

**PIOTR REMŹA<sup>1</sup>**

## **Changing the Manner of Teaching Mathematics in the Pandemic Era as a Chance to Reduce School Failures**

### **ABSTRACT**

This text contributes to the debate on the change in the way of teaching mathematics as it responds to the shifts caused by the transition to distance learning during the pandemic. The author analyses the conclusions of contemporary publications and international research alongside teaching experiences related to various aspects of the functioning of mathematics teachers, the efficacy and quality of their work as well as the issue of their education and improvement. In the course of literature research, probing questions on the pandemic-era school failures occurring in mathematics have clearly highlighted inequalities in the education system. The author analyses the application of ICT in distance learning, which has significantly stimulated processes and phenomena linked to the functioning of an individual in schooling. The time of the pandemic has exposed the shortcomings of the Polish education system and necessitated reflection on the future of Polish schooling. When the magnitude of failures in mathematics does not decrease but remains constant, it is imperative that the reason why it is the leading subject of school failures is determined. Therefore, it is important to establish the new role of the mathematics teacher in the process of changes prompted by distance learning.

### **Keywords:**

education, mathematics, school failures, distance learning.

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1 Faculty of Education, University of Białystok, Poland.  
E-MAIL: p.remza@uwb.edu.pl ORCID: 0000-0002-2755-4121

*At school, it is not mathematics  
that should be modern but rather its teaching.*  
René Thom (1923–2002)

## INTRODUCTION

Since March 2020, when schools have been closed due to the pandemic, changes in teaching took place. We are no longer in an emergency situation, but in a long-lasting crisis that is more and more devastating – not only in terms of education, but also socially, economically, and mentally. Lost learning is no longer counted in days and weeks, but in months. The pandemic has deepened inequalities, exacerbating a pre-existing educational crisis. It also changed the way we think about future education (Holmes, 2020). Remote education, which was only an option just a year ago, that teachers could take advantage of in the scope of their choice, became a necessity and is now the only available method of conducting educational activities.

While in the course of classroom teaching taking advantage of modern technologies could only support the didactic process, it currently constitutes the basic element of mathematics education, regardless of the educational level. Regardless of the capabilities, competences, and willingness, such solutions must be used by everyone, not only those who want and can. It is important in the context that digital competences, so necessary when it comes to participating in distance learning, for teachers, parents, and students, are greatly varied. This is shown by both comparative international studies (Cortesi et al., 2020; Pyżalski, 2019; Smahel et al., 2020), as well as research conducted at a national level (Pyżalski et al., 2019).

The coronavirus has accelerated the long-announced digital revolution. Terms distant to most teachers: data cloud, virtual work environments, or distance learning platforms have suddenly become more realistic. It is no longer a distant future, but the present. A year of distance learning was enough for us to see in practice how much education relies on modern technologies. And the time of the pandemic has highlighted the need for a new profile of a teacher, one who knows how to work with technologies and at the same time understands the consequences of integrating with technology in terms of teaching. Digital technologies themselves are not a methodological revolution, but offer opportunities and potential that can contribute to new configurations and reconfiguration of teaching and learning processes (Schlemmer, 2013).

## **MATERIALS & METHODS**

In order to change the way mathematics is taught it is important to recognise the existing state of knowledge as well as identify the findings and failures noted in earlier research. New opportunities offered by ICT, easy access to scientific information in particular, have led to a rapid development of systematic methods for managing knowledge resources (Matera & Czapska, 2014). For this purpose, a review of the literature on school failures and education during the pandemic was conducted and on this basis a cognitive procedure was applied to establish the existing state of knowledge in the form of a customary (narrative) literature review for collecting and interpreting data (Booth, Sutton, & Papaioannou, 2012). The literature research carried out is meant to provide an overview of the state of researchers' inquiries regarding Polish and foreign practice as well as offer insight into innovation in the scope of teaching and learning mathematics alongside educating and training mathematics teachers, in particular in the context of the transition to distance learning.

The research goal of this paper is an attempt to synthetically indicate, approximate and describe research findings from selected literature as well as examples and experiences drawn from the mathematics teachers' education practice. Meanwhile, the research goal is to formulate a diagnosis and draw innovative conclusions for the Polish practice of functioning and improving the quality of work of mathematics teachers as well as their education and further training, starting with an analysis of the state of school failures occurring during the pandemic. These objectives are reached by establishing the reasons why mathematics is considered to be the cause of school failures and by defining the new role of the mathematics teacher in the process of changes triggered by distance learning. Also, better methods and forms of work are explored in order to allow optimal response to the diverse educational needs of pupils alongside probing unconventional ways of counteracting school failures in this subject. At present, the answers to such problems remain ambiguous in the light of the literature.

## **RESULTS: SCHOOL FAILURES IN MATHEMATICS DURING THE PANDEMIC**

Failures, which constitute a natural phenomenon accompanying every type of work, and in a sense are also a factor stimulating the development of an individual, also appear in the process of teaching mathematics. When the difficulties overwhelm an individual's abilities, they become a serious obstacle in the way of

acquiring mathematical knowledge. It is assumed that if these obstacles were not present, everyone would make satisfactory progress and there would be no grounds to determine any educational problems (Kupisiewicz, 2012). Their occurrence is, in a way, an inseparable part of school life, and the scale of the phenomenon is determined by many socio-economic, bio-psychological, or pedagogical factors (Karpińska, 2013).

However, currently in the times of the pandemic, our social life, including in the field of education, has been significantly disorganized and new educational problems emerged making it impossible to learn and teach effectively. Mediated contacts, which are the domain of modern youth, suddenly became obligatory for all teachers of various levels of education, regardless of age and level of digital competences, and the school, teachers, parents, and students themselves faced so far unknown difficulties marked by negative emotions exacerbating the already existing problems concerning mathematics (Barlińska, 2009). Contemporary students do not experience change, but live in change. This results in a necessity to adapt the teaching to changing conditions, and the lack of direct interaction often results in the fact that despite a great amount of work performed by teachers, students are not interested in acquiring knowledge, which is translated directly into problems with mathematics.

Current school failures are a natural consequence of a series of negative factors which the average teacher has no direct and immediate impact on. These include, for example, technical problems, the need to change teaching habits, or difficulties in handling complex interfaces necessary for using various methods and forms of organizing classes. Transferring students to the platform of online learning has clearly exposed inequalities in the education system, starting with children who, in this situation, have been left without a meal, without devices, and unlimited access to the Internet, ending with those whose equipment and competences in terms of using modern technologies significantly exceed the capabilities and skills of teachers. Inequalities in life opportunities resulted in educational inequalities, meaning that they contributed to the already difficult school situation related to mathematics and the unequal struggle for scarce resources, i.e., “high-quality education” (Mikiewicz, 2017, p. 13).

The sole manner in which young people experience this difficult situation as well as experience and dealing with school failures are also varied and depend on four basic determinants: (1) the social context, which includes: changing their everyday life; movement restrictions; information concerning the situation in the country and abroad; behaviours presented by peers; (2) the family context, which includes: the economic and demographic situation; quality of family relations; and

problems in the family; (3) the student's personality traits, e.g., age and maturity of defence mechanisms; sensitivity; temperament; (4) the functioning of the educational system – the organization of school and its involvement in implementing the educational process; its base and teaching resources; the involvement of teachers, educators, and school counsellors in the didactic and educational processes, as well as taking advantage of other activities supporting students (Poleszak & Pyżalski, 2020).

So far, we do not know how distance learning will affect further mathematical education and the number of school failures, and what makes some teachers effectively shape students' consciousness, cognitive, functional, and motivational structures which are rational from the point of view of their future needs, while other teachers do not achieve success during online education. Every child has great mathematical potential, but we must rethink how we currently teach mathematics and what consequences integration with technology will have in terms of the practice of teaching mathematics?

Apart from a book, distance learning constitutes the only technology that impacts the mind the most, and that is because it provides many sensory and cognitive stimuli: repetitive, intense, interactive, addictive, that result in changes of neural circuits and brain function. However, it should be emphasized that when teaching online, we work in an environment that works in favour of inaccurate reading, chaotic thinking, and limited learning. Thus, the difficulties in understanding content read online. It turns out that lasting focus, mental coordination, and making choices prevent the brain from performing the work required to interpret the content of information, which may increase school failures. This explains the result of an experiment that showed more limited neural activity in the brains of book readers than those of Internet users. Therefore, it has been determined that the Internet constitutes a source of greater mental stimulation than reading books, which stimulates the senses to a lesser degree (Johnson, 2006). Students simultaneously perform a lot of additional activities unrelated to the lesson, and the amount of information reaching their working memory constitutes a great cognitive load. After exceeding the mind's ability to store and process information, the received messages, both concerning mathematics and those flowing from other activities performed concurrently, are not retained in long-term memory. This lowers the ability to learn as understanding becomes superficial, resulting in school failures, which in turn may lead teachers to halt the changes concerning the way math is taught and limit the use of ICT (Information and Communication Technologies) during math lessons.

Distance learning has obvious benefits, facilitates quick access to educational materials by reducing the time needed to copy worksheets, distributing works and

collecting them, and a well-prepared task facilitates checking, and thus receiving feedback by students which makes further work easier. The pandemic has completely disrupted the course of education and the system focusing on traditional skills (Bowman et al., 2010). However, regardless of the various opinions concerning distance learning, it is obvious that applying ICT in education during the pandemic, necessary to move to online learning, has become a significant stimulator of processes and phenomena related to the functioning of an individual in the educational reality, which must be reflected in the teaching-learning process as well as educating conscious recipients and creative users of new technologies (Borawska-Kalbarczyk, 2021).

However, the number of failures in terms of mathematics does not decrease, and despite taking advantage of various didactic and compensatory activities as well as ICT during classes, it remains at a constant level with only the causes constantly changing (Czajkowska, Grochowalska, & Orzechowska, 2015). Therefore, there is a need for continuous monitoring of the quality of education, the activity of students and teachers in the didactic process, and thus a new look at the issue of school failures, especially those related to the “mother of all sciences”, because mathematics is one of the subjects whose teaching-learning efficiency is relatively low (see: Karpińska & Remża, 2019). Meanwhile, many initiatives aimed at increasing the quality of education and eliminating failures do not bring the expected results, and instead solidify the current state (Mazurkiewicz, 2012). Therefore, it is essential that we understand what lies at the root of failures concerning mathematics of students and teachers, and think about how to foster a passion for this subject in both. When looking for the reasons for failures in mathematics, one should not be limited only to analyzing what can be measured, but also take into consideration the components independent of the participants of the educational process as well as those that are not measurable, such as most personal feelings and educational experiences (Conner & Sliwka, 2014).

## **MATHEMATICS AS THE SUBJECT REASON FOR SCHOOL FAILURES**

Literature (Krutiecki, 1971; Wrona, 2004; Łubianka, 2007; Gruszczyk-Kolczyńska, 2019, 2021) indicates that all talents – including mathematical ones – are distributed according to the law of normal distribution. Therefore, average mathematical capabilities are possessed by 68.2% of the population – even if the range of this mediocrity would be regarded in a narrow way – we have the majority! Additionally, there are 13.6% of above-average gifted people and 2.1% of those who are

exceptionally gifted in mathematics. In total, we have 83.9% of people who should not have difficulties with mathematics! Note that almost 84% of the population can deal with common mathematical requirements. Only 13.6% will encounter special difficulties when learning mathematics and there are only 2.1% of students who are absolutely unable to learn (Tadeusiewicz, 2014).

Not everyone has a mathematical talent or special abilities in this field, but this does not constitute a reason preventing an average student from acquiring proper knowledge, even in the field of secondary school (Szwed, 2017). However, the popular opinion that our brains are fixed and we simply do not have a talent for math has a negative impact on education and many other events in our daily lives. It is easier to justify the mathematical failure of a student by referring to that person as having a “humanistic mind” than to verify and modernize the methods used in teaching mathematics. After all, students do not come to school with a natural aversion for performing calculations. They acquire it only during the classes (Gawrońska & Woźniak, 2014), unless they experience cognitive development disorders and related dysfunctions that become real obstructions for learning mathematics, such as: acalculia, calculasthenia, oligocalculia, paracalculia, or dyscalculia (Košč, 1982).

Research by Michael Merzenich (2013) showed that the adult brain physically changes under the impact of changes in the surrounding, which has been called the neuroplasticity of the brain, and each time we learn something we change and reorganize neural networks. Therefore, any average student, meaning a student who is able to learn to write and read and is sufficiently resistant to school stress, is able to learn math with pleasure and good results – provided that he or she is taught in the right way (Yeager & Walton, 2011; Goyer, Walton, & Yeager, 2021).

Meanwhile, school failures concerning this subject are appalling. Due to their scale, we can actually speak of a plague of mathematical illiteracy (Dąbrowski, 2008). It does not apply solely to primary education, because in 2019, 11% of all students participating in the matura exam failed (Smolik, 2019), and in the school year 2020 – 17% of all high school graduates were not able to handle tasks in the field of mathematics (Smolik, 2020, p. 3), which means that they’ve experienced an overt, evident, “relatively permanent school failure” concerning mathematics (Karpieńska, 2013, p. 95). And despite the fact that in the Podlaskie Voivodeship this result was slightly better – 86%, with an average positive result in mathematics at the level of 54% and a standard deviation of 24% of the obtained points, it is still the worst result in terms of passing the matura exam concerning all subjects in 2020. The situation is even worse when it comes to the results at the advanced level exam, here the average number of obtained points was 35% with a standard

deviation at 28%, meaning that most of the results belonged to the range between 7% and 63%. There were also papers with zero points – 1.8%, and there were only 0.05% of graduates with a score of 100% among all taking the exam at an advanced level (Fromelc-Chmielewska, 2020).

Mathematics is not an easy subject, both because of its language, concepts, and the manner in which they are implemented. It is a subject that requires synthesizing, analyzing, and abstracting not only from students, but also from – and maybe primarily – teachers who sometimes fail in terms of teaching by acting in a schematic manner, building distance, or even blocking students' creative thinking, without which understanding math is impossible. The consequence of such negative episodes consists in systematically suppressing the interests and capabilities as well as accumulating cognitive backlogs during the entire learning cycle, and the only question that may arise during such education is the question about “an effective message” as a synonym for good teaching. Teaching mathematics at school focuses too heavily on the old techniques of “transferring knowledge” treating the constructivist knowledge-building and self-learning processes in a marginal manner (Dryden & Vos, 2005).

Traditional approaches to teaching mathematics are not accepted by students. First of all, they are inconsistent with the identity of a child and a teenager, especially during adolescence. Young people want to have their own ideas, students want their way of thinking to be appreciated; they do not want to simply receive ready-made information that they duplicate – recreate. Expository methods, very often used by teachers during math lessons, make it seem as a subject area where they cannot express their ideas, and this is largely the reason why people do not like math. Because teachers impose the only correct way to solve a task, the one that complies with the key for scoring tasks during the final elementary school or matura exam.

Therefore, it is not surprising that in the public opinion, mathematics is perceived as the causative subject behind the failures of students and teachers, but also the failures of parents and educators – in short, everyone. Therefore, there must be certain causes of these “troubles” focusing on the common denominator of mathematics. It is a highly undesirable phenomenon, and at the same time one that occurs often in school reality, characterized by high social harmfulness, because it must be taken into consideration that the failures incurred during education largely affect the future fate of an individual. It is an issue rarely dictated by one specific condition. Usually, it constitutes an implication of many factors, the knowledge of which seems to be the key for designing activities minimizing learning difficulties and mitigating school failures (Karpińska, 2014).



## **A MATH TEACHER IN THE PROCESS OF CHANGES CAUSED BY DISTANCE LEARNING**

Transmission of knowledge is a theory that should not be implemented in modern school and distance learning, where information and (theoretical) knowledge are available “on demand”. Bad attitudes of teachers towards mathematics, consisting in over-simplifying as well as overcoming difficulties for the students and providing ready-made solutions, consolidate very quickly and have a negative impact on further education. Thus, a student has no chance of becoming a discoverer of a solution. He or she is merely an implementer of simple instructions. Everything that the teacher does in favour of the student or instead of the student deprives that person of the opportunity to do it independently, thus resulting in that the student ceases to present own ideas, waiting for instructions, which kill creativity (Robinson, 2006) and interest in mathematics (Łakwa, 2015). It destroys unconventionality, which allows changing the perspective and opens the mind to new ideas, and constitutes the essence of reasoning and argumentation – one of the general requirements for the matura exam in terms of mathematics – mastered only in 27% by the total number of participants in 2020 (Kozak, 2020). This proves that it is not developed enough during classes.

Therefore, a lesson in mathematics should not constitute the teacher’s performance in front of the class, but an activity of the students themselves under the guidance of the teacher, based on the principles of partnership and cooperation (Muszyński, 2011/2012). Placing the educator in the role of a lecturer of knowledge and the student in the role of a person being equipped with it, whose duty is to absorb the knowledge, builds the general principle of the authoritarian model of “teaching-learning”. Placing the teacher in a dominant position generates a specific type of communication (Teacher–Student) that has a great impact on learning. It is devastating that so many teachers and people in charge of the education system still take advantage of an approach to the student that was characteristic of many Polish schools before the Barnes era (Łukawski, 2018).

These endlessly invoked stereotypes begin to function as common-sense knowledge of teachers and students. They are also constantly worked on in subsequent empirical research. Thus, reducing mathematics to believing in the scheme and procedure (dogmatism) as well as obeying the teacher’s commands must end in failure – mass thoughtlessness and a lack of trust in one’s own reasoning (Klus-Stańska & Kalinowska, 2004; Klus-Stańska & Nowicka, 2005; Malenda, 2001). Currently, there is a need for teachers-facilitators who provide adequate methods of acquiring information, developing habits and skills in managing searches,

selecting and processing information, adapting ICT to teaching, and not teaching ICT (Espinoza-Freire, Tinoco-Izquierdo, & Sánchez-Barreto, 2017).

Prof. Robert Bjork from the University of California actually believes that a math teacher should constitute a stimulator of creative and not re-creative processes but also create situations for overcoming “desired difficulties” in a creative manner. Material which is difficult to learn requires from students a greater effort for getting deeper into the subject, which makes it remembered for longer. However, often instead of a method for overcoming failures it is possible to come across solutions consisting in eliminating difficulties, the disappearance of which does not improve the educational situation at all. This incorrect approach may seem especially attractive to teachers when lessons are conducted online. If a student handles a difficult situation, then that person discovers something about himself or herself and often strengthens the self-esteem, which results in more strength for further action. So let’s not be afraid of difficulties, because overcoming them brings many positive effects. For example, it shapes our personality. However, if the student does not possess previous knowledge or skills allowing to effectively deal with stress and tensions accompanying overcoming failures, then “desirable difficulties” become “undesirable difficulties” or even ones that are harmful for the process of mathematical education (Bjork & Bjork, 2011).

Whereas, by insisting on mathematics as a joyful, easy exploration, we harm children, and by reducing or eliminating the hardship of self-inquiry, we deprive students of mathematical fluency (Walenty, 2020). Regardless whether the teaching takes place online or in-house, it is more effective when it involves some effort. This builds our personality, but also has a positive effect on the work of the mind. If we learn with difficulty and at a slow pace, we get the impression that our efforts are not effective and we tend to choose strategies that seem more fruitful to us, unaware that their benefits are generally short-lived. On the other hand, many teachers believe that if, thanks to their effort, learning becomes easier for the students then it will be done faster and they are going to learn the material better. However, research suggests the opposite. The more difficult the learning is, the more solid is the knowledge and the longer it stays in the mind (Kozielska, 2015).

It is commonly known that teacher competences are important in the instruction and learning process, but it is still an open question as to what skills of a mathematics teacher have the greatest impact on instructional effectiveness. This is because there is no complete consensus among scientists on this issue (Czajkowska, 2013, p. 73). The findings to date indicate a strong correlation between the teacher’s mathematical and teaching competences (Krauss et al., 2008, pp. 722–723). However, as most researchers believe, it is a teacher’s knowledge on the

subject that is the foundation and a vital condition for effective teaching while its deficit may inhibit the development of their teaching skills (Baumert et al., 2010, p. 167).

These facts are confirmed, among others, by the results of an international assessment carried out among pupils and active teachers in grades 1–3, the Teacher Education and Development Study in Mathematics (TEDS-M, from 2008), which showed that countries where pupils achieve the best results are the ones where investment is made in a high-quality teacher education system and only high-performing pupils are admitted to pedagogical studies. Taiwan and Singapore may serve as an example. In these two countries a successfully passed state exam is a necessary condition for working at school (Sitek et al., 2010).

Meanwhile, in the reality of Polish schooling, the classic teaching method prevails. It is centred on the managerial role of the teacher and the logic of the external order of unified teaching content. It is characterised by an ostensible embellishing of old theories with trendy terminology, superficial borrowings as well as resorting to normativity and measurement instrumentalism subjugated to the expectations of the educational administration, which leads only to apparent rather than real changes. This entails an actual continuation of existing thinking patterns, also in terms of research and academic education, while introducing elements of “modernity” and “fashion” alongside new linguistic rites, which attests to an absolute failure of this process (Kwieciński, 1993).

There are differences in the quality of the way pupils are taught mathematics, the quality of the work of their mathematics teachers and diverse traditions and concepts in the pedagogical education of mathematics teachers in various countries (including regions of a given country). This is evidenced, among others, by the results of international research studies: PISA (Program for International Student Assessment), and TIMSS 2019 (Trends in International Mathematics and Science Study), the results of which are less than satisfactory. This is because the results in mathematics have dropped (from 535 to 520 points) compared to the previous TIMSS 2015 assessment. This means that out of 58 countries, Poland was 26th in mathematics, while in 2015 Poland obtained the 17th spot out of 49 countries (Sitek, 2020).

Of particular concern is the increase – compared to the previous assessment – in the number of pupils who are weakest in mathematics at the two lowest achievement thresholds. And it is already every fourth pupil pursuing education in Polish schools (while in 2015 – every fifth). Worse results are not even compensated by pupils’ satisfaction with being schooled as the survey part of the study shows that in terms of the sense of belonging to school, Poland is third from the bottom of

the ranking and pupils are reluctant to learn mathematics, which has not changed compared to the 2015 assessment (Sitek, 2020). Teacher job satisfaction does not help improve the opinion on Polish schools either, as out of 58 countries it is lower only in Japan. This means that neither pupils nor teachers like schools.

This information permeates further, frustrating not only domestic but also foreign educational circles, when it comes to their quality, effectiveness, and mathematical efficiency in teaching pupils and academic students. However, higher results among pupils in countries whose teachers declare more frequent application of certain methods in mathematics lessons do not necessarily indicate their higher didactic effectiveness – such a statement requires research with an experimental or longitudinal scheme and therefore solutions from other countries should not be indiscriminately implemented in mathematics education in Poland. TIMSS is a good tool for diagnosing differences between teaching styles in individual educational systems, yet it does not allow to draw any conclusions about their effectiveness.

## **CONCLUSIONS: PROMOTING HIGH-QUALITY EDUCATION OF MATHEMATICS**

Today's adolescents are no longer satisfied with the traditional methods of teaching mathematics and reducing school failures, including the classic triad of preventing educational failures (Kupisiewicz, 2012). They require something new, something that will arouse their curiosity and interest, something that is going to bring a breath of fresh air to their everyday school life and constitute a change in their teaching process. A year of distance learning has shown that it is possible to introduce highly effective teaching strategies without forgetting the learner's needs.

This concerns primarily creating a friendly learning environment in which students discover and appreciate the patterns of their talents that can become a guarantee of educational success in the field of mathematics. It is also a guarantee of a better memorization of the teaching material through the multiple coding of information in an analytical, creative, and practical way, which should be used to replace less effective but widely accepted practices rooted in the theory, tradition, and intuition of Polish teachers of mathematics (Sternberg, Jarvin, & Grigorenko, 2015). Therefore, the focus should be placed on the needs of a contemporary teenager, and not on the needs of a peer from several dozen years ago. The contemporary network generation is no longer satisfied with passive participation and listen-

ing to lectures given by the teacher. Young people surrounded by technology want to have a choice when it comes to their education, want to have an impact on what, when, and how they learn. They want the teaching to fit in with the real world, the one they live in. They expect changes in the manner of teaching mathematics. They want learning to be easy and interesting, and they actually demand support and inspiration from teachers. There is a need to undertake actions supporting teachers of mathematics at all levels of education, as well as to reward and take advantage of the potential of outstanding teachers who can account for very good teaching results (Makiewicz, 2018). Therefore, the system of educating future teachers at universities should be modified, so that effective teaching of mathematics can be carried out thanks to an effective teacher who knows the individual needs of students, adjusts teaching methods to them, and creates a learning environment that helps in achieving the intended goals of classes (Kubiczek, 2009).

There is no evidence confirming that new technologies are a particularly good starting point for a comprehensive reform of the system, but they speed it up incredibly if led by teaching methods as well as qualified and motivated teachers and students (Fullan, 2007). And it is no secret that there is a great gap between the possibilities offered by information and education technologies and the manners in which they are used. There are many programs that simply focus on turning pages, that is, fill the screen with text that contains information. The variety of content is vast, but a lot of material needs to be adjusted as many are poorly designed and this only solidifies existing problems concerning mathematics by performing the same tasks that were done before computers came along. The digital versions of these tasks do not take advantage of the possibilities offered by information and communication technology, and often their electronic version obscures the essence of the mathematical problem (Petty, 2016).

Technology undoubtedly constitutes an opportunity for education in a period of transformation, but nevertheless it carries the risk of “choking” on innovative technology, losing sight of the broadly understood quality of teaching. Changing the way of teaching mathematics through implementing modern technologies in education must be accompanied, primarily, by preparing methods of their use, stimulating the learning process. However, we know for sure that the development of children who will not have access to new media or their access to it will be limited, is going to result in permanent social disability (Tapscott, 2008). The return to classroom mathematics teaching should not stand for returning to pre-pandemic teaching, as distance learning has also revealed a number of shortcomings in the way teachers taught mathematics previously in schools. In order for digital technologies to become a permanent fixture in mathematics lessons, and not only a temporary fashion in

the processes of teaching and distance learning, a critical and reflective analysis of incorporating technology into pedagogical practice is necessary. It is important that the information technology effectively used in a classroom constitutes the means, used as a catalyst for mathematical operations, and not an end in itself (Boaler, 2016). It should be used with great caution when counteracting school failures in terms of mathematics and only where it actually increases the effectiveness of teaching, because the effects of its application are deeply disappointing and the voices of fascination are increasingly hampered by research indicating the ambiguous nature of the impact of virtual space on students (Spitzer, 2012). Only when designing online education is carried out from scratch and becomes a permanent complement to (and not a replacement for) classroom education can it contribute to increasing efficiency in mathematics teaching.

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