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Multimedia tests and geographical education: the 2008 International Geography Olympiad

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Although there is a widespread interest in testing in geography, very few empirical studies exist of internationally validated testing models. Arguably the best international geography test in secondary education is found in the International Geography Olympiad, and this test is the focus of this paper. Apart from a written response test and fieldwork assignments, the International Geography Olympiad includes a multimedia test. This paper analyzes the results of the multimedia test of the 2008 International Geography Olympiad. Although the validity of the test is good, the performance of students on individual questions is open to a variety of interpretations. Tests such as the multimedia test can be used to assess the geographical literacy of students in the upper levels of secondary education, and this point is extended in the final section of the paper that promotes international benchmarking and improvements to the testing protocol.

Keywords: International Geography Olympiad; geographical literacy; geography test; assessment for learning

Introduction

Geography is a key to understanding and acting effectively in our world (Haubrich, 1994; IGU-CGE, 2006). More than any other subject, geography enables people to comprehend the Earth and its environment, and to appreciate the delicate balance between human and physical elements. Although many people will agree with this definition of geography and its importance, there is at present no coherent body of research about students' understanding of geography (Bennets, 2005). Literature about how geography students think, learn and achieve is restricted to specific themes or situations. Review studies or broad international studies in the field of geography in education are scarce. Stimpson (2006, p. 83) wrote:

> The more one delves into practices the more one realises how little is known about assessment practices, intentions and practices, across educational systems and the more new questions arise.

InterGeo II

There are exceptions, however. InterGeo II, a project of the Commission on Geographical Education (CGE) of the International Geographical Union (IGU), developed a broad-based, field-trialled testing instrument for making cross-national comparisons of achievement in

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geography (Niemz & Stoltman, 1992; Purnell, 1994). The purpose of InterGeo II was to provide a reliable test of basic achievement in geography for 14-year-old students in different countries. The test consisted of 42 multiple-choice questions in five domains, viz. locational knowledge, physical geography, human geography, geographical skills and regional geography. At the request of the teachers who participated in the pilot project, a sixth category was added, with questions relating to the specific region or country involved. Field trials of InterGeo II were held in 23 countries. Data were analyzed for national achievement levels as well as cross-national comparisons on the six subtests. The data analyses suggest a wide variation in basic geography achievement between and among countries. The authors of InterGeoII state that despite design problems regarding sample selection and curriculum validity, the test results provide general patterns of information regarding achievement in geography to educators worldwide.

National Geographic World Championship

Some years after the InterGeo II test stopped, two international geography tests started. One is an American-based international geography test for students up to 16 years of age called the National Geographic World Championship. This international test started in 1995 and is organized by the National Geographic Society and is held in uneven years. Eighteen teams of the geography students from around the globe met in 2007 in California, to take part in the competition. Each team comprised of three students, chosen for their excellence in their own national geography competitions. The teams answered questions on physical, cultural and economic geography in two levels of competition consisting of a written test in their own language and an outdoor activity. The three teams with the highest scores – Canada, Mexico and the United States – then met at Shamu Stadium in SeaWorld San Diego for the final round. They answered questions in a game-show format. In addition to the top three teams of Mexico, the United States and Canada, teams from Argentina, Australia, Bulgaria, Chinese Taipei, France, Germany, Ghana, Hungary, India, Poland, Romania, Russia, Singapore and the United Kingdom also competed. The 2009 National Geographic World Championship was held in Mexico City (http://www.nationalgeographic.com/geographybee/worldchampionship/2009.html).

International Geography Olympiad

The second international geography test started in 1996. It is a competition for the best 16- to 19-year-old geography students from national geography competitions and is held every even year. The International Geography Olympiad (www.geoolympiad.org) is held under the auspices of the IGU Olympiad Task Force. Participating countries send the best four students of their national geography competition to the International Geography Olympiad. English is the language of the International Geography Olympiad. The aims of the International Geography Olympiad are to (1) stimulate active interest in geographical and environmental studies among young people, (2) contribute positively to the debate about the importance of geography as a secondary school subject and (3) facilitate social contacts between young people from different countries and, by doing so, contribute to the understanding between nations.

From the participation point of view, the International Geography Olympiad may be considered a great success if we look at the growing number of entrants. From six countries attending the first International Geography Olympiad in the Netherlands in 1996 (Ankoné, 1996), the Olympiad has grown to 24 countries at the seventh International Geography Olympiad in Tunisia in 2008. The question whether the International Geography Olympiad

is evolving in line with its aims can be answered positively. It is not difficult to prove that the Olympiad stimulates active interest in geographical and environmental studies among young people. Hundreds of thousands of students all over the world participate enthusiastically in national geography competitions with the goal of participating in the International Geography Olympiad. In a large country such as Mexico there is a local, regional and national geography competition. Russia has four levels: school, district or city, regional and national. The number of participating students in the first stage of the Olimpíada Mexicana de Geografia 2005 was 107,491 (García-García, 2007, p. 277). The Russian organizer Naumov (2007, pp. 284–285) states as follows.

> If we count the participants of all its rounds, the Olympiad is the most numerous event for Russian geography, even incomparable with the Congress of the Russian Geography Society. Or, in other terms, if we count all the participants, who competed at the Olympiad in Russia during the past 15 years, the number will be more than the population of a small European country.

Reports from different countries show that the Olympiad's second aim is also met. Educators report that the content of the tests of the Olympiad contributes positively to the debate about the importance of geography as a secondary school subject.

> This kind of competition is a great stimulus for students and increases the prestige of school geography in general (Liiber & Roosaare, 2007, p. 298). The results of this competition provided a solid basis for others to build on in the years to come, and the Chinese organizers will continue the China National Geography Olympiad on a bi-annual basis (Min & Dongying, 2007, p. 282).

Of course, it is more difficult to measure how the Olympiad facilitates social contacts between young people from different countries and, by doing so, contributes to the understanding between nations. Nevertheless, by analyzing emails of students participating in the International Geography Olympiad, we see evidence of a significant student interaction after an Olympiad took place (Van der Schee, Ankoné, Vankan, & Henau, 2004, p. 439).

Although the reactions of the participants and their teachers about the content and organization of the National Geographic World Championship and the International Geography Olympiad are positive, little is known about the scores of the students in relation to the content of the tests. As we have access to the scores of the multimedia test of the last International Geography Olympiad, it seems worthwhile to investigate the quality of the multimedia test more precisely. Students and teachers say that the test was "good", but what exactly does it measure? What is a difficult assignment and are there great differences between pupils in scores? Analyzing the structure and results of the multimedia test of the 2008 International Geography Olympiad, this contribution will try to answer these questions and to give an advice for the development of this type of geography tests in the near future.

The 2008 multimedia test

The 2008 International Geography Olympiad consisted of three parts: a written response test (40% of total score), a substantial fieldwork exercise (40%) and a multimedia test (20%).

More countries than ever participated in the 2008 Olympiad in Tunisia: Australia, Belarus, Belgium, China Beijing, China Taipei, Czech Republic, Estonia, Finland, Germany, Hungary, Japan, Latvia, Lithuania, Mexico, The Netherlands, New Zealand, Poland, Romania, Russia, Saudi Arabia, Slovakia, Slovenia, Tunisia and the United Kingdom.

Many students said that they liked the multimedia test of the International Geography Olympiad. When asked to explain this, most interviewed students said things like "the assignments are compact and intriguing". The whole test and its answers can be found at www.geoolympiad.org. Figure 1 shows a question of the multimedia test used during the 2008 International Geography Olympiad in Tunis. Students have to combine their knowledge of famous places in the world and their locations with knowledge about the general climate patterns in the northern and southern hemisphere. Figure 2 shows another question of the 2008 multimedia test. To give the right answer the students need to have a sound geographical knowledge. Students must be able to locate the countries on the map and must have knowledge about the distribution of landscapes, vegetation zones and the type of buildings in different regions of the world. As this question illustrates, the multimedia test of the International Geography Olympiad transcends the mere knowledge of facts and figures. Modern geography is about understanding the world we live in by studying spatial patterns and processes of physical and human phenomena and how they operate in different parts of the world. Although many geography tests on TV let us believe otherwise, geography is more than knowing place names. As the website 'My wonderful world' – a campaign of the National Geographic Society (2008) in the United States – says:

> Geography is more than places on a map. It's global connections. People and cultures. Economics and environments. Our young people need to know geography in order to understand today's world and succeed in tomorrows.

Geography turns out to be much more significant than most people realize. Geographers focus on world themes such as water, climate, energy, population growth, cultural identities, globalization and sustainable development and study these themes in a special way by looking at locations, distributions and interaction. All this is vital to understand everyday life on our globe. The three components of the International Geography Olympiad try to test this geographical knowledge and understanding. The official themes for the test items of the written test and the multimedia test are the following:

1. climate and climate change
2. hazards and hazard management
3. resources and resource management
4. environmental issues and sustainable development
5. land forms, landscapes and land use
6. population and population change
7. economic geography and globalization
8. transport, infrastructure and logistics management
9. urban geography, urban renewal and urban planning
10. agricultural geography and food problems
11. tourism and tourism management
12. regions and regional identities.

The required skills are inquiry and graphicacy skills.

The 2008 multimedia test was defined as a test that measures geographical knowledge of students using maps, photographs, graphs, satellite images, cartoons and films. Maps and photographs were the two dominant sources. The test consisted of 30 multiple-choice questions and used 40 different images. As Figures 1 and 2 show, a combination of images

Images of the four cities are shown below. To which of these cities A, B, C or D does the climate graph correspond?

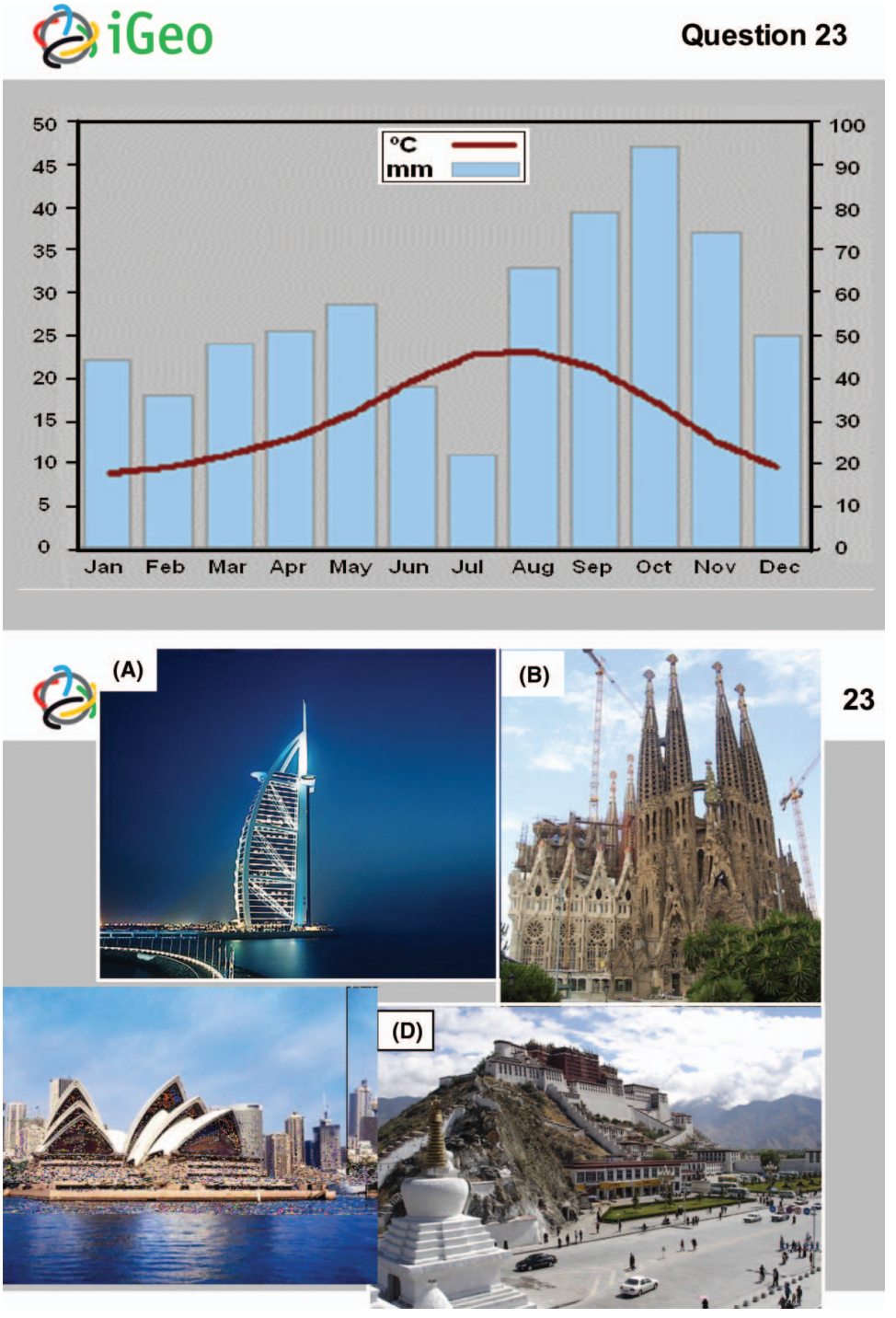

Figure 1. An assignment from the multimedia test of the 2008 International Geography Olympiad. Source: www.geoolympiad.org.

Here are three photographs. They were all taken in the same country. Look carefully. In which country were they taken?

A. Spain
B. Canada
C. Zimbabwe
D. Philippines

Figure 2. An assignment from the multimedia test of the 2008 International Geography Olympiad. Source: www.geoolympiad.org.

Table 1. Rank correlations between parts of the 2008 Olympiad and the total score.

	Total score
Written test	.90
Fieldwork	.82
Multimedia test	.71

can be used in one assignment but this was not done at every assignment. The last two assignments of the test showed two short films.

The 96 students completed the multimedia test in two shifts in a classroom where the images were projected in a classroom by a beamer. The students used paper and pencil to answer the questions. Students received the questions on paper and every question was also read aloud by a native English speaker. Depending on the complexity of the question students had 30 to 90 seconds to answer a question. There was an invigilating teacher in every corner of the classroom. None of the questions gave obvious advantage to the participants of any competing country. Half of the assignments' questions were on world-scale geography and the remaining half were questions distributed in quite an even way across the different continents. Although not all themes of the official list of themes for the test items of the multimedia test were covered, the distribution of human geography and physical geography assignments in the tests was equal. After deleting one question (question 5) from the multimedia test, the outcomes of the multimedia test could be called reliable (Cronbach alpha is .7).

Results of the 2008 multimedia test

Table 1 shows that there is a strong correlation between the three parts of the 2008 Olympiad and the total score. However, the correlation between the multimedia test and the total score is not as good as the correlation between the written test or the fieldwork and the total score. Table 2 shows that there is a significant correlation between the outcomes of the individual tests. This implies that students performing well on the written test or the

Table 2. Correlations between parts of the 2008 Olympiad.

	Written test	Fieldwork	Multimedia test
Written test			
Pearson correlation	1	.581**	.475**
Significance (2-tailed)		.000	.000
N	96	96	96
Fieldwork			
Pearson correlation	.581**	1	.417**
Significance (2-tailed)	.000		.000
N	96	96	96
Multimedia test			
Pearson correlation	.475**	.417**	1
Significance (2-tailed)	.000	.000	
N	96	96	96

**Correlation is significant at the .01 level (2-tailed).

fieldwork also perform well on the multimedia test. The fieldwork scores and even more so the written test scores are better predictors for the overall Olympiad score than the scores on the multimedia test.

Table 3 shows the *p*-value of every question of the multimedia test starting with the lowest score, i.e. the most difficult question for the participants. The *p*-value .34 of question 9 means that 34% of the students gave the correct answer. After analyzing the data in Table 3 it is clear that there is a significant difference in difficulty between the questions. Question 9 is the most difficult question and question 16 the easiest one. The last three questions in Table 3 seem to be too easy. Question 3 with a "corrected item-total correlation" of .428 is the most discriminating question, which means that students with a high total score scored well on this question and students with poor scores scored badly on this question. Question 5 does not fit in the test since low-scoring students scored well on this question. Differing geographical skills (see Table 3) seem to discern between difficult and easy questions: 80% of the questions that are answered incorrectly by more than 50% of the students are map interpretation questions and 70% of the map interpretation questions belong to the difficult half of the test. Map interpretation implies that a student is able to make statements or predictions not only using the associations discovered on the map but also using other sources of information than just the map. Map interpretation is the highest level of map skills. Map reading and map analysis are prerequisite stages of action for map interpretation. The map user will only be able to interpret the map if he or she has enough procedural and declarative knowledge (Van der Schee, van Dijk, & van Westrhenen, 1992, p. 92). Question 9 was difficult because students had to combine information about the topography and physical geography of different parts of the United States with knowledge about the appearance of hazards (see Figure 3). Unlike question 23 (see Figure 1), the source of question 9 does not give much information, so students are more dependent on their content knowledge. In addition, in order to answer question 9 students have to integrate knowledge about the spatial distribution of four phenomena namely about hurricanes, tornadoes, wild fires and volcanic eruptions. In question 23 students just have to deal with one spatial distribution of one phenomenon, namely climate.

The top three countries in the 2008 multimedia test were (1) Poland, (2) Lithuania and (3) Romania. The best students in the multimedia test, two boys from Lithuania, answered 28 out of 30 questions correctly. The lowest score was 12 out of 30 and the average score of the 96 participants was 20 out of 30.

Overall, the top three best performing countries at the 2008 International Geography Olympiad were (1) Romania, (2) Estonia and (3) Australia. When we look at the scores of all the tests we see that almost all Eastern European countries are doing remarkably well. This is also true for earlier International Geography Olympiads. From interviews with students and their teachers during the Olympiad we learned that students from Eastern Europe are trained more intensively before the Olympiad than other teams. There is also a lot at stake for these students: in many cases if the students come home with a prize, free entrance to a university in their country is the reward. In the light of the results of the students of Eastern European countries in the last Olympiads, the high score of Australia in the 2008 Olympiad is a significant achievement.

Discussion

A discussion with those involved in the Olympiad in Tunis provided insight into the performances discussed above. The statutes of the International Geography Olympiad state that two adult team leaders should accompany the four students participating in the Olympiad. These team leaders must be involved in geography teaching or geography in

Table 3. Characteristics of the 2008 multimedia test.

Question	Theme	Region	Source	Geographical skill	*p* value	Corrected item: total correlation
9.	Hazards	North America	Photo	Compare characteristics of regions	.34	.330
25.	Sunlight	Australia	Satellite photo	Map interpretation	.35	.152
8.	Population	North America	Map	Map interpretation	.40	.052
6.	Environment	Europe	Satellite image	Map interpretation	.43	.197
21.	Economic geography	World	Map	Map interpretation	.45	.167
26.	Location	Asia	Photo and map	Map interpretation	.50	.322
3.	Location	World	Photo (1x)	Compare locations	.53	.428
14.	Relief	World	Map	Map interpretation	.53	.259
28.	Poverty	South America	Map	Map interpretation	.55	.120
18.	Political geography	World	Map	Map interpretation	.57	.343
7.	Landscape	World	Map	Map interpretation	.64	.361
23.	Climate	World	Photo (4) and graph	Compare characteristics of regions	.66	.201
24.	Economic geography	Non-regional	Satellite photo	Map interpretation	.67	.219
27.	Climate	World	Map and graph	Map interpretation	.70	.187
20.	Sun light	World	Satellite photo	Map interpretation	.71	.290
4.	Landscape	Non regional	Photo (1x)	Describe characteristics of one place	.77	.373
11.	Agriculture	World	Map	Map interpretation	.77	.327
19.	Location	World	Flag/map	Map interpretation	.77	.307
1.	Landscape	World	Photo (3x)	Compare characteristics of regions	.78	.149
22.	Climate	Non-regional	Photo	Describe characteristics of one subject	.78	.048
5.	Political geography	Non-regional	Map	Compare locations	.79	−.089
29.	Climate	Africa	Film	Describe characteristics of one place	.79	.088
13.	Population	World	Map	Map interpretation	.81	.312
30.	Hazards	Asia	Film	Describe characteristics of one place	.81	.154
15.	Plate tectonics	Africa	Map	Map interpretation	.82	.407
2.	Landscape	World	Photo (3x)	Compare characteristics of regions	.84	.125
12.	Agriculture	World	Satellite photo	Compare characteristics of regions	.85	.289
10.	Environment	World	Photo (3x) and cartoon	Describe geographical effects	.93	.038
17.	Landscape	North America	Map and photo	Compare characteristics of regions	.96	.182
16.	Economic geography	World	Map	Map interpretation	.97	.097

This picture from the USA shows a:
A. Hurricane in Florida
B. Tornado in Alabama
C. Wild fire in Utah
D. Volcanic eruption in Maine

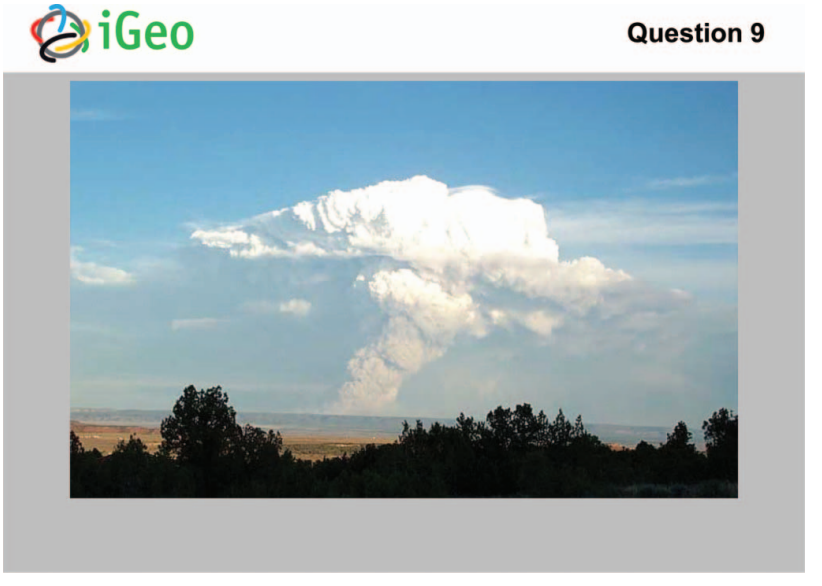

Figure 3. An assignment from the multimedia test of the 2008 International Geography Olympiad. Source: www.geoolympiad.org.

education in their country. Discussions with teachers established the extent to which the number of geography hours, the content of geography lessons and the way students learn geography are different in every country, and this may explain the differences in test scores during the Olympiad. In addition, the experience of the team leaders and students with Olympiad tests and the training before the Olympiad starts are important factors for success. The team leaders assembled in Tunisia supported the idea to establish an international benchmark for geographical literacy with the aim of improving the quality of geography teaching worldwide, and the use of the Olympiad tests was regarded as a good starting point. The team leaders suggested a strategy in which each country should send a set of draft multimedia test assignments to the organizers of the next Olympiad.

Provided that an agreed geographical framework is available, this strategy can be successful. Apart from a fair division of assignments about different regions in the world and the use of a wide range of resources, such a framework should also include different geographical themes, different geographical skills and above all questions that can be distinguished in the number of geographical phenomena and relations that are at stake. To develop a good framework the organizers of the next multimedia test may learn from the work done by Lambert (1996) and Stimpson (2003, 2006). A combination of development and research seems to be fruitful here in the way Williams (1998) advocates. This would require the Olympiad organizers to work with international groups and to integrate this work, with research carried out in the geographical educational community. Developing an international geography benchmarking test would be a real step forward, although this is not a trivial undertaking. Teachers need to develop a shared understanding of level

descriptions before they can be used effectively (Lambert, 1996) and students should get training facilities to practise different types of test assignments, particularly students who have experienced geography teaching that is focused on learning facts and figures. Although the multimedia test is in itself a summative assessment, learning how to do a multimedia test successfully using feedback and discourse is part of formative assessment (Stimpson, 2006). A good discourse between teachers and students about the complexities of contemporary geography in general and about the content of the multimedia test in particular is crucial and indispensable if we are to upgrade geographic literacy internationally.

A well-developed international test may help to draw more attention to the importance of geography and good geography teaching, especially if it is combined with research not only in the field of assessment of learning but also in the field of assessment for learning.

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