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Modern mathematics teaching with the use of computer-based tasks – reality or myth?

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Editorial preface

During traditional teaching, a teacher should stimulate the Adult ego state, support the ability of problem solving and proper situation assessment. It seems that in case of online teaching this process shall be disturbed. It turns out that on the one hand it generates organisational and communication problems, and on the other hand, in certain education areas, it allows us to use new, untypical ways of teaching. Selected mathematical tasks solved online make "students work at their own pace, approach problems in their own way, independently look for solutions, find and process necessary information." It might turn out that using the right approach, the Adult ego state can be appropriately stimulated. The teacher can follow the student's progress in real time with the help of computer technology and manage their work so that they can independently take decisions and draw the right conclusions. Showing the direction and supporting the student, which is facilitated by computer technology, can be a very good environment for the development and integration of the Adult ego state.

Zbigniew Wieczorek

Abstract

In this article, I present partial results of my research, conducted as part of the project entitled Introducing students aged 12-17 to solving computer-based tasks. Research shows that the vast majority of teachers are merely pretending to conduct modern teaching when making use of computer-based tasks during mathematics lessons. In reality, their lessons are typical and conservative,

dominated by frontal work and methods based on knowledge transfer. Most often, lessons feature selected-response questions used to verify the student's knowledge, rarely implementing tasks which require the student to experiment by making use of a computer screen. This situation is caused by multiple factors, including: teachers' views on the place and role of using IT resources for teaching mathematics, insufficient number of computers, tablets, and smartphones in schools, not enough computer-based mathematical tasks with a significant didactic value, insufficient competence of teachers, outdated external exam system, incorrect teacher evaluation system.

Keywords: mathematics tasks, mathematics teachers, IT, modern teaching.

Introduction

The extremely rapid development of information and communication technologies and the growing popularity of computers and mobile devices (e.g. tablets, smartphones, iPods, iPhones) have made IT resources an integral part of everyday life (Bednarek, 2006, p. 8). The modern youth, "born with a computer mouse in their hands", are very strongly immersed in the digital world, which they consider a natural functioning environment. They do not remember times when there were no computers or smartphones. They came into contact with mobile devices and virtual reality as early as pre-school (Bąk, 2015, p. 7). The Internet is a part of their lives. They are constantly "connected" to it by way of various devices that they are unable to part with in order to participate in everyday life (Balcer and Wojnarowska, 2016, p. 30). Therefore, the inclusion of IT resources in the teaching and learning processes became a necessity. Research conducted by Rybak (2011, p. 127) shows that according to some mathematics teachers, IT resources currently appeal the most to students. The same teachers considered the following as some of the teaching aids necessary for modern students: interactive whiteboards, computers, laptops, and computer software (with emphasis on a modern and attractive look).

It is therefore not surprising that IT resources are being used more often in mathematics education. Computer-based tasks also appear more frequently nowadays. Such tasks are very different in terms of content as well as the mathematical and IT skills necessary for solving them, the degree of interactivity, the availability of operations that can or must be performed, the management of information (its acquisition and processing), the location and method of providing answers, etc.

The research I conducted between 2015–2018 and now, shows that students function differently when solving pen-and-paper assignments compared to solving assignments in computer-based form. The students must perform different actions and organize their observational field differently. Research has also shown that various tasks in the computer-based version determine the behavior of students and imply their actions (Czajkowska, 2016a, 2016b). It is therefore important to distinguish several types of computer-based mathematics tasks and to develop a methodology of approaching them.

1. Categorization of computer-based mathematics tasks

I first attempted to characterize computer-based tasks in the years 2014–2016 (Czajkowska, 2016a, p. 103). However, over the course of further research, I had to make certain modifications to their characteristics. Before briefly describing the distinguished types of tasks, I will provide an explanation as to what I consider a mathematics task in computer-based form.

I define a mathematics task in computer-based form (digital task) as any mathematics task which was recorded digitally and is made available to the student by means of computer-based devices (e.g. computer, tablet, smartphone).

Every computer-based mathematics task is interactive, in a sense. By moving the mouse a certain way or clicking on the appropriate buttons, the image on the computer or smartphone screen can be e.g. moved, enlarged, or shrunk. However, such interactivity is too primitive to have any significant impact on the students' acquisition of the experience necessary to shape, develop, or improve their mathematics skills. What is important are tasks which stimulate the student to take action and establish a research attitude. Computer-based tasks also differ in terms of where the solution or result is supplied. Sometimes, the student can or must provide it digitally. However, this is sometimes not possible, and the solution must be provided on paper.

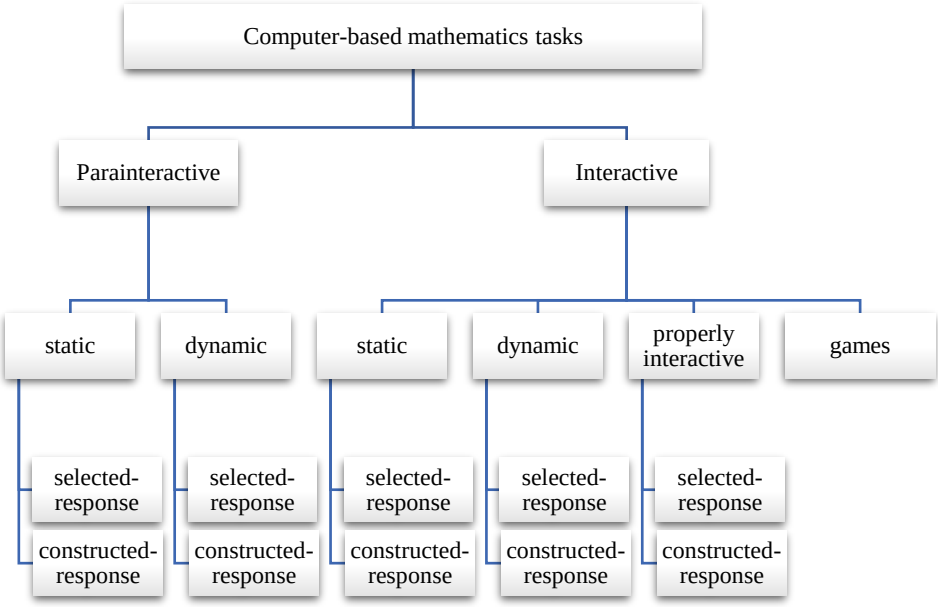

Chart 1
Categorization of computer-based mathematics tasks

Source: own work.

Therefore, my criteria for the categorization of computer-based mathematics tasks were: degree of interactivity, availability of operations that the student can perform, location of providing the answer, and whether the student is to come up with the answer on their own or to pick one from a set of readymade answers.

I define a *parainteractive task* to be an computer-based task with severely limited interactivity. The only available interactions include e.g. moving the text of the task on the screen, zooming in or out, taking a screenshot, or, sometimes, selecting fragments of the text or writing simple, short comments without any mathematical formulas. The student is unable to make any significant changes in the text or experiment on the computer or smartphone screen. They are also unable to provide the full solution or the result directly in the software - it must be done on paper. While the actions done by the student, such as enlarging the text, are intentional and conscious, they are so primitive and basic that they do not have any significant impact on solving the task.

I define an *interactive task* as an computer-based task which allows or sometimes even requires the student to carry out thoughtful, planned actions aimed at studying the presented situation and finding a way to solve the issue or to write down the answer, e.g. by experimenting, matching or selecting data, adding comments, entering or modifying data, moving, dragging, building, drawing and inputting the solution, or providing or selecting the result. Sometimes the student receives feedback on the actions taken after or during solving the task, including the correctness of the presented solution.

Parainteractive and interactive tasks can be static or dynamic. I consider a static task to be an computer-based task which is a direct copy of its paper form. The text is not provided traditionally (on paper), but on a screen. The person solving the task can print it out without issue to change the form of the task from computer-based to paper. In static parainteractive tasks (e.g. when the task is contained in a read-only PDF file or in the form of a JPG or PNG file) as well as some interactive tasks, the student is unable to modify the text, use different colors, or write long comments. In other static interactive tasks, this is allowed. The student is able to (e.g. if the task is contained in an ODT/DOC/DOCX/ XLS/XLSX file) select certain fragments of the text, add notes, create drawings, or write down parts of the solution.

A dynamic task is defined as a task that contains a dynamic drawing alongside the text. To solve it, the student either must carry out a focused observation of the drawing or make use of such an observation to help choose a strategy for solving the task. If a dynamic task is also parainteractive, the student is unable to modify the text of the task or its animation. Sometimes it is only possible to set the speed of the animation or to stop it and resume it from the beginning or from the same spot. The student is to present the solution to such a task on paper or in a separate file. In the case of a dynamic interactive task, the student is able to e.g. speed up, slow down, and stop the animation at will, as well as modify the dynamic drawing

by e.g. changing the parameters or the moving object, selecting fragments of the text, as well as writing comments or fragments of the solution.

I define a properly interactive task as a task which essentially forces the student to experiment by using the computer as well as to conduct focused observations of the effects of their actions and formulate hypotheses and verify them on the basis of pure mathematics. It is often impossible to solve a properly interactive task without using a computer. This happens e.g. when the task text lacks the necessary data. To obtain such data, the student must first plan, and then conduct appropriate experiments by using the computer. It is important for the student to not only perform the appropriate actions, but to also know what the purpose of performing subsequent actions is as well as to how to interpret the obtained results.

Among computer-based tasks I also distinguish constructed-response and selected-response tasks, making use of a slightly modified version of the task classifications described by Niemerko (1999, p. 104–111, 115–130) as well as Dolata and Sitek (2015, p. 49–50). The former do not suggest any answers and allow the student to come up with the answers on their own. In the latter, the student is to choose what they consider the best answer from a fixed, finite list of possible options. Among constructed-response tasks, I distinguish the following: *long answer constructed-response tasks* (which require a longer, logically constructed answer), *short answer constructed-response tasks* (which require a short, concise answer), and *gap tasks* (where a gap needs to be filled with a formula, term or phrase). I divide selected-response tasks into: *multiple-choice item* (tasks with one correct or best answer), *complex multiple-choice item* (tasks in which several answers are correct or none of the suggested answers are correct), *true-false item* (which require the assessment of a thesis, formula, etc.), *multiple true-false item*(which require the assessment of a set of thematically-related statements instead of a single statement), and matching tasks (which require the assembly of answers from the provided options, e.g. combining the drawings of geometric figures with their names).

In the case of a parainteractive task, regardless of whether it is constructed-response or selected-response, the student is required to present the solution either on paper or in a separate file, as it is impossible to do so in the document containing the task. In the case of an interactive task, the method of answering and presenting the solution depends on various other characteristics of the task. Usually, the student can provide an answer by e.g. clicking on the chosen answer (or in a specific location next to the answer), providing the answer as a comment, highlighting it in a color, or by making use of the drag & drop method (e.g. in a matching task).

I also consider mathematics games as interactive tasks. They are increasingly being used in education (Wawrzak-Chodaczek, 2012, p. 239–240, Polcyn, 2016, p. 123–125). In computer game tasks, the activities of the student are governed by the rules of the game. The student's opponent can be the computer or another

student. The game may also be based on the idea of getting the best possible result and beating one's own high scores. Some mathematics computer games are skill-based, used to practice certain skills. There are also many strategy or logic games which require the student to think ahead and to develop a winning strategy. Success and victory in the games are usually not dependent on chance (or do so slightly), but rather on the knowledge of the student as well as their ability to plan and predict the effects of their moves, the speed and flexibility of their thinking, and their proficiency in using the mouse and keyboard.

The typology of the computer-based mathematics tasks presented here is not a strict classification in the mathematics sense. The conditions for correct classification are not met, i.e. sharp separation of the classes of division and the exhaustion of the set by the sum of these classes. By assigning a task to a certain category, I intend to highlight some important feature of the task which may be important in the task-solving process and which could be used for a specific didactic purpose.

When choosing an computer-based task, the teacher should consider the extent to which the type of the task can influence its solution as well as which skills – not just concerning mathematics, but also IT – must be demonstrated by the student when solving the task, and how much impact can particular elements of the task have on the student's attitude towards the task and their motivation to solve it.

It is also worth noting that some computer-based tasks can be prepared by a teacher with average or even below average IT skills. However, properly interactive tasks, which are usually either web-based, desktop, or mobile apps, require programming skills which the teacher may not possess.

The definition of various types of computer-based tasks and the preliminary identification of strategies used by the students when solving interactive tasks (Czajkowska, 2016a, p. 106–108) led me to consider how often students are provided particular types of computer-based mathematics tasks, what the selection criteria are for in regard to the considered teaching goals, and what the method is for introducing the students to solving such tasks.

To clarify the indicated issues, I conducted basic research entitled Introducing students aged 12–17 to solving computer-based tasks, at the Maria Grzegorzewska University in Warsaw. This paper contains only an excerpt of the research and some of the obtained results.

2. Research aims and methods. Characteristics of respondents

The main aim of the research was to describe the attitudes of mathematics teachers towards the use of IT resources in mathematics lessons and to characterize the ways of introducing students to solving computer-based mathematics

tasks. As part of this aim, I distinguished i.a. the following research tasks: 1) learning the beliefs and opinions of teachers about the use of computers and mobile devices in mathematics lessons, 2) ascertaining the frequency of making use of various types of computer-based tasks during mathematics lessons, 3) determining the criteria for selecting computer-based tasks in regard to the set teaching goals, 4) determining the way the students are introduced to working with computer-based tasks.

The main research method I used was a survey conducted by way of an computer-based questionnaire. The survey was addressed to mathematics teachers and was anonymous. It contained questions about: 1) the purpose of using computers and mobile devices in mathematics lessons, 2) the frequency of using such resources, 3) methods of planning a mathematics lesson which includes the use of Internet resources, 4) knowledge of Internet websites containing computer-based tasks, 5) using Internet resources for working with students with special educational needs (either mathematically gifted or having difficulties learning mathematics), 6) the frequency of offering students computer-based tasks, 7) methods of introducing students to working with computer-based tasks. In the survey, some of the questions were open-ended, giving the respondents freedom of expression and presenting their own point of view. In closed-ended questions which intended to identify the frequency of occurrence of a given phenomenon, I usually used a four-level scale. When analyzing the teachers' responses, I assigned the choices of "very often", "often", "rarely", and "never or almost never", as well as "during every or almost every lesson", "often, during many lessons", "rarely, during some lessons", and "never or almost never", the following numbers: 1.5, 0.5, −0.5, −1.5, respectively. This allowed me to calculate averages and make certain comparisons. The second method used was in-depth interviewing. The questions contained in the interview outline concerned the same issues as the contents of the questionnaire. Twenty mathematics teachers took part in interviews. The only criterion for selecting teachers to take part in the interview was their consent to participate in the study. I discuss only some of the results of the survey in this article, however I also make use of information acquired during the interviews when interpreting the results.

I conducted the research between July and December 2018. It involved 155 mathematics teachers working in various types of schools. The study group included 133 women (86%) and 22 men (14%). The respondents came from multiple voivodships. Respondents working in rural schools comprised 15.5% of respondents, while 84.5% worked in schools located in cities. Certified teachers comprised 68% of respondents, 11% were nominated teachers, 15% were contract teachers, and 3% were interns. The remaining respondents did not have any professional advancement degrees.

3. Research results

First, the teachers were asked to define the term "computer-based mathematics task (digital tasks)". It was an open-ended question, giving the respondents freedom of expression. The aim was to learn what mathematics teachers consider to be the meaning of the term. For approx. ⅔ of respondents, an computer-based mathematics task meant one or more of the types of tasks described in this article. Most often, the teachers equated it either to a static, interactive, selected-response, multiple-choice task, where the students receive feedback regarding the correctness of their answer immediately, or an interactive mathematics game. However, for approx. 25% of teachers, an computer-based mathematics task is defined as a task that can be presented to the student in any form (orally, on paper, digitally) and for which computers can (but do not have to) be used to help facilitate the solution (e.g. by visualizing the described situation or performing tedious or troublesome calculations). Several teachers explained the term in a somewhat surprising way, writing e.g. "it is a task which summarizes messages when it is complete" or "it is a mathematics task with IT-related content, concerning bit conversion, drive capacity, etc." Approx. 5% of respondents skipped this question or stated that they do not know this term.

Almost 91% of respondents declared that they advise students to solve computer-based mathematics tasks, while approx. 67%of respondents make use of mathematics tasks available on the Internet at least often. When asked to provide the websites they make use of most frequently, the teachers indicated a total of 63 different sites, with 32 sites appearing only once. Websites of publishing houses (GWO, Nowa Era, WSiP) were the most frequently mentioned by the teachers, alongside https://www.matzoo.pl/ and https://learningapps.org/. Some indicated that they use several different websites, with others preferring one or two. Approx. 14.5% of respondents who declared that they make use of tasks sourced from the Internet often or very often were unable to provide any websites.

Fourteen teachers declared not seem to be making use of computer-based mathematics tasks. They argued that they do not do it because: 1) such tasks do not appear in external exams, and therefore would be a waste of time, 2) they must follow the curriculum, which also makes these tasks a waste of time, 3) they are unable to do so, 4) they are not sufficiently prepared to do so, 5) they do not know what computer-based tasks are and where they are located, 6) there are no sufficient repositories of such tasks, 7) they are not convinced as to the effectiveness of learning mathematics with the use of such tasks, 8) they believe that schools are not a place for experimenting and that traditional teaching methods should be used, as they are known to be proven and effective. The teachers usually mentioned several reasons.

When asked whether the teachers introduce their students to solving computer-based tasks, 83% answered yes. However, only some of them were able to

explain how they do it in a more or less detailed way. Approx. 30% of those who answered yes in the previous question either rescinded it in the question regarding the method used, noting that they do not do it as they either do not have the possibility or they lack conviction in the effectiveness of working with such tasks, or were unable to explain how they do it. This group also includes the teachers who had their own interpretations of the terms "solving" and "introducing". They did not consider the direct use computer-based tasks in a classroom environment. Some described searching the Internet during the lesson preparation phase for tasks to use when working with the students. Moreover, some of the respondents admitted to then printing such tasks and presenting them to students in paper form. Others stated that by learning how to solve tasks on paper, the students automatically learn how to solve computer-based tasks. One of the respondents wrote "It is not important whether the task is on paper or on the computer. When the students are solving tasks from a set, they are learning how to solve computer-based tasks as well". Approx. 20% of respondents stated that they familiarize their students with various computer programs, e.g. GeoGebra or Excel, which could help them perform troublesome calculations or figure out how to solve a task. Therefore, they did not distinguish between the aspect of IT resources facilitating the solution of a mathematics task (regardless of how it was presented to the student) and of a task being presented in computer-based form.

Typically, the teachers who used computer-based tasks provided several different ways of introducing the students to solving such tasks. The most frequently mentioned methods were: guiding students to websites containing such tasks (39 persons), using multimedia presentations or displaying tasks from online textbooks (24 persons), playing computer games and quizzes (20 persons), solving tasks on an interactive whiteboard (18 persons), solving tests on websites (e.g. https://gwo.pl/, https://www.matzoo.pl/) (16 persons). Nine teachers declared that they create interactive tasks for students themselves and publish them e.g. on the Moodle platform or their web pages.

Several teachers stated that their students are systematically introduced to solving computer-based tasks in various ways, as they use tablets during lessons. They noted that in such an approach to teaching, every student works at their own pace, approaches problems in their own way, independently searches for solutions, and finds and processes the necessary information. Additionally, the teacher can see what each of the students is doing; this lets the teacher know what difficulties particular students are facing and how they overcome them, as well as seeing when they make mistakes and of what kind. The teacher can also provide more support to students with learning difficulties in mathematics.

As many as 43% of respondents stated that they are unable to organize lessons in such a way as to at least sometimes allow the students to use computers, tablets, cellphones, iPads, smartphones, etc. for individual work. They noted the lack of necessary equipment and software, lack of access to computer rooms, and regu-

lations prohibiting the use of cellphones and tablets at school, sometimes even for didactic purposes. Primary school teachers also informed that they are unable to use the children's personal equipment. Some of them do not have smartphones or do not bring them to school, while others do not have Internet access on account of it being blocked by their parents. Another problem is that the children's phones are different models. They are personalized – the students only have access to applications and functions which their parents allow for or consider necessary for the children. Moreover, when children are using their own equipment, the teacher is unable to have full control over what the students are doing – whether they are following the teacher's orders, or browsing the Internet or checking their e-mail.

Many of the teachers declare that they recommend students to solve mathematics problems available online at home, on their own. However, they usually do not check whether the students have followed their instructions, although some of the respondents stated that they do sometimes discuss these tasks with the students. Only a few of the teachers declared that they regularly check whether, and how, the students solve the computer-based tasks they were told to solve at home.

The teachers were also asked to specify how often they make use of particular types of computer-based mathematics tasks after being briefed on the definitions of the tasks. The results are presented in Table 1.

Table 1
Distribution of answers to the question of the frequency of using various types of computer-based tasks in mathematics lessons

	very often	**often**	**rarely**	**never or almost never**	**average**
interactive selected-response task	18,7%	34,8%	27,1%	19,4%	0,03
static parainteractive task	15,5%	34,8%	33,5%	16,1%	0,00
dynamic parainteractive task	4,5%	25,2%	40,6%	29,7%	−0,45
interactive mathematics game	7,1%	20,0%	36,8%	36,1%	−0,52
properly interactive task	4,5%	19,4%	39,4%	36,8%	−0,58

Source: own research.

Relatively speaking, the teachers most often make use of selected-response interactive tasks. Such tasks often appear in online mathematics competitions as well as various websites containing tests for auditing or auditing of the student's knowledge and skills. They also make use of static parainteractive tasks relatively often. They are usually in the form of PDF files or are extracted from digital editions of school textbooks. The content of the task is displayed on a screen or interactive whiteboard, and the students solve the tasks individually in their note-

books. It is also common for one student to present the solution on a traditional or interactive whiteboard, and the others copy it.

The tasks used least often by the teachers are properly interactive tasks. This may be due to the fact that such tasks require that every student has access to a computer or tablet in order to be able to conduct experiments, formulate hypotheses and verify them. Moreover, the number of available tasks of this type is still relatively scarce.

The teachers also stated that the main and deciding criterion for the selection of computer-based tasks for the considered teaching goals is the compatibility of the subject matter of the task with the issue at hand. Sometimes they also take into consideration whether the task allows for auditing and self-auditing of the student's knowledge.

4. Discussion

The constant development as well as the intensity of the changes taking place in the modern world cause the school to be unable to provide the students with knowledge which could be useful long-term. Therefore, more emphasis should be placed on self-education and equipping students with learning skills (Morbitzer, 2011, p. 52). This could be facilitated by the use of IT resources in education. However, as noted by Kowalik-Conder (2017, p. 107–110), the opportunities of students in Polish schools to learn with the help of these means are very limited. This thesis is confirmed by my research.

Despite most of the surveyed teachers declaring that they make use of computer-based tasks as part of their mathematics teaching and learning process, their statements show that such tasks appear in mathematics lessons only occasionally. There are several reasons for this. I will list the reasons which manifested themselves most often in my research.

Some of the teachers are not convinced of the educational value of computer-based tasks. However, they feel significant pressure and feel that the head of the school as well as the education authorities and local government are expecting them to make use of IT resources and computer-based tasks as part of the mathematics teaching and learning process. They perceive these social expectations as an obligation. Therefore, they state that they make use of computer-based tasks, despite not actually doing so. The use of outdated teaching methods is also in favor of the system of external exams which include only paper-based tasks and where key competences of the lifelong learning process are not tested (*Zalecenia Rady...*, 2018). Some teachers explicitly stated that their goal is for the students to achieve good scores in the external exams or that their work is assessed by their students' performance in the external exams, which is why they teach in

accordance with the exam requirements. Since the exams lack computer-based tasks, they do not use such tasks in class.

Many teachers were not properly trained on how to work with students on computer-based tasks. They are unable to perform a didactic analysis of such tasks, they do not know how to pair them with considered teaching goals, how to introduce students to solving such tasks, how to organize working on such tasks in the classroom, or where to find such tasks or how to create them. Some think that if the students are able to solve tasks on paper, they will also be able to solve computer-based tasks. This is an educational trap, as it is known that some types of computer-based mathematics tasks, e.g. properly interactive tasks, are more difficult for students than those in paper form. This is caused by the difficulty of the mathematics task being compounded by the difficulty of using a computer (Czajkowska, 2016a, 2016b).

The teachers who stated that they advise students to solve computer-based tasks, do it somewhat blindly and impulsively. They are guided by intuition as well as their own observations and experiences. Many of them noted that the schools they work in are not sufficiently equipped with IT resources. They do not have free access to computer rooms, as mathematics and IT lessons take place at the same time. The teachers also noted poor Internet connectivity, causing them to not be able to make use of Internet resources when they wish to do so. Moreover, when planning a lesson involving the use of IT resources, they feel discomfort and fear regarding whether the equipment will be operational and the Internet connection sufficient. Many respondents stated that they only have access to an interactive whiteboard or one computer connected to a multimedia projector. It is worth noting that mathematics teachers have been emphasizing the lack of sufficient IT equipment in schools and classrooms for years (Rybak, 2011, p. 124–125; Czajkowska, Grochowalska and Orzechowska, 2015, p. 52–53, 71), and, unfortunately, little has changed. It is therefore not surprising that the teachers use static parainteractive tasks relatively often, with the students writing down the solutions to the tasks in their notebooks. However, this way of teaching, despite making use of IT resources and computer-based tasks, is still traditional, conservative teaching, where the student learns by being provided readymade content by the teacher.

Teachers rarely use the students' personal equipment or do not do it at all. Some because of the personalization of smartphones and the difficulties with controlling the work of the students, some due to the use of phones being prohibited in their schools, and some think that only equipment provided by the school should be used in class. A relatively common tactic used by the respondents is to advise the students to solve computer-based tasks at home, on their own. Sometimes the teachers guide the students to websites containing such tasks, and sometimes the students have to find them and solve them themselves. Therefore, the

students are not being prepared to solve computer-based tasks and have to work out the best ways of solving such tasks on their own.

Conclusion

Some interactive mathematics tasks, particularly properly interactive tasks, when properly selected and used, could bring forth a new quality of teaching mathematics. They allow for shaping several key competences simultaneously (*Zalecenia Rady*..., 2018) – most importantly in the scope of mathematics, IT, learning skills, understanding and producing information, as well as multilingualism and being resourceful.

However, students in Polish schools are rarely able, if ever, to solve such tasks. This is because learning mathematics with the use of interactive tasks requires a change in the teaching culture and a shift away from the provision and transmission methods which are still dominant in mathematics lessons. The mere use of computer-based mathematics tasks is by itself not an innovation, and will not prepare the students to face the challenges of the modern world. Many of the teachers who use parainteractive tasks or some of the types of interactive tasks in class are merely pretending to conduct modern teaching, when in fact they conduct conservative lessons dominated by frontal work and methods based on knowledge transfer.

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Nowoczesne nauczanie matematyki z użyciem zadań w wersji komputerowej – prawda czy mit?

Streszczenie

W artykule przedstawiam częściowe wyniki badań, prowadzonych w ramach projektu pt. Wdrażanie uczniów w wieku 12–17 lat do rozwiązywania zadań w wersji komputerowej. Badania pokazują, że zdecydowana większość nauczycieli, stosując na lekcjach matematyki zadania w wersji elektronicznej, tylko pozoruje nowoczesne nauczanie. W rzeczywistości prowadzą typowe, konserwatywne lekcje, na których dominuje praca frontalna i metody oparte na przekazie wiedzy. Relatywnie najczęściej na lekcjach pojawiają się zadania w formie zamkniętej, służące do kontroli wiedzy ucznia, sporadycznie zaś takie, które wymagają od ucznia eksperymentowania na ekranie komputera. Na taką sytuację wpływ ma wiele czynników, wśród których należy wymienić: poglądy nauczycieli na temat miejsca i roli środków IT w nauczaniu matematyki, niedostateczne wyposażenie szkół w komputery, tablety i smartfony, zbyt skromną ofertę zadań matematycznych w wersji eletronicznej, mających dużą wartość dydaktyczną, niewystarczające kompetencje nauczycieli, skostniały i przestarzały system egzaminów zewnętrznych, niewłaściwy system oceniania nauczycieli.

Słowa kluczowe: zadania matematyczne, nauczyciele matematyki, TI, nowoczesne nauczanie.