Development and Validation of the Test of Geography-Related Attitudes (ToGRA)

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Abstract
This paper introduces the development and validation of the Test of Geography-Related Attitudes (ToGRA). The ToGRA measures student attitude on four discrete scales: 1) leisure interest in geography; 2) enjoyment of geographic education; 3) career interest in geography; and 4) interest in place. The ToGRA was validated from a field test sample of 388 ninth-grade World Geography students who responded to the Web-based instrument. Statistical analyses were performed on these data in order to enhance the overall scale characteristics and to determine construct validity. The resultant survey is the first validated affective-trait measurement instrument available to secondary-level researchers and practitioners.

Key Words: *Affective-trait research, student attitudes, geography education*

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Introduction

There are apparent links between student affect and learning. Students tend to be more proficient at problem solving when they enjoy what they are doing, they are involved, they are comfortable in the classroom environment, and they are in a good mood. Despite this knowledge, and the popularity for U.S. schools to have some mission or values statement that promotes affective student outcomes, we still live in a world governed by high-stakes cognitive assessment. There is little attention given to seriously assessing student affect in meaningful ways. The affective-trait measurement that is typically conducted in schools is done by informal teacher observation and results in conduct grades, which emphasizes little more than students being "good" in class—it is not assessment for enhancing student learning.

This paper presents a brief background to student affect and research relevant to student affect in geographic education. Next, the paper presents the development and validation procedures of the new *Test of Geography-Related Attitudes* (ToGRA) that is modeled after the popular *Test of Science-Related Attitudes* (TOSRA) (Fraser 1986). Data are presented that support the validity and reliability of the ToGRA based upon a field test of 388 high school world geography students. The 29-item ToGRA itself is presented in the Appendix.

Student Affect: Background

Affect

From a purely academic definition *affect* is the feelings or emotions people have toward something. However, in popular education parlance affect is a term often applied to student characteristics that are not cognitive in nature. For example, students' interests, values, opinions, self-concepts, emotions, feelings, preferences, motivation, self-esteem, emotional development, altruism, moral development, and citizenship often are categorized by educational practitioners as affective traits. Affective traits are internal states that have bearing on what students are likely to do. These traits are typically considered in terms of positive/negative, or favorable/unfavorable reactions toward a person, an object, a situation, the general learning environment, or a group of objects and people. Affect is neither behavior, with which it is often associated in the school setting, nor is affect a student's ethical sense—knowing what is right or wrong. Affect is evident in student attitudes such as those in U.S. society and schools that we tend to encourage as positive, such as attitudes toward learning, homework, school, cooperative learning, and working with the teacher. Similarly, in schools we discourage negative attitudes, those toward dropping out of school, cheating, fighting, and drug abuse, to list a few.

Affect in the form of students' attitudes can be differentiated from students' *opinions* or *beliefs* in that attitudes have a tendency to be consistent and are composed of three components: (a) *affective* component, (b) *cognitive* component, and (c) *behavioral* component. The affective component of attitude is related to one's feelings associated with something—good feelings/bad feelings, or comfort/anxiety. The cognitive component considers one's evaluative belief or their thinking related to something's value, while the behavioral component of attitude is related to the action(s) one takes in response to something. Therefore, when considering student attitudes, if you ask a student about their feelings about geography you might find that they express their feelings as positive (affective component). However, if you ask students to place a value on geog-

raphy as a classroom subject (cognitive component) the same students may express that they find little value in geography as it is taught. When students place little value on a subject, their actions may result in not pursuing that particular subject matter (behavioral component). Each of these components must be considered when investigating students' affective traits.

Given that affective traits in students are not directly observable, they must be inferred based upon a student's behavior, which is only one component of an attitude, or they must be measured based upon what students report about their own attitudes. There are a number of instruments used in education to investigate students' affective traits; however, they are rarely used to enhance learning or to improve cognitive achievement. Additionally, when considering student affect we must keep in mind that students' emotions and feelings are transitory. Therefore, we should focus on their more stable and prevalent attitudes.

Research on Student Affective Traits

Research regarding student affect is most often reported as attitudinal research, yet in some reports terms are mixed and several affective traits such as motivation and parent/teacher expectations are reported. This is further evidence that in common parlance, as well as in academic literature, affective traits and attitudes are often viewed as interchangeable terms, regardless of whether the author is correct or not. While the term "affect" has different meanings to different individuals who consider the use of the term, perhaps Klopfer's (1971) six affective categories can be used as a guide in determining what is meant by student affect. Klopfer lists as affective categories students'

1. attitudes toward the subject matter,
2. attitudes toward inquiry,
3. adoption of attitudes similar to the subject at hand,
4. enjoyment of the learning experience,
5. interest in the subject matter at hand (apart from the learning experience), and
6. interest in the subject of study as a career.

Additional affective considerations by others have included students' satisfaction in the classroom, which is to educational outcomes what job satisfaction is to workplace productivity (Zandvliet and Fraser 2004), and efficacy which has been measured with the scale of *Student Academic Efficacy* using such items as "I am good at this subject" or "I am an intelligent student" (Aldridge, Dorman, and Fraser 2004). Still others have developed instruments considering subject anxiety, attitude toward success, confidence, motivation, subject usefulness/value, and teacher/parent expectations (Tapia 2004). Early affective trait research in educational settings attempted to measure students' fleeting feelings toward the subject matter (Dutton 1954; Dutton and Blum 1968).

Research on Student Affect in Geography

Few studies have attempted to measure student affect in geographic education. In Stoltman's (1997) commentary and review of assessment in geography from 1930 to 1997 student affect is not mentioned. Similarly, in McKeown-Ice's (1997) look toward the future of assessment in geography, student affect is not considered. Still further, when Boehm and Petersen (1997) categorized future paths for research in geographic education they listed 46 areas of potential research, none of which made note of affective-trait assessment. Likewise, there is no mention of student affect related to geography education in Gerber's (2003) edited *International Handbook on Geographical Education*.

The limited research related to student affect in geographic education is dominated by studies related to technology and students' attitudes toward geography, either in terms of the World Wide Web use in classrooms (Lee 2001; Ross 2003; Toriskie 1999), or geographic information systems (GIS) and its influence on students' attitudes toward geography (Baker and White 2003; West 2003). A study of early childhood spatial experiences and their relationship with achievement and attitude in the ninth grade (Alvarez 1998) is one exception.

Gerber (2001) conducted a study of certain Australians' attitudes toward geography in a large-scale investigation; however this was not specific to K through 12 geographic education, despite any linkages that one could make between K through 12 students' attitudes toward geography and their attitudes later in life.

In spite of the scarcity of empirical studies related to student affect in geographic education, any initiative to move forward in this research area requires a sound instrument with which investigators can collect and analyze data. It is crucial that any such instrument be technically sound if the conclusions are to be perceived as valuable in the geographic-education research community. Tapia (2004, 17) stated it well in her development of an affective instrument for mathematics education:

> The relationship of affect to course selection, performance, achievement, and cognitive processes must be based solidly on a valid, reliable measure of attitudes. Attitude scales must withstand factor analysis, tap important dimensions of attitudes, and require a minimum amount of time for administration.

The remainder of this paper presents the results of the development of a valid and reliable instrument that can be used in the geographic education arena to investigate students' affect.

Data Collection and Stages of Development

Data Collection

The target population for this study was ninth grade students in a San Antonio, Texas high school. The survey

sample was a population sample drawn from all attending students in 17 World Geography classes offered by three teachers at this high school. The survey instrument, the *Test of Geography-Related Attitudes* (ToGRA), was available as a Hypertext Mark-up Language (HTML) form on the World Wide Web. The sample of respondents consisted of 388 grade nine students.

Stages of Development of the ToGRA

The development of the ToGRA was conducted in three stages, similar to approaches used in the development of learning environment surveys (Fraser 1986; Walker and Fraser 2005). Stage 1 included the identification of salient scales grounded in previously developed science education affective assessment by Klopfer (1971) and Fraser (1981). Stage 2 involved writing individual items within the scales and Stage 3 involved field testing items, followed by item analysis and validation procedures. Each stage is described in detail below.

Stage 1: Identification and Development of Salient Scales

This stage consisted of reviewing literature associated with student affect assessment in geographic and science education. Very little was found regarding geographic education, thus much of the scale development was patterned after that which has been conducted in science education, with a specific reliance on work conducted by Fraser (1981) and his development of the *Test of Science-Related Attitudes* (TOSRA).

The TOSRA consists of seven scales which are derivatives of Klopfer's (1971) science attitude classifications (Table 1). The ToGRA borrowed and modified three of the TOSRA scales that transferred well from science education to geography education. These three scales are renamed the scales of (a) *Leisure Interest in Geography*, (b) *Enjoyment of Geography*, and (c) *Career Interest in Geography*.

In terms of K through 12 geography education the TOSRA scales of *Social Implications of Science* and *Normality of Scientists* do not make sense in the context of general geography. Likewise, while "geographic inquiry" (Malone, Palmer, and Voigt 2002) is a term used in some geography classroom settings, it is not as ubiquitous as the notion of "scientific inquiry" is in science education, thus a scale related to attitudes toward inquiry was not considered applicable for this instrument. Similarly, in geography education there is little or no sense of a "geographic attitude," so a scale modeled after the TOSRA scale of *Adoption of Scientific Attitudes* was not considered.

Table 1. ToGRA scales in relation to TOSRA scales and Klopfer's classification system.

Klopfer (1971) classification	TOSRA Scales (Fraser 1981)	ToGRA Scales
Manifestation of favorable attitudes toward science and scientists	Social Implications of Science Normality of Scientists	
Acceptance of scientific inquiry as a way of thought	Attitude to Scientific Inquiry	
Adoption of scientific attitudes	Adoption of Scientific Attitudes	
Enjoyment of science learning experiences	Enjoyment of Science Lessons	Enjoyment of Geography
Development of interest in science and science-related activities	Leisure Interest in Science	Leisure Interest in Geography
Development of interest in pursuing a career in science	Career Interest in Science	Career Interest in Geography

Stage 2: Writing Individual Items

Stage 2 involved three steps. Step one was a consideration of negatively-worded or reverse-scored items. Step two involved adapting items used in the TOSRA to fit the geography classroom context. Step three involved subjecting the entire set of items to face validation. Subsequently, pilot testing reviewed items with a sample of university-level students for useability and layout, as well as for determining how best to efficiently process the digital data derived from the Web-based forms.

Step 1. Although the ToGRA is heavily patterned after the TOSRA, 50 percent of the TOSRA contains negatively-worded items. However, negatively-worded items or reverse-scored items have questionable utility in guarding against passive responses (i.e., those responses marked without the respondent making a conscious choice) (Barnette 2000). In terms of response accuracy and internal consistency, studies have revealed higher reliability when all items are worded positively (Chamberlain and Cummings 1984; Schreisheim, Eisenbach, and Hill 1991; Schriesheim and Hill 1981). Negatively-worded items, when mixed with positively-worded items, have been found through factor analyses to solicit differing response patterns (Benson 1987; Knight, Chisholm, Marsh, and Godfrey 1988). Barnette (2000) concluded that mixing positive and negative items is not a recommended procedure and that negatively-worded items cannot be considered direct opposites of positively worded counterparts.

Because the use of reverse-scored and negatively-worded items can reduce the reliability and validity of instruments and scales, I utilized neither negatively-worded nor reverse-scored items in the ToGRA.

Step 2. With the permission of Fraser (personal communication) I modified 30 items from the TOSRA's scales of *Leisure Interest in Science, Enjoyment of Science Lessons*, and

Career Interest in Science to fit the ToGRA's scales of *Leisure Interest in Geography, Enjoyment of Geography,* and *Career Interest in Geography*. Each ToGRA scale contained ten items modified from the TOSRA. For example, a TOSRA item in the *Enjoyment* scale that required little modification read, "Science lessons are fun." This was altered to read, "Geography lessons are fun" on the ToGRA. Other items required significantly more modification and are not as recognizable when adapted. For example, the negatively-worded TOSRA item in the *Leisure Interest* scale read, "I get bored when watching science programs on TV at home," served only as a loose model when it was adapted as a positively-worded item reading, "I enjoy looking at maps and globes."

Step 3. The new 30-item draft ToGRA was subjected to content validation by one class (N=24) of undergraduate pre-service teachers enrolled in an education technology class that used geographic information systems (GIS) software in a significant portion of the class. Students were asked to consider the wording of items and the layout of the instrument itself and provide anonymous feedback. Changes were made to clarify some items and the instrument was then subjected to a second content validation by a doctoral-level geography education assessment class (N=6) with no further changes resulting.

The result of Stage 2 was a new 30-item ToGRA field test instrument on the World Wide Web. The response choices followed a Likert format that requires subjects to express a degree of concurrence with each item on a five-point scale. The response scale was: *Strongly Disagree, Disagree, Neither Disagree or Agree, Agree,* and *Strongly Agree*. Since the ToGRA is a Web-based *form* it was programmed not to allow non-responses. If subjects in the Stage 3 field test failed to respond to one or more items they were not able to submit their survey.

Stage 3: Field Testing and Analyses

Stage 3 required two steps. Step one included field testing the draft instrument with the target population in order to collect sufficient responses to utilize in statistical analyses. Step two involved exploratory factor analysis, aimed at identifying items whose removal would enhance the instrument's factor structure and to identify if the items measured their a priori structure, and internal consistency reliability analysis, to determine the extent to which items within a scale measure the same construct as other items within that scale.

Responses were collected from 399 ninth grade World Geography students over the span of one month. Of the 399 original responses 11 were not usable. Three hundred eighty-eight responses were used in the analysis step of Stage 3 where item and factor analyses were conducted to (1) refine the ToGRA scales; and (2) to provide evidence regarding reliability and validity of the refined scales. Analyses of the refined data set provided evidence to support the overall reliability and factorial validity of the refined scales.

Reliability and Validity of the ToGRA

The development of the ToGRA utilized the *intuitive-rational strategy* in which only items with high internal consistency remain in the final instrument. It also relies upon the *internal strategy* (Hase and Goldberg 1967), whereby

Table 2. Rotated component matrix.

Item	Factor Loading			
	Leisure	Enjoyment	Career	Place
L4	.591			
L13	.506			
L19	.738			
L22			.696	
L28			.534	
E2		.678		
E5		.642		
E8		.629		
E14		.608		
E17		.651		
E23		.612		
E29		.618		
C3			.750	
C6			.633	
C9			.766	
C12			.769	
C15			.539	
C18			.789	
C21	.656			
C24			.570	
C27			.522	
C30			.772	
L7				.788
L10				.811
L16				.501
L25				.503
E11				.807
E20				.741
E26				.685
% Variance	9.18	55.22	23.72	11.88

Factor loadings smaller than 0.50 have been omitted. L = Leisure interest in geography, E = Enjoyment of geography, C = Career interest in geography. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. N=388

only those items with high factor loadings on their own scales and low loadings on other scales are kept in the final instrument.

Factorial Validity

The construct validity of the ToGRA was investigated using principal component factor analysis with varimax rotation and Kaiser normalization. The aim of factor analysis is to ascertain the fundamental structure of a comparatively large set of variables (Garson 2004). This method of analysis is consistent with the *intuitive-rational* method of instrument development (Fraser 1986) and has been used (Dorman 2003; Walker and Fraser 2005) to determine if items load on a priori scales. Essentially, factor analysis provides information about whether items within a given scale are measuring that scale and no other scale. Only those items with an absolute value threshold of at least 0.50 (Fish and Dane 2000) with their own scale, and less than 0.50 with all other scales, were kept in the refined instrument.

Three scales were originally developed for the ToGRA, yet exploratory factor analysis presented a number of items loading on an altogether different scale. Table 2 presents the rotated component matrix based on individual items. Of the ten original *Leisure Interest in Geography* items one was lost as a "faulty" item that loaded below the 0.50 threshold on its own scale and on other scales. Three items loaded between 0.506 and 0.738 on the a priori scale constituted 9.18 percent of the variance. Two items loaded on the *Career Interest in Geography* scale and four items loaded on an altogether new scale later identified as relating to students' interest in *place*.

Of the ten original *Enjoyment of Geography* items, seven loaded on the a priori scale from 0.608 to 0.678, accounting for 55.22 percent of the variance. Three items loaded on the new *Place* scale. Nine of the *Career Interest in Geography* items loaded on their own scale ranging from 0.522 to 0.772 and accounting for 23.72 percent of the variance. However, one *Career* item loaded on the *Leisure Interest* scale.

The new scale that resulted accounted for 11.88 percent of the variance contained in wording related to people and places. For example, one item intended as a *Leisure Interest* item read, "I like to read about people and places." Another item, intended as an *Enjoyment* scale item read, "I really enjoy lessons about people and places." Each of the items in the field test that contained words related to people and places loaded on the new scale, indicating students' interests in place and people, and has been accepted as a new scale for *Interest in Place*.

Reliability

In the development of the ToGRA, each scale was assessed for internal consistency. Table 3 presents the alpha reliability for each refined ToGRA scale for the sample of 388 subjects. The internal consistency reliability (coefficient alpha) ranged from 0.74 to 0.92 for the four scales. Using a generally-applied "rule-of-thumb," this range is considered to be acceptable to excellent (George and Mallery 2001). The alpha reliability for the scale of *Career Interest in Geography* (0.92) is considered "excellent," while reliabilities for the scales of *Enjoyment of Geography* (0.88) and *Interest in Place* (0.88) are considered "good." The remaining scale of *Leisure Interest in Geography* (0.74) has "acceptable" reliability.

Table 3. Scale reliability using Cronbach's alpha coefficient.

Scale	Number of Items	Alpha Reliability
Leisure	5	0.74
Enjoyment	7	0.88
Career	10	0.92
Place	7	0.88
	N=388	

Conclusion

This paper contributes to research in geographic education by presenting a brief introduction to student affect, background in research related to student affect, and the current state of affective-trait research in today's geographic education environment. It introduces a new instrument, the *Test of Geography-Related Attitudes* (ToGRA) that has acceptable validity and reliability for use by others.

Moreover, this study is important in that it establishes an economical instrument that can be utilized by researchers and practitioners alike to determine students' attitudes toward geography and geographic-oriented education in other subjects such as physical science and in technology classes that utilize GIS. When researchers and practitioners can identify determinants in students' attitudes with the aid of the ToGRA, they then have opportunities to alter those determinants to improve cognitive performance by supporting those factors that aid in establishing positive student attitudes in geographic learning.

APPENDIX

ToGRA
Test of Geography-Related Attitudes

Directions
This survey contains several statements about what you think about geography. There are no right or wrong answers. Your opinion is what is wanted.

For each statement, select the number that best corresponds to what you think.

Some statements in this survey are very similar, please indicate your opinion for each statement.

Please select one response for each item below.	1-Strongly Disagree 2-Disagree 3-Neither Disagree or Agree 4-Agree 5-Strongly Agree				
1. Geography lessons are fun.	1	2	3	4	5
2. I would like to be a geographer after I leave school.	1	2	3	4	5
3. I enjoy looking at maps and globes.	1	2	3	4	5
4. I like studying geography.	1	2	3	4	5
5. When I graduate from school I would like to work with people who do geography.	1	2	3	4	5
6. I like to read about different people and places.	1	2	3	4	5
7. School should have more education in geography.	1	2	3	4	5
8. I would like a job doing geography after I leave school.	1	2	3	4	5
9. I like to talk about different people and places.	1	2	3	4	5
10. I enjoy studying about people and places.	1	2	3	4	5
11. Working as a geographer would be an interesting way to earn a living.	1	2	3	4	5
12. I enjoy listening to radio programs about different people and places.	1	2	3	4	5
13. Geography is one of the most interesting subjects in school.	1	2	3	4	5
14. A career in geography would be interesting and exciting.	1	2	3	4	5
15. I like to read newspaper articles about other places.	1	2	3	4	5
16. Geography lessons are worth my time.	1	2	3	4	5
17. I would like to teach geography when I leave school.	1	2	3	4	5
18. I prefer to use maps when inquiring about places.	1	2	3	4	5
19. I really enjoy lessons about people and places.	1	2	3	4	5
20. A job that uses maps would be exciting.	1	2	3	4	5
21. I would like to belong to a geography club.	1	2	3	4	5
22. The materials covered in geography lessons are interesting.	1	2	3	4	5
23. A job as a geographer would be interesting.	1	2	3	4	5
24. As a gift I would like to be given a book about people and places.	1	2	3	4	5
25. I look forward to studying about people and places.	1	2	3	4	5
26. I would like to study geography in college to help me get a job.	1	2	3	4	5
27. Talking about geography to people outside of school is interesting.	1	2	3	4	5
28. I would enjoy school more if there where more geographic education.	1	2	3	4	5
29. I would like to be a geographer when I leave school.	1	2	3	4	5

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