FROM THE BASIC TO THE LONG-TERM KNOWLEDGE OF GEOGRAPHY: EXAMPLE ON URBAN GEOGRAPHY CONTENT

Filip Domaćinović[1]
Ružica Vuk[2]
[1]I. gimnazija Osijek, Department of Geography, Faculty of Science, University of Zagreb, **Croatia**
[2]Department of Geography, Faculty of Science, University of Zagreb, **Croatia**

ABSTRACT

Understanding how geographical knowledge is created and retained in educational geography in Croatia is, for now, poorly researched. The aim of this research is to examine the level of retention of geographical knowledge and skills for a chosen outcome. During the school year (SY) 2021/2022, in seven schools with a high school program in the Osijek-Baranja County, at the end of the learning and teaching process, an exam on the retention of the outcome GEO SŠ C.B.3.2 was carried out. 420 students participated, with average score being 48.81%. In the first semester of the following school year, a new exam was carried out with the same sample (428 students) for the same outcome. A written exam contained eight items, with the average score being 44.95%. By using the focus group method, exam tasks were agreed upon by teachers of Geography in schools of the researched area, while one evaluator conducted the evaluation. The results indicate students can recognize elements of the city system well, distinguish between elements of a smart, sustainable and inclusive city, and recognize the urban heat island while suggesting possible measures for its mitigation. In test items where a higher cognitive level is expected, the results are significantly weaker. Using Maude's typology of PGK, we can conclude that student knowledge retention is good for types 1 and 4, while type 2 is below average. This research is a continuation of research started in SY 2021/2022. By comparing the research results for seniors (470 students) of the SY 2021/2022 and the seniors of the SY 2022/2023, we conclude that the results are very similar (average score of 50.48%).

Keywords: educational geography, Maude's knowledge typology, knowledge retention, curriculum

INTRODUCTION

If a school is an institution the task of which is to achieve the educational goals set by the school curriculum, and education is "the most important available tool for encouraging a deeper and more harmonious human development" [15] then it is of crucial importance to have a good understanding of the ways of creating and retaining knowledge in the minds of students. Cognitions about the creation and retention of knowledge would enable teachers to have greater control over the educational process in classrooms, as well as the application of those teaching methods that would ensure the creation of permanent knowledge at the appropriate cognitive level.

In the focus of this paper is the teaching of geography in the Republic of Croatia, which has undergone significant changes in the past four years with the introduction of a new

curriculum for the subject Geography and a curriculum of cross-curricular topics. The new geography curriculum in Croatia brought changes in the content, but also in the methods of teaching geography in elementary schools, high schools and high schools with a grammar school program. With the goal of developing the fundamental values taught by Geography in students' and making them conscientious members of the community and builders of a better future for the Republic of Croatia, Europe and the world, the new curriculum is structured according to four concepts within which educational outcomes are organized. The student will adopt them throughout the education process guided by the teacher using modern teaching methods and tools, which encourages the development of critical thinking, problem-solving skills, increases their satisfaction, but also the motivation of both teachers and students [2]. Still, it is yet to be determined what effects this reform will have on the geographical skills and knowledge of students who have studied geography according to the new curriculum in all school years during their education. The introduction of a new geography curriculum in vocational schools is imminent in the Croatian educational system. Therefore, it is necessary to improve the understanding of the process of creating and retaining geographical knowledge in order to further develop and improve geographical education. Vocational education reform takes place within the project of Modernization of vocational education and training systems [13]. The aim of the project is to develop innovative and flexible sectoral and vocational curricula based on the needs of the labor market while strengthening the competences of educators for the introduction and implementation of the curriculum, as well as the development of vocational education and training that is attractive, innovative, relevant and connected to the labor market.

Understanding how geographical knowledge is created and retained in educational geography in Croatia is, for now, poorly researched. Therefore, the goal of this research is to examine the level of retention of geographical knowledge and skills on the chosen outcome through two different written tests of initial knowledge (knowledge from the previous school year) conducted in two different school years, thus determining whether the cognitive level of the set outcome and/or "power" of geographical knowledge affect the retention of knowledge. The determination of the "power" of geographical knowledge will be done using Maude's typology for powerful geographical knowledge [9] while the cognitive levels for the observed outcome will be determined from the geography curriculum for high schools. The selected outcome GEO SŠ C.B.3.2. belongs to the concept of Sustainability and reads: The student analyzes the city as an organized system, investigates the causes of temperature differences in the city and proposes ways and measures of sustainable development of cities. In the elaboration of the outcome, it is specified that by adopting this outcome, the student will be able to describe the elements of the city system (traffic system, waste management, energy system, land usage), investigate the causes and consequences of the existence of the city microclimate, distinguish the characteristics of a smart, inclusive and sustainable city, as well as identify the elements of a sustainable city (environmental, economic and demographic sustainability) on the example of the hometown [14]. If the ideas of the new curriculum are well applied, and given that the new curriculum promotes the development of critical thinking skills and problem solving (not only in the subject of Geography), it is to be expected that there will be no significant differences between the results in tasks that test knowledge and skills of lower and higher cognitive levels. Maude's typology of powerful geographic knowledge will be included in this research with the aim of observing the new curriculum through the prism of "perhaps the most important debate that has appeared in

educational geography in the past few years" as well, referring to determining what powerful geographic knowledge really is [11]. By analyzing the results of this paper, it will be determined which of Maude's five types of powerful knowledge correlate with those in the selected outcome and how successfully the students managed to retain that knowledge.

AN OVERVIEW OF THE SELECTED RESEARCH

Few authors dealt with the topic of retention and creation of knowledge in educational geography in Croatia. From the work of Ivić and Vuk [4], in which an overview of works related to geography methodology and educational geography in the last five decades in Croatia is given, we can identify works related to this research, and these works are found in the category of works whose primary theme is student achievements. According to the topic of knowledge retention and partly methodology, one paper stands out. It is the work of Grofelnik and Pap [3], which is very similar in terms of applied methodology to this paper. The authors used an initial exam of cartographic knowledge and skills among high school students in first grade in three selected high schools with a grammar school program in the area of the City of Rijeka. They conducted an analysis for the written exam as a whole and for each question separately and evaluated the average results, differences in results according to groups of theoretical knowledge and cartographic skills and differences in results according to the categories of factual, conceptual and procedural knowledge. According to the average result for the entire written test in all observed schools of 31.6% and the differences in the results of test items for checking factual knowledge (66%) and cartographic skills (22%), the authors concluded that "mastery of permanent cartographic knowledge and skills of students after elementary school is very low" [3].

In the group of papers on student achievements since 2000, there is a significant number of those dealing with the topic of analyzing the results of national matura exam and other external evaluation exams [16, 17, 18, 19, 20, 21] the methodology of which, relating to the analysis of individual test questions, is useful as a guideline in the analysis of individual questions conducted in this paper.

Other than the aforementioned paper by Ivić and Vuk, Hrčak (Portal of Croatian Scientific and Professional Journals) was used to review published papers in the Republic of Croatia. Only one paper dealing with the research of retained knowledge was found, by the authors Latin et al. [8]. The authors of the paper investigated the differences in the retention of knowledge in biology lessons among students of second grade during the application of different teaching methods in the Third High School Osijek. Two different teaching lessons were chosen, which were covered in two different ways (two different teaching methods used predominantly) in four different classes. Through three exams (initial, final and repeated final exam), the authors found that students which covered the lesson content using the conceptual maps achieved better results on exams and solved issues related to higher levels of knowledge better compared to the other group of students not using conceptual maps in same lessons, whereby their prior knowledge was at a similar level. Regarding the retention of knowledge, the group of students who worked with conceptual maps achieved better results on the repeated exam conducted during the following school year. The overall results in repeated exams in both observed groups were still worse than those analyzed in final testing when the teaching content was still fresh in students' minds, i.e., at the time immediately after learning and teaching process [8].

The second goal of this paper is to link the obtained results with Maude's knowledge typology. Given the novelty of this typology and the whole debate on powerful geographical knowledge, it is not surprising that there are no papers dealing with this typology in Croatia. Also, there are no similar formulations that will observe geographical knowledge in that way. Perhaps the reason is that curricular developments in Croatia are still far away from that level of observing geography. In the paper by Lambert et al. [7], who are among the first to give an overview of the concept of powerful geographical knowledge, three concepts can be observed: Future 1, Future 2 and Future 3 curriculum. Observing geography through the prism of powerful geographic knowledge can be found only in the last one (Future 3). Future 1 curriculum implies those curricula the orientation of which is on stale and factual knowledge that teachers in classrooms needs to pass on to students. It is the traditional way of teaching and this, according to the authors, makes geography boring. The Future 2 curriculum is oriented towards the outcomes that the student needs to achieve through independent learning in which the teacher is a "guide" for students towards the sources of knowledge. The authors also mention the phrase "learn how to learn", which is often mentioned in new curricula in Croatia. They are not in favor of that form of curriculum either and they find the solution in the Future 3 curriculum, which is between the pure factography of the first one, but also for the abandonment of the less important role of the teacher in the second. According to them, the teacher must be a person who brings forth that powerful geographical knowledge [7].

Maude engages in this debate created over Young's idea of powerful disciplinary knowledge with the desire to define what powerful geographical knowledge really is. Young believes that the goal of schooling should be to create such knowledge in students that allows them to think and reason beyond the boundaries of their environment and experience [11]. Analyzing what other authors have written in the current debate [9, 10, 11, 12], Maude presents five types of powerful geographical knowledge. According to him, there are a lot of analyses of the idea of powerful geographical knowledge [11], but few have tackled defining what it really is and how to integrate it into the education of geography i.e. in the new curriculum. According to Maude's [11] paper, the subject was dealt with only by Lambert in 2011 [5] and 2014 [6]. Maude sees two ways to define powerful geographical knowledge. One starts from the approach of determining what in a discipline (in this case geography) is of good quality, and the other sees powerful knowledge as a set of skills, knowledge or abilities that this knowledge will bring to a student if they master it [11]. In this way, Maude composed five of those types of powerful geographical knowledge, in the following order:

1. Knowledge that provides students with new ways of thinking about the world.
2. Knowledge that allows students to analyze, explain and understand the appearance of the processes around us.
3. Knowledge that gives students power over their own knowledge i.e., the power of self-reflection.
4. Knowledge that enables students to, as members of their communities, follow and participate in ongoing debates on significant local, national and global issues.
5. Knowledge of the world i.e., parts of the world which are not their immediate surrounding. [9]

RESEARCH METHODOLOGY

As part of the longitudinal research and observation of the changes brought by the new curriculum in the first years after its experimental and subsequent frontal introduction into schools with a high school program, in the area of Osijek-Baranja County, written exams testing adoption of selected outcomes are being carried out for the second year in a row, one of which is GEO SŠ C.B.3.2 mentioned in this paper. The schools involved in this research are First High School – Osijek, Third High School – Osijek, Jesuit Classical High School – Osijek, Đakovo High School, Valpovo Secondary School, Donji Miholjac Secondary School, and "Isidor Kršnjavi" Secondary School – Našice. This encompassed 11 teachers and approximately 900 students in two generations who, during the school years 2021/2022 and 2022/2023, wrote three different written exams of geographical knowledge and skills. The test materials were compiled by the authors of this paper, after which they were presented to the teachers who teach geography in the selected schools using the focus group method before each written exam. The teachers had the opportunity to make their suggestions regarding the exam materials, which were then corrected if necessary. After the exam, evaluation of the answers was conducted by only one evaluator. The first exam that was taken in September 2021 by the 4th graders (the generation enrolled in the high school in SY 2018/2019) was of the initial type of knowledge check and contained seven questions that checked the adoption of the GEO SŠ C.B.3.2 outcome. In May 2022, a second exam was conducted, which determined the adoption of the same outcome, but this time in the third grades (the generation enrolled in the high school in SY 2019/2020) for whom this was the content learned and taught in that school year. This written test had six questions that checked the adoption of the aforementioned outcome and it was possible to achieve a total of 7 points, as was the case in the exam from September. The last exam of geographical knowledge and skills was carried out in November 2022, when the fourth graders of the time (the generation enrolled in high school in SY 2019/2020) demonstrated how much knowledge and skills from the observed outcome they retained in their memory in eight questions because this, too, was an initial exam. The tests were not announced to the students and they were not specially prepared for them. It should be emphasized that the tasks were not the same, but they checked the same outcomes from elaboration of GEO SŠ C.B.3.2. outcome and tested different levels of knowledge.

After the exams were graded, the average success rate (arithmetic mean) of all the questions that tested the adoption of the GEO SŠ C.B.3.2 outcome was calculated. The same was done for average success rate on each individual question item and the average success rate of the individual questions according to cognitive levels of knowledge they tested. At the end of the analysis, individual question items were classified according to Maude's typology of powerful geographical knowledge. Each question got assigned one of the five types it represents, and after that it was observed in which question the students achieved better results. Using the results of research conducted on the same sample of students and at the same time [2], the connection between the results of the written exam and the teaching methods that teachers often use in classrooms was determined as well.

RESULTS

The focus of this paper is the retention of geographical knowledge and skills. Therefore, the results of exams conducted in May and November 2022 will be more interesting in the analysis because they refer to the same generation of students (enrolled in the high

school in the SY 2019/2020). In May 2022, 420 third graders took part in written tests of knowledge and skills, while in November the number of respondents was 428 students. The sample is almost the same, so the results are comparable. At the test in May when the students actually reproduced the knowledge that was current to them at that moment, the question tasks that checked the adoption of the outcome GEO SŠ B.3.2. were solved with a 48.81% success rate, which can be considered a satisfactory result. It was expected that in the initial exam in November, students (who attended the fourth grade at the time) will perform worse due to the time gap from the moment they learned the examined content. With a result of 44.95% success rate, we can conclude that the retention of knowledge is at a high level. If we compare the results of the exam done in November 2022 with the generation surveyed in 2021, we notice that better results in initial exam were achieved by the older generation of students. Their average score was 50.48%. The reason for such a result could be found in the structure of exam i.e., in the types and formulations of tasks. The initial exam written in November 2022 contained a total higher number of questions and had a higher number of questions at higher cognitive levels, with particles at the application level of Bloom's taxonomy done at a significantly worse success rate.

Through further analysis of the individual questions of the written exam, they were classified according to cognitive levels of knowledge in the revised Bloom's taxonomy [1] (Table 1). In an initial written exam conducted in September 2021 written by a generation enrolled in the high school in SY 2018/2019, a total of seven questions checked the adoption of the outcome. Of these, two questions examined the lowest cognitive level of knowledge, two questions examined the cognitive level of understanding, and three questions the cognitive level of application in Bloom's taxonomy. The exam taken by the generation enrolled in the high school in May 2022 also had two questions that examined the acquisition of knowledge of the lowest cognitive levels, while the cognitive level of understanding was examined by three questions and the cognitive level of application by one question. A written exam conducted in November 2022 had two questions that examined lowest cognitive level of remembering, four questions that tested the cognitive level of understanding, and two questions that tested cognitive levels of application (which includes higher cognitive levels of knowledge).

Table 1. The structure of written exams according to the number
of questions and cognitive levels of the revised Bloom's taxonomy

Date/time of exam	Remembering	Understanding	Application
September 2021	2	2	3
May 2022	2	3	1
November 2022	2	4	2

Furthermore, the average success rate of resolution of test questions according to cognitive levels was compared (Figure 1). In all three exams, the parts solved at the highest level of success were the questions that examined the elements from the elaboration of outcomes at the cognitive level of understanding (55.89%), which is encouraging for the realization of the curriculum at the planned level. The test questions that tested the cognitive level of remembering had the worst success rate (33.95%), perhaps due to the fact that they tested the memorization of new terms or syntagms specific for the subject with short answer tasks. They are also interconnected in the exam so the solving of the second depends on the solving of the first question. To check the

knowledge on the cognitive level of understanding, the following question types were used in all three exams: three multiple-choice tasks, one matching task and six short-answer tasks. This means that a significant proportion of the exams was made up of closed-type tasks, and no extended-response task was used from open-type tasks. Test questions that checked the cognitive level of application were better solved in all three conducted exams compared to questions that had the function of checking the adoption of knowledge for the cognitive level of remembering, and weaker than those that tested the cognitive level of understanding. Another argument in favor of better acquisition of knowledge at higher cognitive levels could be related to the results of a study conducted on the same sample which found that, in the schools included in the research, the dominant teaching method was the discussion method followed by an indirect graphic method and work-on-text method [2]. All three teaching methods can encourage students to reflect and talk about certain topics. For students, this results in retaining in permanent memory the basic knowledge about the topic, but poorer memory of new terms because students did not encode them with sufficient quality (deep learning was absent). Further research should check the possible positive impact of the application of conceptual maps in teaching and learning of new subject terminology.
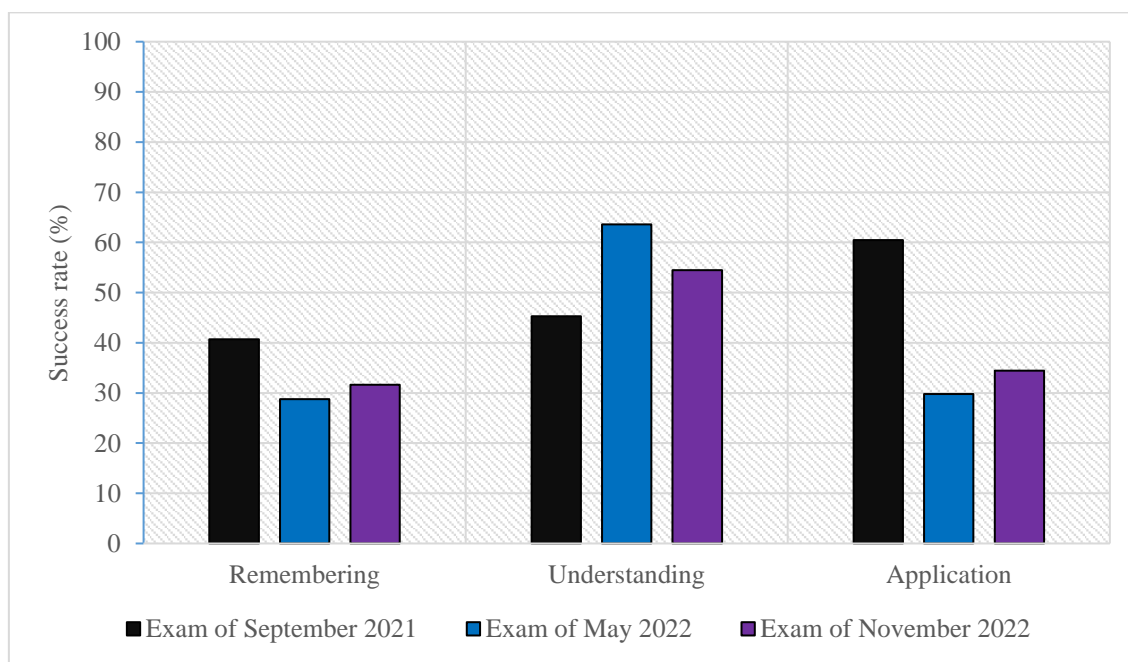
Figure 1 - Average success rate in test questions for the outcome SŠ C.B.3.2., according to cognitive levels of Bloom's taxonomy in all three exams carried out

In an exam conducted in November 2022, we note a high degree of knowledge retention (54.46%) in test questions that tested for the cognitive level of understanding (54.46%), and a satisfactory level is also present in questions that have tested the cognitive level of application in which the average success rate was 34.46%. The particles that examined the cognitive level of remembering at 31.66% success rate are at the limit of what could be considered a satisfactory retention of knowledge. It is also interesting to note the anomaly that students scored better results in test questions that examined cognitive levels of remembering and application in an exam conducted half a year after teaching, in November 2022, than the exam conducted in May 2022, immediately after the learning and teaching process. One of the possible reasons could be the time when the exam was

conducted. It was the part of the school year in which a large number of written exams of knowledge in most subjects take place, which could affect the reduced motivation of students in solving test materials that were not evaluated with a numerical grade in the subject of Geography in that school year.
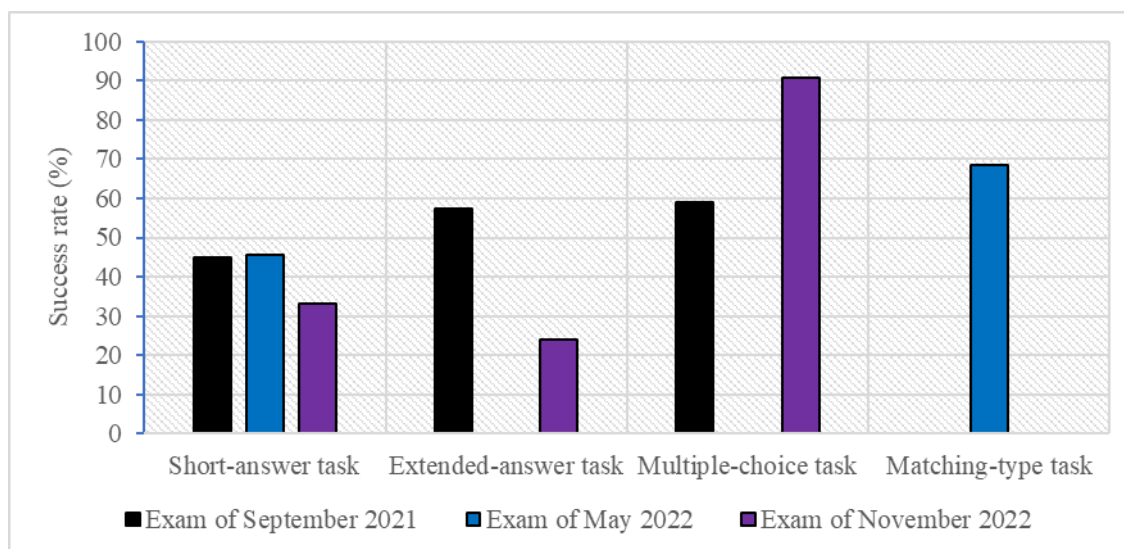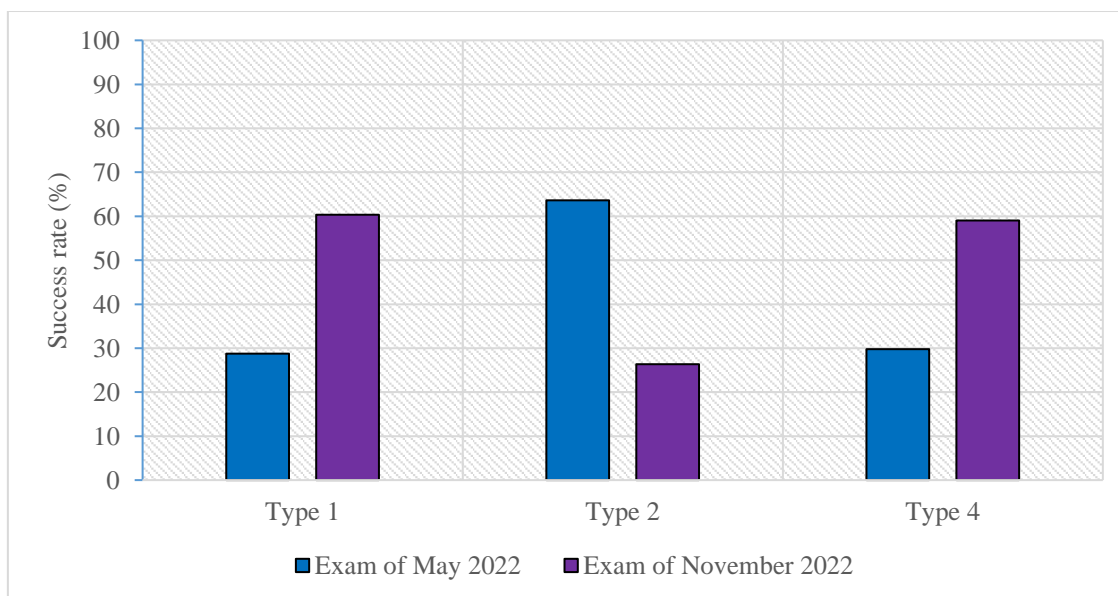

Figure 2. Average success rate on test questions for the outcome SŠ C.B.3.2. by types of tasks in all three exams

Different types of questions were used in the three written exams (Figure 2). Open-type tasks (short-answer and extended-answer) were used in each exam, while the matching type task was present as a closed-type task only in one of exams and multiple-choice tasks in two of three exams. As expected, the multiple-choice tasks (79.53%) and the matching-type task (68.45%) were solved most successfully. Among the open-type tasks, extended-response tasks (46.96%) were more successfully solved than short-response tasks (40.8%). Comparing the results of the generation enrolled in SY 2019/2020 in both exams (in May 2022 and November 2022), we can conclude that they solved multiple-choice tasks most successfully, and the weakest success rate was noticed in the extended-response task. The above is not surprising considering that in closed-type tasks there is the possibility of guessing the correct answer, the possibility of recognizing the correct answer among the ones offered, as well as the application of the technique of eliminating incorrect ones among the offered answers. For example, here is a type of multiple-choice task in which students had to carefully observe the offered features and circle one of the offered options that does not make the city an inclusive one. The features offered were a ramp for the disabled, low-floor trams, accessible pedestrian signals and natural gas-powered bus. Another example is that of a matching-type task in which students had to connect the terms inclusive city, sustainable city and smart city with photos that showed some of the characteristics of such a city. In the questions where extended-response tasks were used, the results were weaker in those questions which tested the outcome at the cognitive level of application. In the questions in which short-answer tasks were used, those in which new terms were tested at the cognitive level of remembering or cognitive level of application in new situations were solved with a lower success rate. Therefore, we can conclude that the students did not adopt subject terminology so well and are better at tasks in which something needs to be described in longer terms. This enabled them to

receive at least a part of the possible points and achieve better results by showing an understanding of the phenomenon in tasks with extended answers.

In the end, the success rate for individual questions and full exams carried out in May and November 2022 was analyzed using Maude's typology. Out of the seven test particles used in the exam in May 2022, two were classified into type 1, four into type 2 and one into type 4. The three questions from the exam conducted in November 2022 were classified into type 1, three into type 2 and two into type 4. In the exam conducted in May 2022, the most successfully solved questions were those that could be linked with type 2 powerful knowledge and the other two types, type 4 and type 1 knowledge, were really similar in success rate but tested below type 2. Immediately after learning and teaching the outcomes of GEO SŠ B.C.3.2., students were most successful in proving the knowledge that allows them to analyze, explain and understand the phenomena and processes in the modern world. In contrast to the above, in the exam carried out half a year after the learning and teaching process of the GEO SŠ B.C.3.2 outcome, the most successfully solved were those questions classified into type 1, slightly weaker were the questions associated with type 4 and significantly weaker success rate was noticed in questions classified as type 2 powerful knowledge. This established that the students most successfully retain the knowledge that allows them to think about the world in different and new ways and that enable them to be involved as members of the community in ongoing debates at the local, national and global level. Given that the students come across and understand the content of the examined outcome for the first time during geography education in the third grade of high school education, a good mastery of this content is very important for understanding contemporary changes in urban settlements and making informed decisions to improve the quality of life in them.

Figure 3. The average success rate of questions for the
outcome SŠ C.B.3.2. according to Maude's typology

DISCUSSION AND CONCLUSION

Even though a more complete evaluation of the new curriculum will require a longer outcome adoption tracking time, as well as a larger sample, the primary results can be a cause for optimism. The results of observing two different generations across two

different school years on only one educational outcome are, at the very least, satisfactory. The focus of this research is an analysis of knowledge retention for the outcome GEO SŠ C.B.3.2. through multiple different levels of analysis. This contributes the, so far, poorly explored topic in educational geography. Research showed a very high level of geographical knowledge retention (44,95%) at the Osijek-Baranja County area for students enrolled into the first grade of high school in the school year 2019/2020. This generation of students was taught according to the new geography curriculum since first grade of high school. Results show that students, after an initial exam in the school year when the knowledge for the selected outcome was fresh and new, solved the initial exam only 3,86% poorer than the first one (48,81%). By comparing these results with the previous 4th grader generation, we noticed that the results are somewhat poorer (50,48%), which can be ascribed to the different written examination structure i.e., the task types and formulations, as well as cognitive levels for which the outcome content tested. Whether this is an exception or a rule, the future results of the currently ongoing longitudinal research will show. The level of retained knowledge may be compared with the results and trends determined in the paper by Vranković et al. [16].

The fact that students, in all examinations, achieved the overall best results in the questions examining the cognitive levels of understanding and application is satisfactory, as well as being in line with the demands of the new curriculum. The results gained by this research significantly differ from the results in the paper by Vranković et al. [19], according to which the tasks with the highest success rate are those on the cognitive level of remembering, and those with the lowest success rate are those on the cognitive level of application. There is clearly room for progress in the teaching of the outcome content at the lowest cognitive level of remembering because the students achieved the worst results in those questions (33,95%). A suggestion for advancing the achievements of students in those outcome contents would be the application of conceptual schemes, the effect of which could then be explored by new research. Latin et al [8] speak on the possible beneficial consequences of such a decision. By observing retention across cognitive levels of Bloom's taxonomy, we notice the anomaly that students achieved better results on examinations done half a year after learning and teaching for the levels of remembering and application than it was in the examinations done immediately after learning and teaching, at the end of the school year. The reason might be student motivation near the end of the school year, which is when the first examination was done. The longitudinal research will potentially also demonstrate whether this is a coincidence not only for the GEO SŠ C.B.3.2. outcome. We notice a high level of knowledge retention for the questions at the cognitive level of understanding (54,46% as opposed to 63,60%). Individual question analysis according to task type demonstrated expected results. The closed-type tasks, in which a student can use, apart from knowledge, various methods and strategies which need not always be a demonstration of outcome adoption, were done with the highest success rate. On the other hand, the extended-answer type tasks in which there is no possibility to guess the correct answer, were done with the lowest success rate. Such results in the success rate of closed-type tasks and extended-answer type tasks have been determined in other research of the level of geographical knowledge at the end of geographical education [19]. Knowledge retention was somewhat harder to determine using this analysis due to the various types of tasks included in the written examinations in May 2022 and November 2022. The comparison could only be done for the short-answer type tasks which were done with an average success rate of 45,54% in September, while the same task type was done with an average success rate of 33,18% in November,

which could be considered a satisfactory level of knowledge retention. The success rate of short-answer type tasks in this exam significantly differs than the success rate determined by other papers [19, 22].

In the spirit of actualization and development of educational geography in Croatia, this paper also dealt with the current debate on powerful geographical knowledge by observing individual questions through the lens of the five types of Maude's typology of powerful geographical knowledge. In the exams done in May and November 2022, three out of five typology types were determined (type 1, type 2 and type 4). Observed as a whole, the questions representing type 4 powerful geographical knowledge were done with the highest success rate (49,41%). However, the differences are not substantial. The type 1 questions were solved somewhat worse (47,86%) followed by type 2 questions in last place with an average success rate of questions being 44,80%. On the other hand, the best knowledge retention was determined for type 1 questions (60,35%) and type 4 questions (59,05%), meaning that students adopted best the knowledge enabling them to think about the world in a different and new way. As such, they are prepared to be active members of their communities in all current debates on various levels of activity (local, national, global). The non-existence of type 3 and 5 questions is noticeable. Considering the fact that these examinations attempted to determine the adoption of individual outcomes, the tasks did not ask students to self-reflect on their own knowledge, which would belong to type 3 questions. On the other hand, the themes of this outcome are a novelty in the teaching of geography in Croatia. However, they are not a novelty to the immediate environment of the students because, as members of their communities, they can experience the consequences of urban heat islands, or notice the characteristics of smart, inclusive and sustainable cities which have their own elements (traffic system, waste management, energy system, land usage). Therefore, we cannot say that the knowledge tested in these examinations expand student knowledge on parts of the world previously unknown to them. We can compare the estimation of content adoption of the new outcomes in geography classes in Croatia only with the results of the state competition held for third grade students in 2022 immediately after the process of learning and teaching. 16 students took part in the state competition, among which there were no students from the Osijek-Baranja County. One task checked for the understanding of the urban heat island. Students were successful in solving the task in 78,1%. The second task, which checked the identification of influence of industrial objects on day and night air temperatures, was done with more success (87,5%), whereas the task which checked the influence of lakes on the edge of the urban area was done with a 68,75% success rate.

As one of the few papers dealing with determining knowledge retention in Croatia, this paper contributes the further development of a young discipline in geography – educational geography. As such, it can serve as a template on the basis and methodology of which similar research could be done on other outcomes or on all outcomes of one of the four basic concepts (spatial identity, spatial organizations and processes, sustainability).

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