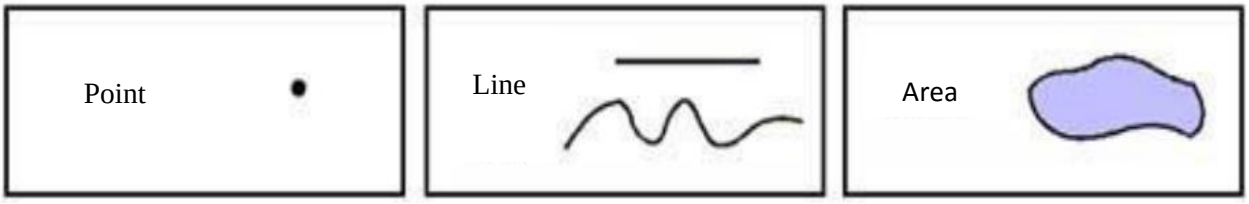
11. D not B (choose an option)



12. A and B and C



Real world objects can be represented explicitly by point, line, and area (polygon) as in the following example.



Example: a tree, a bank

Examples: rivers, roads

Examples: the area of a continent or a lake.

Select the type of object (point, line or area) that can be represented in the questions 13-16 (choose one option for each question)

13. Locations of weather stations in Cartago.
(A) Line
(B) Area
(C) Points and lines
(D) Points and areas

14. Tempisque river tributaries and its basins
(A) Line
(B) Area
(C) Points and lines
(D) Lines and area

15. Shuttle bus route from San José Bus station to Liberia Bus Station:
(A) Points
(B) Area
(C) Points and lines
(D) Points and area

16. Places that can be reached by an Ambulance Car from Alajuela in 5 minutes or less
(A) Points
(B) Lines
(C) Area
(D) Points and lines

On a scale from 1 to 10, where 1 means very easy and 10 very hard ¿How would you grade the test difficulty?

1	2	3	4	5	6	7	8	9	10

On a scale from 1 to 10, being 1 the lowest value and 10 the highest, ¿How would you evaluate the academic preparation you have had for solving the previous exercises?

1	2		3	4	5	6	7	8	9	10

Thank you!

Your collaboration is very important to achieve the research objectives. If you have any questions about the survey or the topic developed, please send an email to the researcher Jose Alejandro Cascante Campos:

Email: jacc1987@txstate.edu

APPENDIX 3

Exemption Request EXP2015P466574E - Approval

AVPR IRB [ospirb@txstate.edu]
Enviado: lunes, 06 de julio de 2015 10:31 a.m.
Para: Cascante Campos, Jose Alejandro

DO NOT REPLY TO THIS MESSAGE. This email message is generated by the IRB online application program.

Based on the information in IRB Exemption Request EXP2015P466574E which you submitted on 07/03/15 12:54:45, your project is exempt from full or expedited review by the Texas State Institutional Review Board.

If you have questions, please submit an IRB Inquiry form:

http://www.txstate.edu/research/irb/irb_inquiry.html

Comments:
No comments.

==========

Institutional Review Board

Office of Research Compliance

Texas State University-San Marcos

(ph) 512/245-2314 / (fax) 512/245-3847 / ospirb@txstate.edu / JCK 489

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