STEPS TOWARDS MODERN GEOGRAPHY IN HUNGARY: RESULTS OF DEVELOPMENT OF PROBLEM-ORIENTED EDUCATIONAL INSTRUMENTS

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ABSTRACT

According to domestic and international surveys, one of the biggest problems in geography education in Hungary is the growing gap between students' thorough theoretical knowledge and practical applicability. However, Hungarian teaching practice has been slow to respond to a process that has been going on for decades, during which the concept of valuable knowledge has changed significantly. While quality, well-applied and practical knowledge has gained high social and economic value (as opposed to directly applicable, passive knowledge), primary and secondary education and teacher training continue to struggle to bring about the necessary change.

The present study discusses the effectiveness of a learner-centered, activity-based worksheet compilation developed by our research team for primary and secondary geography education to facilitate problem-based geography education. The results show that the short-term use of worksheets has already helped the experimental groups to solve their tasks more successfully than the control groups.

The results of the pretest showed that there was only a small difference between the two groups attitudes toward geography, and the difference in mean performance was not significant in the evaluation test. However, the results of the follow-up showed that the short-term use of activity-based worksheets had already helped the experimental groups to complete the questionnaire tasks more successfully than the control groups. In the geographic post-test, the students in the experimental group significantly outperformed their peers in the control group (Mexp = 21.92 (SD = 5.83), Mctrl = 18.99 (SD = 6.31), t = 3.31, p = 0.001). The experimental effect size was found to be medium (eta-square = 5.6%).

Keywords: activity-based learning, problem-based learning, inquiry-based learning, Geography education, effectiveness of activity-based exercises

INTRODUCTION

Our teaching practice is often based on the usual content and methodological schemes. This is true for both geography teachers who have been teaching for decades and geographers with a recent degree in public education. At the same time, it has been felt for years that changes in content, curriculum, the proliferation of digital teaching tools, and changing societal demands for knowledge (to name but a few of the external constraints) pose new challenges for colleagues in public education and geography teachers of the future. Nowadays, instead of the predominance of lexical knowledge, the acquisition of geographical knowledge that can be applied in practical life has become more important, and at the same time there is a growing need to renew the methodological culture of geography teachers [17], [18].

According to national and international surveys, one of the biggest problems in Geography education in Hungary is the growing gap between the students' thorough theoretical knowledge and its practical applicability. However, Hungarian teaching practice is slow to respond to the process that has been taking place over several decades, during which the concept of valuable knowledge has changed significantly [6], [7]. Unfortunately, curriculum reforms in Hungary (National Core Curricula were published in 1995, 2003, 2007, 2019) have not or only slowly been followed by a change in the methodological practice of Hungarian teachers, and the social promotion of the necessary changes has been insignificant. While qualitative, well-applicable and practical knowledge has gained high social and economic value (as opposed to knowledge that cannot be applied directly and contains passive knowledge), primary and secondary education as well as teacher training are still struggling to implement the necessary changes in their basic methodological practice [3].

The contemporary world of work requires certain new skills and abilities which people need to thrive in everyday life. These skills and abilities are like those that students need to employ when solving the exercises of a PISA survey. The new expectations arising on behalf of present-day society and economy imply that instead of employing traditional teaching methods to transfer lexical knowledge, there is a growing need for new methods that facilitate greater student activity, skills enabling, for example, the development of communication, problem-solving methods, group collaboration, and the development of the critical use of Geographical information in addition to solid Geographical literacy [14], [31].

The need for methodological change has been encouraged for years in Hungary, but the implementation process is slow. A possible solution of the present situation is to empower teachers with diverse teaching methods and teaching aids [15], [28], [14]. The complete science education, including Geography, should be reconsidered in terms of curriculum content, amount and quality of information, teacher training, and methodological renewal is only one step in this process [5], [16].

In 2016, the Geography Methodology Research Group of the Hungarian Academy of Sciences was established with the support of the Hungarian Academy of Sciences from the researchers of the Universities of Szeged, Pécs and Debrecen and teachers working in public education. Our main goal was to establish a tool development that offers problem-oriented educational opportunities and digital technological innovations for the methodological renewal of geography education. Our aim is to prepare student aids for 13 - 17-year-old, processing the geography of Hungary, which allow teachers to process the problem centrally in certain areas of Hungary, and serve as a model for a similar methodological approach to other parts of the curriculum [25].

THEORETICAL BACKGROUND

One of the main tasks of today's geography teachers is to prepare their students to receive, select and organize information from traditional and digital media and other sources, to evaluate and monitor changes in the world. Problem-based teaching and learning (PBL) is a very good opportunity to develop all these knowledge elements, the main feature of which is a learning environment in which the driving force of learning is embodied by the problem itself [1], [20]. Students become familiar with the problem before learning the information needed to solve the problem, and do not have to solve various lifelike problems to practice the acquired knowledge. An important benefit of problem-based learning is that it also develops students 'critical, analytical, and creative thinking. Students can work in groups to solve a problem, but it is also possible in the form of individual research tasks [2]. In other words, cooperative learning, project work, ICT (Information Communication Technology) and research-based learning can also be linked during PBL.

The new challenges Geography education must face justify the needs for employing new methods instead of traditional ones. Methods that transfer lexical knowledge should be replaced by those that increase student activity. If children are active participants in the learning process, their work can become more effective. When the learning and instruction process becomes more efficient, the competencies set up by the new challenges of our world can develop, so there is a real need for a reinterpretation of the the Hungarian methods of learning and instruction [10], [11].

Both national and international studies aim at elaborating, testing, and developing new methods, which can be used from the lower grades of primary schools to higher education. Such methods include active learning, problem-based, project-based, inquiry-based methods, as well as a greater involvement of ICT tools [8], [23]. By employing these methods, students' skills and abilities can and do develop. Their problem-solving ability improves, because they actively must engage in finding the answers and optimal solutions to questions, tasks, and projects. Due to students' active role, causal relationships are also easier to notice and understand, while their critical thinking is also evolving [19]. Working in groups entails the development of communication and reasoning skills, and they can learn to adapt to each other much better. The coordinating and final evaluating role belongs to the teacher, but the students also self-check and self-assess their own progress, which have a positive effect on their self-knowledge. The development of these skills helps the process of knowledge consolidation, which also has a positive effect in the practical application of their knowledge in the future [4], [9], [21], [22], [24], [26], [27], [30].

These skills are also essential in the world of work. During an interview, would-be employers are interested in how well the applicants can communicate, whether they can work in a team or not, how creative, independent they are, how good their problem-solving method is, and whether they are able to self-reflect. The previously mentioned learning methods positively affect skills that are important today, that is, they meet the new challenges of the world. [5], [29].

To raise the prestige of Geography, it is mainly the teachers who can contribute to it the most by employing new, student-centered and inquiry-based methods. Though educators can motivate and arouse interest, due to the constant shortage of time, a toolkit can also help them. A toolkit should be designed by including the latest methodological innovations, employing ICT tools, etc. The focus is on diverse methodological applicability which helps students use their knowledge in everyday life. If they experience

the usefulness of what they do, if they are active participants in the process, if they feel that they are improving, and they receive continuous external and internal confirmation, their motivation, interest, and enthusiasm are likely to increase. As a result, these changes can increase the prestige of the geography too [12], [13].

RESEARCH QUESTIONS AND HYPOTHESES

The main purpose of our present investigation was to reveal the effects of using a methodological toolkit our research group has been developing. This methodological toolkit includes separate worksheets that focus on selected parts of Hungary, either a town or a region, and provides a diverse compilation of geographical problems. The problems are connected to physical geographical, environmental, social, and economic issues, and provide opportunities to engage students in active and inquiry-based learning. In addition, we sought to increase the geographical literacy and the reading comprehension of students by certain tasks that involved active reading. Therefore, a classroom-based Geography teaching experiment was designed to test the effectiveness of our worksheets. There was our major research question: Will the experimental group students outperform their control group peers with respect to standard geographical performance?
Our hypotheses were as follows: (1) Students from the experimental group will significantly outperform their control group peers with respect to geographical tasks that require active and constructively responsive thinking. (2) At the same time, their performance will not be significantly weaker on more traditional geographical tasks

METHODS

To determine the benefits of the developed toolkit over traditional education as accurately as possible, we conducted an experimental and control group study with six elementary schools in spring, 2019, when, according to the curriculum, the main topic of the geography lessons is the geography of Hungary (Grade 8). A quasi-experimental research design was used, i.e., Geography classes volunteering to be involved in the training program were selected first, and then control classes from both the same schools and from other settlements with similar SES-background students were recruited. 115 people took part in the experimental instruction (during which the participating teachers used the worksheets developed by us during their teaching), while 151 students in the control groups, who learned the geography of Hungary in the usual way (266 people in total). The experimental group worked with the worksheets we developed for about 3 months. Following data cleansing, 94 responses from the experimental group and 95 responses from the control group were included in the analysis (Table 1).

Table 1 Participants of the pre- and post-tests.

Data	Pre-test	Post-test
Total	189	189
Experimental group	94	94
Control group	95	95
Participating schools (Hungary)	Esztár, Hajdúhadház, Kaposvár, Kiskunhalas, Pécs, Szeged	

We employed a pre- and post-test design to measure differences in learning outcomes between experimental and control groups. The pre-test consisted of two parts: an attitude test based on the questions of the PRIMAS Project [8], and a geographical assessment test. The post-test consisted of only one part, the geographical assessment test of the pre-

test. The effectiveness of the application of the experimental, inquiry- and problem-based tasks was measured by the pre- and post-test design of the geographical assessment. The assessment test consisted of four exercises, two of which (Exercises 2 and 3) were specifically aimed at traditional topographic knowledge (which is a focus of traditional Geography teaching in Hungary). Two exercises (Exercises 1 and 4) were novel, inquiry- and problem-based exercises that put traditional geographical information into a new textual framework, thus testing the efficiency of enhancing geographical literacy and reading comprehension.

Participating teachers of the experimental training program were asked to use the worksheets developed by our research group. They were also the ones to administer the pre- and post-tests to the students. After testing, the data were collected and processed, and only those entries were used for further quantitative and qualitative analyses that were included in both the pre- and the post tests.

The toolkit, developed by the research group, is a collection of inquiry-based and problem-oriented tasks related to the teaching of Hungary's geography, which can facilitate the methodological renewal of Hungarian Geography education. The main principles of the interactive worksheets are as follows:

- 1. Teaching how to learn: the purpose is to teach students how to collect information independently, thus establishing the ability to learn, and the tasks are age specific.
- 2. Providing a creative learning environment that facilitates the joy of discovery and develops communication among other social skills.
- 3. Offering textbook renewal: the tasks of the individual worksheets belong to the geography of Hungary, and they represent a truly complex approach.
- 4. Applying information and communication technologies (ICT), providing access to up-to-date information using QR codes that lead students to different online educational software.
- 5. Creating a constructivist learning environment in which the acquisition of knowledge is not passive but active and creative.
- 6. Applying innovative, cooperative learning organization techniques which diversify the learning process and encourage action, individual research, knowledge acquisition and discussion.
- 7. Acquiring real, applicable knowledge through problem- and practice-oriented training that focuses on everyday life situations.

In the data analysis process, statistical analyses usually applied for revealing experimental effects have been used. We used the IBM SPSS Statistics 25 software, and the statistical analyses were selected according to the measures we used. While the geography test items were of dichotomous nature, the questionnaire items used four-point ranking scales, and Likert-scale items can be handled as interval-scale variables. Our analyses therefore involve descriptive statistics (absolute and relative frequencies), comparing distributions (two-sample Kolmogorov-Smirnov tests), and comparing group means (t-test, Levene-test and ANOVA).

RESULTS

To analyze the effectiveness of our intervention program, we (1) compared the control and experimental groups with respect to the pre-test score (both cognitive and affective variables), and (3) compared their performance at the post-test. While the latter enables for measuring the effect size of the experimental treatment, the pre-test comparison may ensure that the two groups have comparable baselines.

Changes in the attitude towards geography

As for the attitude towards Geography as a school subject, the experimental and control groups have similar mean values. Mexp = 3.63, Mctrl = 3.59. The difference is not significant (t = .27, p = .79).

On the questionnaire items concerning agreement or disagreement with different statements about the students' personal relations with geography, there were some items on which the experimental and control groups significantly differed from each other (p > .05). The three exceptions are items 2, 8 and 13. As we can see from the results presented in Table 2, the mean values obtained from the two groups are close to each other, and the direction of the difference varies with items. Nevertheless, all three items on which significant differences were revealed indicate in general a more favorable affective prerequisite inclination towards learning geography.

Table 2 Mean (SD) values for the statements on personal relationship with learning geography (items adapted from the attitude test of the Primas Project, [8]).

Item	N	Mean	Std. Deviation
I enjoy Geography at school.	186	3.55	0.953
I'm talented in Geography.*	186	3.05	1,109
I talk to my family about what I experienced in Geography class.	184	2.48	1.109
I talk to my friends about what I experienced in Geography class.	186	2.57	1.133
I'm waiting for the Geography lessons.	186	3.17	1.007
I think Geography helps us understand the world around us.	186	3.82	0.880
I enjoy studying Geography.	185	3.11	1.039
I agree that we have to study Geography at school.*	186	4.09	0.899
As an adult, I want to deal with things related to Geography.	185	2.09	1.055
I like to occupy myself with Geography-related things in my spare time.	185	2.49	1.089
Geography is very important to me.	186	2.78	1.008
I like Geography.	186	3.46	1.019
I learn Geography quickly.*	182	3.23	1.020
As an adult, I will benefit from Geography in my daily life.	186	3.22	1.138
I wish we had more lessons in Geography at school.	186	2.54	1.111
I would like to spend my life using Geography at a higher level in my work.	183	2.13	1.045
I think it's helpful to have Geography at school.	185	3.82	0.955
Even at an advanced level, Geography would be easy for me.	185	2.38	1.087
After graduating from school, I will have many opportunities to use Geography.	185	3.1	1.074
I want to work in a profession where Geography is important.	186	2.11	1.107
I can easily understand the new geographical materials.	185	3.36	1.060

Note. The between-group average of the experimental and control groups was significant on items marked with *.

Students' results on the geography tests

Having analyzed the affective characteristics of students' Geography learning, now we turn our attention to the Geography pre-test results. 32 items were examined in the assessment test. Their reliability is adequate: 0.89 (Cronbach-a), i.e., based on item-omitting reliability, the test measures reliably. The average solution level is 20.10 (standard deviation: 6.52).

There was no significant difference between the experimental and control group's average performance (Mexp = 12.27 (SD = 4.95), Mctrl = 11.18 (SD = 4.65), t = 1.56, p = 0.12).

On the Geography post-test, students from the experimental group significantly outperformed their control group peers (Mexp = 21.92 (SD = 5.83), Mctrl = 18.99 (SD = 6.31), t = 3.31, p = 0.001). The experimental effect size proved to be of medium level (eta-squared = 5.6%). Table 3 presents the task-level analysis of the results of the post-test as revealed by general linear model (ANOVA).

Table 3. Task-level analysis of the results of the post-test.

Task	*Experimental group*		*Control Group*		*F*	*p*	η^2*(%)*
	M	SD	M	SD			
1*	6.23	2.81	4.80	2.86	11.88	0.001	6.0
2	4.76	2.14	5.15	1.87	1.72	0.19	0.9
3	6.29	1.83	5.77	2.00	3.48	0.06	1.8
4*	4.68	1.54	3.27	1.61	37.35	<0.001	16.7

* Inquiry-based task

The results in Table 3 suggest that students in the experimental group proved to be significantly more successful on two tasks: Task 1 and Task 4. The difference between the experimental and the control group on Task 3 was marginally significant. Eta-squared effect size indices show that there was a large experimental effect on Task 4, a middle-sized effect on Task 1, and there were small effects on Task 2 and Task 3. The success of the research group's experimental training program is likely to be due to the fact that the inquiry-based tasks, which the students got used to during the three-month trial period, aroused their interest and are more closely connected to the world around them, which are known to increase learning outcomes. The use of the worksheets developed by our research group helped the experimental groups to solve these tasks more successfully (Table 3) compared to the control groups.

Discussion of pedagogical experiences

An important phase of any methodological development is testing the "product", based on the experience of which it can be further developed. Geography teachers volunteered to test the toolkit we developed, and they also agreed to share their comments and experiences not only in the form of a questionnaire, but also during personal discussions, which took place in forums and school meetings.

Overall, students were happy to solve the new worksheets. They enjoyed the fact that in many cases they could use the Internet for finding the solution, collecting information independently, creating a flyer, a presentation, a plan a trip for a specific topic, etc. Working in groups or pairs helped them to communicate with each other. Their feedback was usually that the tasks in the worksheets were interesting and not too difficult in the first place.

The products of independent work and the opinion of teachers show a more nuanced picture. Questions that require short answers and are easy to solve were considered easy and interesting. However, there are also more complex questions, during which connections must be seen, or the answer must be collected from several places, prior knowledge must be used, and conclusions must be drawn. These tasks were already more difficult to cope with, which is mainly the result of the frequent use of traditional, mainly frontal teaching methods. In the course of frontal instruction, students are given ready-made knowledge that only needs to be recognized, but they do not need to apply this knowledge to their everyday life, so activity-based tasks like the ones in the worksheets may scare the students.

However, due to the active student role in the solution of the tasks, the knowledge and connections could be found by the students, and as the work required more practical, deeper thinking, it seemed to be more efficient in consolidating knowledge.

CONCLUSION

High-quality and practical knowledge has become greatly valued in our post-modern society, values which are not well-represented in contemporary Hungarian Geography education. Most of the Hungarian teachers still employ traditional instructional methods which do not empower students with skills and competences required in present-day labor market. As a change to activity- and inquiry-based learning and instruction involves curriculum reforms, the continuous development of teaching tools and the renewal of in-service teachers' methodological practice, the necessary methodological transformation seems to be taking place rather slowly. Hungarian teachers of Geography are limited to a narrow choice of teaching tools, so the MTA-SZTE Research Group on Geography Teaching and Learning set out to develop an activity-based toolkit consisting of interactive worksheets. These worksheets are based on inquiry-based approach and focus on the teaching and learning of Hungary's Geography.

The effectiveness of this student-centered, activity-based worksheet compilation for Geography teaching was tested in 2019. Volunteering teachers of Geography (with Grade 8 students) were asked to use the new developed worksheets in their Geography lessons for a period of three months. These Grade 8 students formed the experimental group, while control groups were also recruited, but this groups did not learn from these new developed worksheets. Students of both groups were administered a pre- and a post-test, the first of which also contained an attitude test. The results of the pre-test indicated that there was only a slight difference between the two groups' attitude toward Geography, and the difference between the average performance was not significant concerning the assessment test. However, the results of the post-test revealed that even a short-term use of the worksheets has already helped the experimental groups to solve the inquiry-based tasks more successfully than the control groups.

Our results imply that by employing activity- and inquiry-based worksheets and making them widely available, hopefully geography teaching will start to change, moving towards active learning more and more increasingly, with the help of more modern teaching aids and more practical knowledge.

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