Searching for Strategies to Help Students to Structure Their Geographical Research Papers in a Domain Specific Way

Hilde M. A. Wildschut and Joop A. van der Schee
Centre for Educational Training Assessment and Research, Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands

In our increasingly complex world, independent information collection is very important and with the help of modern technology this is becoming easier each day. However, it is very difficult if knowledge and training about how to structure information in a domain specific geographical way is missing. By 'domain specific', we mean the coherence between declarative and procedural knowledge which is specific to the way of thinking in geography. This paper presents the results of a study in which Dutch geography teachers reflect on students' research papers in the upper divisions of secondary education. The present study shows that teachers have different opinions about the necessity of a more explicit way of coaching students in geographical thinking in order to improve the geographical structure of research papers. Nevertheless, it seems worthwhile to investigate the possibility of designing a framework for geographical thinking on the quality of geography research papers.

doi: 10.2167/irgee222.0

Keywords: geography, secondary education, domain specific thinking, research skills

Introduction

In his intriguing book '*The World Is Flat: A Brief History of the Globalized World in the 21st Century*', Friedman (2005: 180) argues that within the last decade, a revolution in the gathering of information has taken place. The advents of Internet, mobile phones and Google have democratised the process of information collection. Independent information collection has become easier and of greater importance. Instead of obtaining a selection of information from teachers, books or television, now people all over the world can gather the information they want to have on their own. Friedman is enthusiastic about the possibilities offered by the new technologies because they open bright new horizons. However, he does not tell *how* individuals organise the information they see. How do we help individuals to distinguish the important information from the unimportant? Should we not help tomorrow's citizens face the overload of information? And if so, how? What role does education play at this point and is there a special task for geography teachers here?

1038-2046/07/04 001-16 $20.00/0

From the 1970s on, there has been a shift in focus in the educational programmes of many countries. This is a direct result of changing perspectives on learning and development. The focus has shifted from the acquisition of knowledge to the mastery of skills required to gain knowledge (Naish *et al.*, 1987). The new educational programmes promote the acquisition of skills combined with active and independent learning in order to better prepare students to function effectively in modern society. The idea is that students should become more active learners and that teachers should act as coaches rather than mere instructors (Novak, 1998; Wood, 1998). Although learning research skills is an important component of these programmes, very little is known about the best way to train pupils in these skills during their secondary school education. There are several problems concerning the question how to help students in secondary education develop their research skills. During an in-service training sessions in the Netherlands, Dutch Geography teachers often report that most students like to work on research projects, but that the average domain specific quality of the research paper written by students is low (Van der Schee *et al.*, 2004).

The central question of the present research is how teachers should help students in secondary education improve the domain specific quality of geography research papers. In order to find an answer to this question we started to analyse students' research papers to get a better idea about the problems students have when writing a geography research paper (section 2). Section 3 gives the results of a questionnaire in which geography teachers give their opinion about the quality of geography research papers in addition to their viewpoints concerning their own role in the process. Furthermore, we report ideas from a panel of teachers discussing a 'thinking map' to help students in secondary education to improve the quality of geography research papers (section 4).

Students' Research Papers

The Dutch curriculum for upper divisions of secondary education requires students to use research skills. Students are required to conduct a number of small research projects, culminating in the writing of a research paper as a formal part of the new examinations. They have to complete at least one practical exercise of approximately 10 hours for geography before they are allowed to advance to a discipline-based or an interdisciplinary main research paper (40–80 hours). The practical exercises and the research paper are important for the students because they are substantial elements in the examinations. In the present study, we focus on geography research papers of senior general secondary education and pre-university education.

To get an idea about the extent to which students already use geographical thinking skills, 46 students' research papers were analysed. The papers were not selected at random, but came from eight schools in the western part of the Netherlands. Half of the papers are products of students in senior general secondary education and the other half were written by students in pre-university education. We used a checklist to analyse the papers. This checklist consisted of 30 items and was based on the skills mentioned in the geography curriculum for upper division secondary education (Table 1). As Table 1 shows, the General Thinking Skills in the Dutch geography curriculum are 'to

Table 1 Geographical thinking skills and general thinking skills (based on KNAG, 2003: 41)

Geographical thinking skills	***General thinking skills***	
	See differences	***Make connections***
A. Compare phenomena and regions in time and space	X	
B. Relate human and nature or spatial structure and behaviour		X
C. Describe and analyse phenomena and regions from different dimensions (natural, political, socio-cultural, economical)	X	X
D. Use geographical contexts to distinguish between the whole and the parts	X	X
E. Describe and analyse phenomena and regions on different scales	X	
F. Describe and analyse phenomena and regions by relating both general and unique patterns	X	X

Table 2 Percentage of geographical thinking skills in main and sub-questions in geography research papers (N = 46)

	A Comparisons	***B Relations***	***C Dimensions***	***D Context***	***E Scale***	***F General***
Main question	17%	9%	0%	2%	0%	0%
Sub-questions	52%	54%	43%	4%	9%	0%

see differences' and 'making connections'. Six Geographical Thinking Skills are related with these more General Thinking Skills.

Examples included in checklist items are: 'Do students compare different phenomena or regions in time and space?' and 'Do students relate human geography and physical geography in their investigation?' Before implementing it, the checklist was discussed with a panel of geography teachers and experts in geographical education. With the improved checklist, a researcher with experience in geography teaching analysed 46 students' research projects. A random selection of 10% of the papers was analysed by a second researcher with experience in teaching geography. A deliberation agreement was reached from all of the scores.

Using the checklist to analyse the main research questions of the 46 students' research papers, we did not find many geographical thinking skills. The same analysis for sub-research questions shows more geographical thinking skills (see Table 2). This is not surprising because most students use two to five sub-questions. Approximately half of the students' sub-research questions can be seen as efforts to make comparisons between phenomena in time or space, to find relations and to look for political, economical, ecological or socio-cultural

dimensions. Only a few of the students use the geographical thinking skills D, E and F in their research questions.

Two examples of our analysis are shown below to illustrate this point further. In these we use four questions to analyse two students' research papers. These questions are part of the checklist mentioned earlier:

(1) Is the paper about space or place?
(2) Which geographical thinking skills are apparent and where?
(3) Are maps included?
(4) Which research method has been used?

Before we discuss the geographical quality of these two research papers, we present the student's research questions, the section of the checklist that is related to the four questions, (Table 3 and 4) and the researcher's comments.

Research paper 1: Storm Within Sight. 'Storm Within Sight' was the title of a geography research project of a student in the upper division of secondary education. His main question was: 'Is it possible to diminish the damage caused by tornados in the near future?' The sub-questions were:

(1) Are all storms alike?
(2) How do heavy storms come into existence?
(3) What kind of damage accompanies heavy storms?
(4) Is it possible to reduce the damage?

Table 3 Example of checklist belonging to research paper 1

Question	*Answer*
Is the paper about space or place?	The student writes about a physical phenomenon. Spatial characteristics are included in the text but not explicitly in the research questions.
Which geographical thinking skills are apparent and where?	The student uses the relation between nature and man in his research questions (sub-question 3) and his text (damage caused by storms)
Are maps included?	One map
Which research methods have been used?	Literature study

Table 4 Fragment of checklist belonging to research paper 2

Question	*Answer*
Is the paper about space or place?	Yes, the students write about a place (Schiphol Airport) and its spatial development.
Which geographical thinking skills are apparent and where?	The students use political, economical and ecological dimensions to analyse the development of Schiphol Airport in sub-questions, text and conclusion.
Are maps included?	No
Which research methods have been used?	Literature study

At the end of his paper, the student writes a conclusion: 'Perhaps it is possible to slightly diminish the damage caused by tornados in the future'.

Comments: The student has chosen an interesting topic studied by physical geographers, and has learned a lot about storms when working on sub-questions 1 to 3. The main part of the paper describes different kinds of storms. The physical part is clear, but the geographical information is not structured well. The research question would be more geographical if the student would investigate where tornados occur and why at those specific locations. Another question could be where tornados cause huge damage and why at those locations. In a small but excellent part of his paper the student describes 'Tornado Alley' in the centre of the USA. A map of the area is included which the student uses to explain the natural processes that cause so many tornados in that area.

Research paper 2: Schiphol Airport, Amsterdam, The Netherlands. Two other students wrote a research paper for geography entitled 'The Extension of Schiphol Airport'. Their main research question was: 'How can Schiphol Airport grow in the near future?' Sub-questions were:

(1) Which political interests are important for the growth of Schiphol Airport?
(2) Which environmental interests are important for the growth of Schiphol Airport?
(3) Which economic interests are important for the growth of Schiphol Airport?
(4) What are the possibilities for Schiphol to extend?

Their conclusion was: 'Schiphol Airport can grow at its present location or on an artificially made island in the North Sea'.

Comments: The development of Schiphol Airport is a geographically interesting topic. The students use different dimensions to structure their paper. However, in the conclusion, the dimensions remain separated from each other. The students do not explicitly give attention to other geographical thinking skills e.g. the international context is completely missing. Although there are many maps available concerning the development of Schiphol, no maps were found in this research paper.

The overall impression is that students did not employ geographical thinking skills consciously or structurally. This seems to be in line with the data shown in Table 2 and previously mentioned comments from geography teachers during in-service training sessions. It is necessary to read the whole research paper in order to decide whether or not a student has engaged in good geographical thinking. It is not fair to conclude this solely from the questions posed by the students. As we saw in the paper about tornados, even though the research questions are not very promising, geographical thinking skills appeared in the text. In the Schiphol Airport paper, the students analysed the problem from different perspectives. Unfortunately, these perspectives were not connected to each other, so no holistic image appeared. By making connections between the different dimensions and interests, the students could have created an integral vision about this topic. Furthermore, it would have been interesting if they had given their own opinion about the issue based on the information gathered. Both research papers, like many others, lack a geographical structure.

It is difficult to tell whether or not students are really aware of place and space. We found a lot of descriptions of geographical phenomena in our collection of

students' research papers. For most students, geography seems to be a description of the characteristics of phenomena or regions. Students focus on practical things while abstract thinking about distributions, relations and different scales seems beyond the scope of many students. Although 95% of all research papers included a map, only 13% of the students used a map to explain a phenomenon or process. Only one paper had a map drawn by the student.

Students' main source of information was the Internet (96%). In addition, many students gathered information from books (63%) and reports (63%). Atlases (15%), magazines (11%) and newspapers (20%) were used less. Only a minority of the students used research techniques other than secondary sources: 4% of the students used a questionnaire, 9% used observation techniques and 28% used an interview. To summarise, we have noted that many papers seem to be 'cut-and-paste' collections of information, mostly derived from the Internet. Many research projects lack a leading geographical thread running through them. Students do not have a good logical framework because they started with a very broad and vague research question. A domain specific structure is lacking. Nevertheless, in the end many students report that they have learned a lot. Although the geographical depth of the research projects can be improved, many teachers give satisfactory marks. The teachers know that research work is not easy and they are happy when a student is motivated about a topic and finishes his or her work. Or, as teachers often say, 'I am happy to get it over with'. In Dutch secondary education, teachers do not have much time to coach students' research papers, which is really a big problem.

Teachers' Views

In evaluating the results of the students' research papers, we wondered how teachers would perceive the quality of work of their students. Are they content with their students' research papers and the way they coach their students? To investigate these issues, a questionnaire was developed by educational geographers from the Centre for Educational Training, Assessment and Research at the Vrije Universiteit Amsterdam. This questionnaire consisted of seventeen questions and was a mix of open-ended and multiple-choice questions. In 2005, the questionnaire was administered to a random sample of 250 geography teachers from a group of more than 500 teachers that had attended Teachers Day of the Royal Dutch Geography Society in 2004. Almost 30% of the teachers filled out the questionnaire which was previously pilot-tested by a group of geography teachers and geography students.

The questionnaire consisted of three main sections. The first section focused on teachers' views on the geographical content and the importance of the geographical character of students' research papers. Examples of questions are:

(1) What should be the difference between students' geographical research papers and research papers for other subjects such as history?
(2) How important is the geographical way of thinking in a student's research paper to you?

In the second section, teachers were asked to reflect on their own role as coach for students writing a research paper for geography. Examples of questions are:

(3) How do you stimulate students to do research in a geographical way?
(4) How effective is the way you help students conduct research in a geographical way?
(5) Do you think that students in secondary education are able to do research in a geographical way?

The third section focused on personal characteristics of the respondents. These were collected to investigate whether any relationship exists between respondents' answers in sections one and two of the questionnaire. National statistics of geography teachers were not available, but we compared our data with national characteristics of secondary teachers in general, derived from the Department of Education (Ministerie van Onderwijs, Cultuur en Wetenschappen, 2006). The percentage of teachers with a university background is 59%. This is more than the national percentage, which is 38%. Because more teachers have experience in conducting research, this number may influence the importance valued and the teaching strategies used for teaching students research skills. Furthermore, 80% of the respondents are male. This is 34% more than the average percentage of women working in secondary education in The Netherlands. However, we do not expect male teachers to answer the questions different from female teachers.

In the questionnaire teachers are being asked to describe the characteristics of a geographical research paper. Many teachers answered: the spatial component, the questions 'where?' and 'why there?' and the use of maps. The next question in the questionnaire had four answer categories and asked the teachers to choose the level of importance of the geographical way of thinking in a student's geography research paper. More than 25% of the teachers valued the geographical component as 'very important', another 60% thought it was 'important' and approximately 15% thought the geographical component was not very important or not important at all. Many teachers stated that geography is important because it fosters the development of children. A minority said that the integration of subjects is more meaningful than geography alone.

Figure 1 shows how important teachers find the different aspects that are deemed important in relation to geography research projects (KNAG, 2003). The respondents were asked to put the aspects in order of importance from one to 10, one being least important and 10 being the most important.

It is clear that the majority of teachers value domain specific knowledge and skills (asking geographical questions, geographical thinking skills, map skills, geographical concepts and regional knowledge) more than general research skills (using information sources, using ICT, presentation and general research skills) and motivation. When analysing the results of the first section of the questionnaire, we can conclude that many teachers think that the geographical way of thinking is important for students' research papers.

The second section of the questionnaire challenged the teachers to reflect on the process of teaching and learning. Based on interviews with geography teachers about how to help students write a research paper for geography, we categorised four types of geography teachers. In the questionnaire, we asked the teachers to identify themselves with one of the four types of teachers. The question was 'How do you teach your students to think geographically in their research projects? With which type of teacher described do you identify yourself with?' These types are:

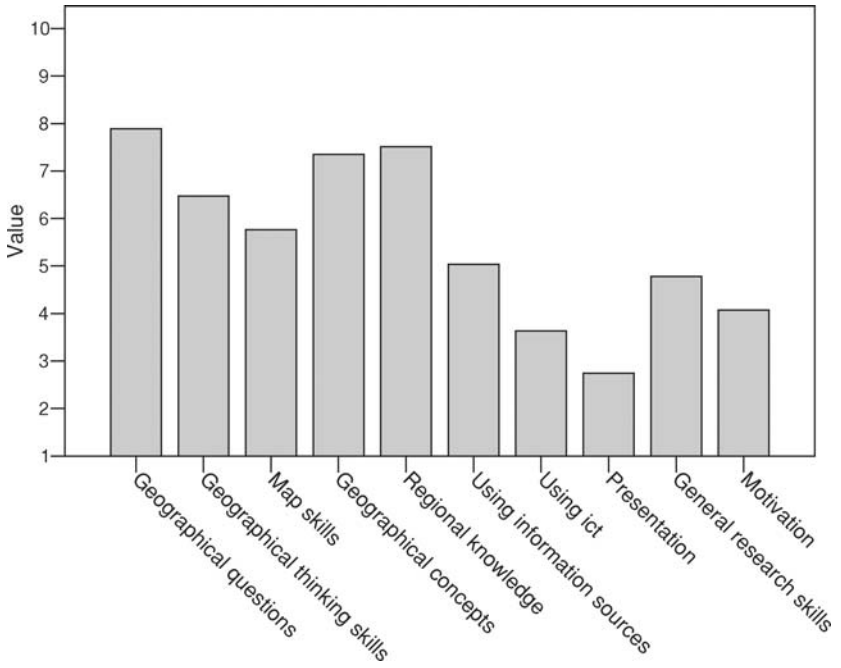

Figure 1 Teachers' evaluation of components of geographical research (0 = not important 10 = very important).

Teacher 1: 'I ask students to make the geographical way of thinking explicit in their papers. Students have to use geographical thinking skills, ask geographical questions and use geographical research skills, as these are demanded in the national curriculum. I teach these skills to students explicitly, by giving them the "tools" which allow them to structure their research in a geographical way'.

Teacher 2: 'When I coach students in their geographical research project, I talk about the geographical components of the project. I explain to them what is geographical and what is not and back it up with supporting arguments. Geographical thinking skills are also mentioned and students learn those skills in these kinds of conversations'.

Teacher 3: 'When I coach students in their geographical research project, I talk about the geographical components of the project. I explain to them what is geographical and what is not and back it up with supporting arguments. Students do not need to learn geographical thinking skills because that is too abstract, but I of course, expect geographical research'.

Teacher 4: 'It is automatically learned by doing geography. You do not have to stress the geographical thinking because it is too theoretical and only useful in an academic setting. Emphasizing geographical thinking is not interesting for students in secondary education. Just teach geography in a nice way and motivate the students. This will make them become interested in the world around them. It is enough to have students interested in the world around them and I think these students' research papers are OK'.

Figure 2 shows that 30% of the teachers prefer to implicitly teach the geographers' way of thinking (teacher profile 4). Teacher type 4 does not want to

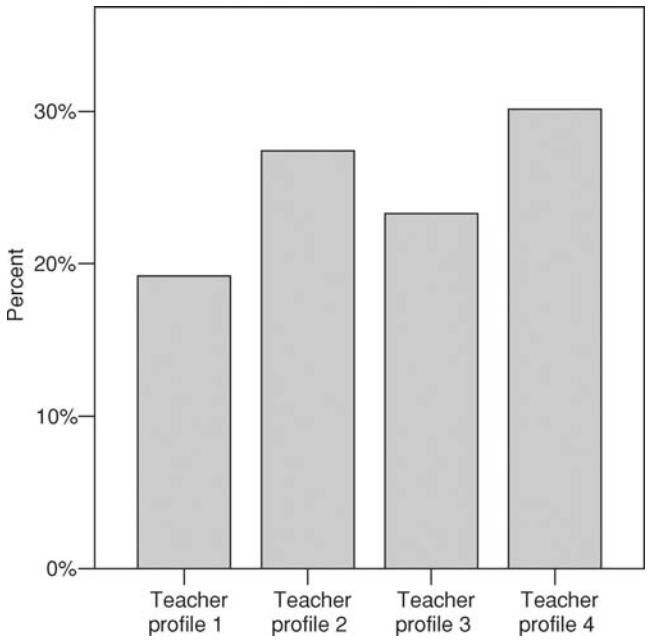

Figure 2 Percentage of teachers in different profiles.

trouble his or her students with geographical thinking skills. Although these geographical thinking skills are mentioned as a mandatory part in the national curriculum, this type of teacher does not seem to see them as an important part of his or her teaching task. The high score on teacher profile 4, in Figure 2, seems amazing if we compare it with the earlier mentioned high percentage (85%) of the teachers, which said that the geographical way of thinking was important or very important in a student's research paper for geography. The conclusion seems to be that many teachers identifying with profile 4 seem to think that geographical thinking skills are important but that these skills will automatically be acquired if students enjoy their geography tasks. From the more explicit teaching strategies, teacher profile 2 is the most popular one. These teachers try to make the abstract geographical thinking skills concrete in debriefing sessions with the students after assignments. In these sessions, the teacher not only asks the students to express *what* has been learned, but also *how* it has been learned. The central notion in this profile is that the thinking process is directly related to the geography task. Students are challenged to form geographical thinking skills by themselves, a method which is used by Leat (1998) in his book 'Thinking Through Geography'.

As Figure 2 shows there isn't much of a difference between the scores on the four teachers' profiles. This difference is not strange if we think about the different backgrounds of the teachers involved. Preliminary teacher and geography training, individual ideas about the core of geography teaching, and their years of experience in education may influence which teacher profile was chosen. However, a significant connection between personal characteristics and teacher profile was not found in this study.

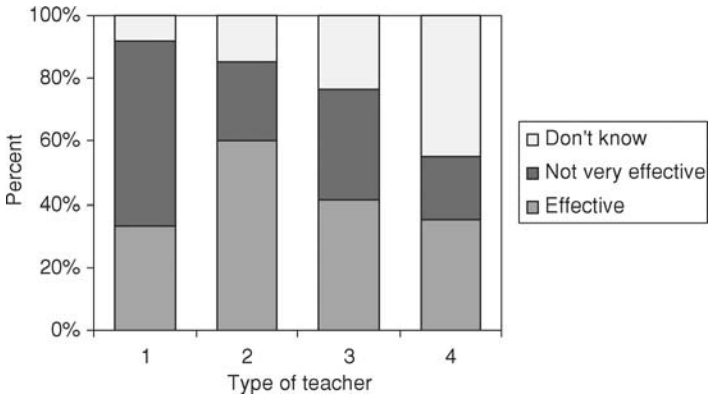

Figure 3 Percentage of teachers per teacher profile that think their way of teaching and coaching is effective.

Table 5 Percentage of teachers estimating the number of students who are able to write a good geographical research paper

Success percentage				
Type of education	*All students*	*Half of all the students*	*None*	*Total*
Senior general secondary education (16–17 years old)	14%	76%	10%	100%
Pre-university education (17–18 years old)	50%	46%	4%	100%

In another question, in the second part of the questionnaire, the teachers were asked to give their own opinion concerning the effects of how they help students write research papers in a geographical way. Forty-three percent of the respondents think that their way of teaching and coaching is effective. However, 31% think that it is not very effective. The arguments for the latter statistic are: time constraints, complexity of research and thinking skills, dependence of students on teachers and motivation. There is no significant relation between teacher profile and satisfaction with the teaching strategy used. However, Figure 3 shows some interesting differences.

Almost 50% of the teachers who choose teacher profile 1 say they think their way of coaching is not very effective. More than 50% of the teachers who choose teacher profile 2 say they think their way of coaching is effective. In teacher profile 4, we see the highest percentage of teachers who are not aware of the effects of their method of teaching. It would be interesting to further investigate these differences through in-depth interviews.

In the second part of the questionnaire we also asked teachers to state how many students are able to write a good geographical research paper at the end of their secondary school time.

According to 76% of the respondents, half of all the students in senior general secondary education succeed in doing good geographical research (Table 5).

Time constraints, motivation and complexity of the issues at stake are the arguments why the other half does not succeed. These are the same arguments that the respondents gave as reasons for the ineffectiveness of their teaching strategy. Opinions about pre-university education differ: 46% of the respondents think that half of all the students do succeed, while 50% think all students do. The teachers argue this is due to their personal coaching skills in conjunction with the motivation of the students.

In analysing the results of the second section of the questionnaire; we see different teacher profiles and a lot of variation in the teachers' reactions regarding the perceived effectiveness of teaching and coaching strategies for geographical thinking skills. The results of the questionnaire as a whole show that teachers think geographical thinking skills are important, but that it is difficult to discern a clear trend in how teachers think that geographical thinking skills should be taught effectively. Although the questionnaire taught us more about the way teachers perceive geography research papers, it did not help us to find a strategy to help students improving their research papers. So we started a discussion with a small group of geography teachers to elaborate on this issue.

A Thinking Map for Geographical Research

By looking at both the analysis of the 46 geography research papers and the questionnaire, it is not yet clear how we should help students to improve the geographical quality of their research papers so we invited a teacher panel to discuss this matter. This panel consisted of three male and two female geography teachers ranging from two to 25 years of experience in education. The teachers participated in three sessions of three hours between April and June 2005. The first session focused on the question about the important components to stimulate the domain specific character of a student's research paper. In the second session, we tried to explore the teaching strategies of the panel members in relation to geography research papers. Finally, in the third session, the panel identified the most important components of a geographical research paper and how to integrate these into a teaching strategy.

The panel decided, the most important components include:

(1) The paper focuses on the questions 'where?' and 'why there'.
(2) The paper focuses on one or more regions.
(3) The paper contains maps.
(4) The data in the paper are collected from students' own fieldwork (interviewing, mapping, etc.).

The teachers said that the first three points should be mandatory and the fourth encouraged. As a teaching strategy, the teachers preferred to have a simple instrument as a memory-aid for teaching students to think about what it is that makes a paper geographical. This memory-aid could be used with students in individual coaching conversations on their papers. It resulted in what the teacher panel called: the thinking map (see Figure 4). The panel members concluded that it was too abstract to teach domain specific research skills explicitly with this thinking map.

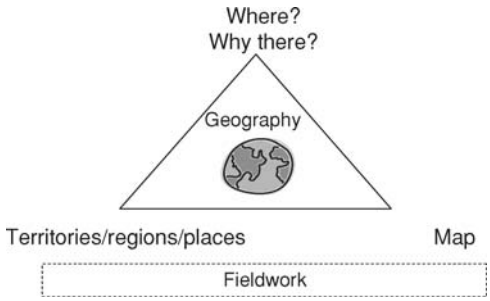

Figure 4 Thinking map.

A thinking strategy map for determining parts / whole relationships:

1. What smaller things make up the whole?
2. For each part, what would happen to the whole if it was missing?
3. What is the function of each part?
4. How do the parts work together to make the whole operate the way it does?

Figure 5 Thinking strategy map (Fisher & Swartz, 2001: 307).

The panel members tested the thinking map at their own schools. One teacher responded in an email: 'Today I used the thinking map in a pre-university education class of 16 year olds. In this class I asked the students to think about a topic for their research paper. After that I let them form questions, with the thinking map as a starting point. It seemed to me the students were eager to choose topics already studied in Geography classes, like volcanoes. In their feedback on the thinking map three different reactions can be distinguished. The smartest students felt less free and more structured in their thinking. Another group of students, who were not as motivated, liked it as an easy way to structure their thinking. The last group of students, facing more problems with geography, did not understand the meaning of the thinking map and could not work with it. They did not understand the differences between the different components and did not know how to include them in their research. In short, I think I am not going to present the thinking map as an obligatory instrument in teaching students to conduct geographical research. Instead, for me, it is a coaching instrument which I can use in guiding students in their research projects. However, it can provide structure for students who have difficulty with structuring their research paper and information geographically'.

Aside from this small-scale trial, we have not yet tested the effectiveness of the thinking map, but at this point, plan to continue with that in mind. In literature we find some examples of the use of thinking maps. Swartz and Fisher (2001) studied the infusion of thinking in science. They used sheets with questions as shown in Figure 5.

They write that a thinking strategy map 'works best if it incorporates instructional techniques that make strategies for skilful thinking explicit, guides students through the use of these strategies, brings them to a metacognitive awareness and evaluation of the strategies' effectiveness, and engages them in

more practices in which they guide themselves in using the strategies' (Swartz and Fisher, 2001: 309). Thinking strategy maps seem to have the same function as a thinking map for geographical research: structuring information by structuring students' thinking. We agree with Swartz and Fisher about the usefulness of a simple instrument for individual coaching which can help to structure students' thoughts through procedural support. However, we wonder whether scaffolding and learning takes place like Swartz and Fisher suggest. Will the students really internalise the step-by-step skills and transfer them to other contexts? Furthermore, we have the idea that the core aspects of geographical research in secondary education should be more specified than as currently have been presented in the panels' thinking map.

Conclusion

This exploratory study gives an idea of some aspects related to geography research papers in Dutch upper division secondary education. In this study, we focused on the practice of geography research papers in three different ways. First, we analysed 46 geography students' research projects. From this analysis, we conclude that it is not easy for students to write good geographical research papers. A domain specific geographical structure lacks in many of the finished products. This brings us to our first question investigated in further research: 'How can we teach students to structure information geographically and conduct good geographical research?'.

Secondly, we administered a questionnaire to geography teachers. Many teachers think a geographical structure in a research paper is important. However, they have different teaching strategies to teach students how to conduct geographical research. From our respondents, 43% are satisfied with their strategy. The others are dissatisfied or are not able to value the effects of their didactics. It seems that a strong useful teaching strategy lacks, that teachers have limited experience in teaching research skills and that time is a bottleneck. Teachers, who talk with their students about geographical thinking while coaching them, seem to be most satisfied about the results of the strategy. From literature (e.g. Alexander & Murphy, 1999) we also learn that it is recommended to make domain specific thinking explicit. This brings us to some more questions investigated in further research: 'Do teachers ask themselves how students structure domain specific knowledge? And do students need more help with doing so?' Research on this topic is scarce. Furthermore, research on designing appropriate teaching strategies to structure domain specific information is also limited. In additional research, we will focus on the following design questions: 'Does a teaching strategy based on explicating domain specific thinking skills for writing geographical research papers really work? And how does it work? And what does a strategy like that look like?'

In our third project we focused on teaching strategies with a teachers' panel in order to begin constructing a design for such a strategy. The panel designed a thinking map for geographical student research. The instrument should be helpful in coaching students by structuring information in a geographical kind of way. This brought us to our next question of investigation: 'Is the thinking map a conceptually and methodologically useful instrument?' Additional research will

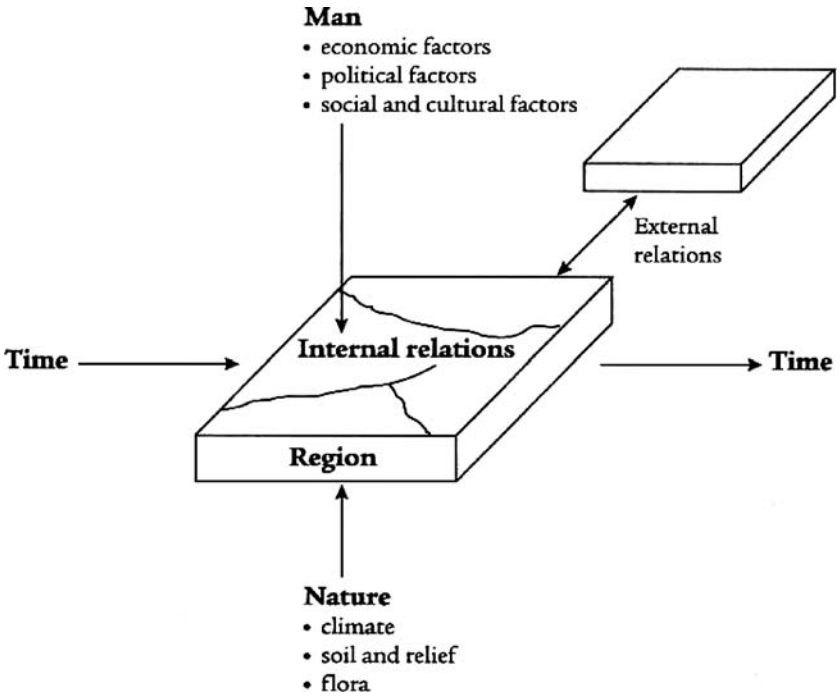

Figure 6 A spatial model for geography teaching (Van der Schee, 2000: 227).

focus on elaborating the geographical thinking map and additional instruments to help students to structure their papers geographically. The thinking map seems to be a good first step in this research design. Leat's thinking strategies (Van der Schee *et al.*, 2006) and some of the thinking strategy map ideas of Swartz and Fisher (2001) may further help us to find ways for students to learn about and reflect on geographical thinking.

Moreover, we should determine and develop a didactical geographical thinking framework, which is appropriate in secondary education. This brings us to another question for further research: Which are the main concepts and skills in geography education? A useful model for this thinking framework might be the spatial model for geography teaching designed by Van der Schee (2000: 227).

This domain specific thinking framework can probably function as the basis of the geographical thinking map. We expect that structuring information with such a framework will improve the quality of students' geographical research papers.

Discussion

Implementing new ways of geographical thinking in daily teaching practices takes time and is quite difficult (Graves, 1996). This also seems to be true for geographical thinking skills. Our last question for further research has to do with teachers' thinking and beliefs: 'How can we prepare teachers for teaching geographical thinking in order to help their students to structure their research projects in a domain specific way? Teachers tend to stick to the disciplinary

thinking models they have adapted to during their training. In some countries, the national curriculum standards and tests, as well as the general image that geography is all about knowing facts and finding places leads to a continuation of an atomistic and mechanistic approach in geography teaching. Morgan and Lambert (2005) argue that teachers are encouraged to consider teaching as a technical rather than as an intellectual activity, and many teachers do not engage in critical and challenging discussions about what they are teaching and why they are teaching it. Teaching to understand, however, assumes that 'knowledge is a human construct and that learners must play an active part in changing their minds, making sense, connecting prior ideas with new ones, thinking about what they learn, and creatively applying knowledge in novel situations' (Stone Wiske *et al.*, 2001: 484). Teachers, then, should be able to guide students. They normally implicitly have the domain specific conceptual and declarative knowledge and thinking structures which students usually don't have. We suggest making these structures explicit and teaching teachers as well as students to work with domain specific thinking frameworks. This, however, shouldn't be a kind of cookbook recipe ('do this first, and then do that'). We will try to design some geographical thinking strategies which teachers, as well as students, will hopefully internalise and use in structuring information in geographical research projects.

Geography has an important task to help students to see the complex natural and human patterns and processes that determine our fast changing planet earth. Without geographical thinking frameworks, we just see what we know and what we expect to see. We need them to discover the world.

This paper reports the start of a PhD research focusing on the importance of geographical thinking in student research papers. Reactions and comments are very much appreciated (h.wildschut@ond.vu.nl).

Correspondence

Any correspondence should be addressed to Hilde M.A. Wildschut and Prof. Joop A. van der Schee, Centre for Educational Training Assessment and Research, Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands (h.wildschut@ond.vu.nl, j.vanderschee@ond.vu.nl).

References

Alexander, P.A. and Murphy, P.K. (1999) Nurturing the seeds of transfer: A domain-specific perspective. *International Journal of Educational Research* 31, 561–76.

Friedman, Th. L. (2005) *The World Is Flat: A Brief History of the Globalized World in the 21st Century.* New York: Farrar, Strauss and Giroux.

Graves, N. (1996) The nature of innovations in geographical education; a historical review. In T. van der Zijpp, J. van der Schee and H. Trimp (eds) *Proceedings of the IGU Commission on Geographical Education, 28th Congress of the International Geographical Union* (pp. 239–241). Amsterdam: Vrije Universiteit.

KNAG (2003) *Gebieden in Perspectief: Natuur en Samenleving, Nabij en Veraf. Rapport Commissie Aardrijkskunde Tweede Fase.* Utrecht: Koninklijk Nederlands Aardrijkskundig Genootschap.

Leat, D. (1998) *Thinking Through Geography*. Cambridge: Chris Kington Publishers.

Ministerie van Onderwijs and Cultuur en Wetenschappen (2006) *Nota werken in het onderwijs 2007*. Den Haag: Ministerie van OC&W.

Morgan, J. and Lambert, D. (2005) *Geography: Teaching School Subjects 11–19.* London: Routledge.

Naish, M., Rawling, E. and Hart, C. (1987) *Geography 16–19, The Contribution of a Curriculum Project to 16–19 Education*. London: Longman.

Novak, J.D. (1998) *Learning, Creating and Using Knowledge*. London: Lawrence Erlbaum.

Schee, J.A. van der (2000). Helping children to analyse a changing world: looking for patterns and relationships in space. In: M. Robertson and R. Gerber (eds) *The Child's World. Triggers for Learning* (pp. 214–231). Melbourne: The Australian Council for Educational Reseach Ltd.

Schee, J. van der, Simons, P.R.J., Rijborz, D. and Straatemeier, M. (2004) Effects of a systematic variation in the training of students' research skills. *Curriculum & Teaching* 19 (2), 5–17.

Schee, J. van der, D. Leat and Vankan, L. (2006) Effects of the use of thinking through geography strategies. *International Research in Geographical and Environmental Education*, 15 (2), 115–224.

Stone Wiske, M., Sick, M. and Wirsig, S. (2001) New technologies to support teaching for understanding. *International Journal of Educational Research* 35, 483–501.

Swartz, R.J. and Fisher, S.D. (2001) Teaching thinking in science. In A.L. Costa (ed.) *Developing Minds, a Resource Book for Teaching Thinking*. Alexandria: ASCD.

Wood, D. (1998) *How Children Think and Learn*. Oxford: Blackwell Publishers.