SZABOLCS RÁKOSI – TIBOR DŐRY

Present and future of primary level Science Education: the experiences of Mobilis Science Centre

Abstract

The breakthrough of science, technology and the growing importance of 21st century skills are radically transforming not only our work, but our daily lives as well. In the long term, STEM career orientation and, in a broader sense, the entire education system play a key role in the availability of well-qualified, motivated workforce. In this paper, results of scientific and technical career guidance in Europe and Hungary are presented, through the analysis of public databases. The study is based on the processing of domestic and international literature and public databases. After that, as a result of personal data collection of the authors, a promising practice is presented in detail, as well as the limitations of its transferability. The main goal of this paper is to present this bottom-up initiative that can be suitable for supplementing and supporting education of its area. The results indicate that science centres can provide exceptional support for public education and some of their activities may even represent the future of science education. This study contributes to the ongoing social discourse on the future of public education and career guidance through the examination of significant challenges of education and the detailed presentation of an initiative that can provide a solution to some of them.

Keywords: STEM, education, human resources, science centre

JEL codes: I20, I25, J24, O15

INTRODUCTION

The appreciation of STEM[1] fields is a process that has been going on for decades globally. It is a well-known fact among educators, managers, HR consultants, career guidance professionals and even among the general public that the accelerated development of STEM disciplines is radically transforming the world of professions, jobs, technology used in work, and even more broadly our everyday lives and all our activities (CEDEFOP, 2012; Csehné Papp, 2021; Klein et al., 2021). According to the classical approach, Physiology, Physics, Chemistry, Mathematics and Statistics, Computer Science, Engineering, and Manufacturing belong to STEM disciplines (Óbuda University, 2018). Recent approaches further broaden this, including Arts (STEAM) (Perignat–Katz-Buonincontro, 2019), the importance of environmental aspects (e-STEAM)

[1] STEM a nowadays widely used acronym derived from the terms Science, Technology, Engineering and Mathematics.

(Candan Helvaci–Helvaci, 2019), and the hot topic of robotics (STERM), which is radically transforming our everyday lives. Public education can play a key role in the development of knowledge-based economy and in the stimulation of innovation which affects not only the development of companies, but also indirectly the development and growth of cities, urban regions and national economies. (Rechnitzer–Smahó, 2012; Filep et al., 2013). The importance of STEM fields is clearly demonstrated by the fact that, according to a study examining the master's programmes of the world's most innovative universities, 64% of the master's programmes offered by 18 top universities worldwide in terms of employability contains STEM-only or interdisciplinary STEM-related courses (Feher et al., 2022). Examination of STEM career guidance activities and processes affecting public education, is an important task, as their effects are key to the development of a region.

Although career orientation with a lifelong approach is widely spread nowadays, its primary arena is still primary education and, to a lesser extent, secondary school (Borbély-Pecze, 2017; Borbély-Pecze et al., 2019). Successful STEM career guidance can hardly exist without effective, high-quality science education and "STEM educational reform has become a topic of discussion in political, economic, and educational circles around the world." (Julia–Antoli, 2019, 304) Therefore, the next part of the study focuses on the situation and current challenges of the education system. The subject of the analysis is primary education and, to a lesser extent, secondary education, so the findings related to teachers refer to educators working in these institutions.

After exploring the situation and significant challenges of public education, a local initiative is presented that can provide an effective answer to several problems. The promising practice presented in detail undoubtedly has its limitations, but if similar initiatives were integrated into a system and a network of such institutions were consciously built, it could provide valuable support for education. Strengthening the quality of science education could lead to the promotion of the STEM subjects, and thus STEM careers in the longer term, which is also a key issue for the national economy.

The study is based on international and domestic literature, as well as on the analysis of public databases. In the second part of the paper, innovative experiential pedagogy programmes are examined, through personal data collection of the authors.

The paper is structured as follows: in Section 1, results achieved so far in the field of STEM career guidance in Europe and Hungary are presented. Following this, the most significant global challenges of public education are examined. Finally, as a promising practice, the educational programmes of Mobilis Science Centre are presented and conclusions are drawn in the final section.

1. STEM CAREER GUIDANCE IN THE EU AND IN HUNGARY

In the field of career guidance, there are many promising practices across Europe today. Numerous actors are active in this field: (local) governments, universities, companies, authorities, chambers, science centres, NGOs, etc. In addition to the promotion of

STEM career paths and curriculum development initiatives, the (further) training and development of teachers is a priority (Caprile et al., 2015).

In many European countries, further training of teachers is provided by science centres, instead of traditional educational actors or authorities. Industrial partners and research institutes can also provide significant support for this activity. STELLA[2] (2009), which provides support to educational authorities, school maintainer organizations, school leaders and educators, and GRID[3], which offers more than 500 promising initiatives for teacher training, are widely known projects in this field. The DSE[4] project has created 27 new centres in Ireland, providing professional training for more than 4,000 teachers of about 3,000 schools. In a Danish project, more than 800 teachers could obtain STEM qualifications and 430 educators gained STEM career guidance counselling qualification. There are also many actors and initiatives in Hungary in the field of STEM career guidance. The use of novel, innovative tools and methods has resulted in a number of promising practices.

Despite great efforts, there has been no breakthrough in STEM career guidance in recent years. There is a general lack of interest in these fields (Julia–Antoli, 2019). The number of students in STEM fields in tertiary education has not increased significantly and women are still clearly under-represented on these courses, which is of serious concern (European Committee of the Regions, 2019). The increasing complexity of technology – instead of refuting stereotypes and dissolving resentments – is fuelling further doubts in society. We have failed to paint a picture for young people that would make engineering studies attractive. Critics of the curricula and methodology often say that engineering education lacks the transfer of management skills and does not prepare junior professionals for subsequent management positions. Talented youngsters are perfectly aware of this fact and they can judge what kind of studies are needed if they want to reach the top in the labour market. It is an unfortunate, but at the same time rational decision if young people refuse engineering education and prefer more profitable management or finance studies, or try to follow lawyers and fashion designers who are overrepresented in the media (Becker, 2010). In most countries, the partnership between public education and industry is still not a matter of course, and structural, cultural and motivational obstacles make the cooperation difficult (Joyce, 2014).

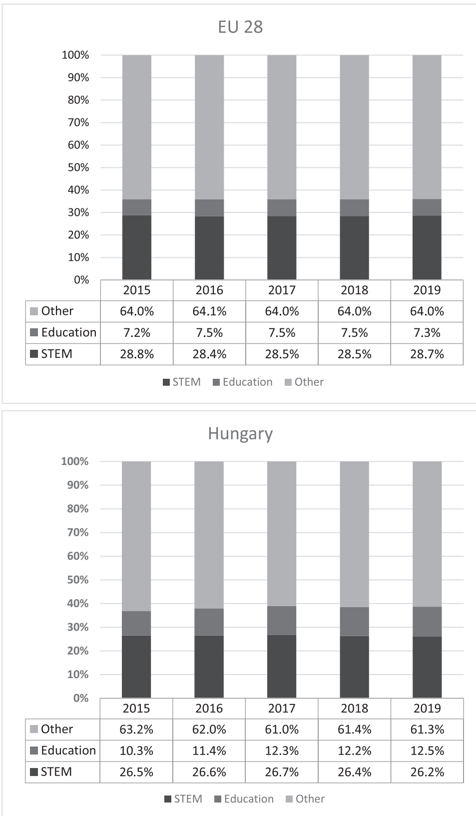
The moderate success of STEM career guidance is also affected by the fact that technical – especially engineering – training is still considered as a particularly difficult field, with traditionally high dropout rates, mainly due to the founding semesters, which are dominated by theoretical and abstract subjects. The even more active role of companies, expansion of dual engineering training and a more practical approach are essential conditions for the growth of demand for engineering courses.

[2] STELLA = Science Teaching in a Lifelong Learning Approach
[3] GRID = Growing Interest in the Development of Teaching Science
[4] DSE = Discover Science and Engineering

EUROSTAT data confirm the findings of the literature. Based on data between 2015 and 2019, the total number of students in higher education in the EU28 increased slightly until 2018 and then declined somewhat in the last year. The number of students enrolled in higher education was 19,369,417 in 2019, which is an increase of 7.4% compared to the base year.

Despite great efforts made over many years, the slight increase in the number of students in tertiary education was not accompanied by a boost of the areas examined in this paper. The proportion of students in STEM areas and in the education sector, which is also vital for our future, is stagnant. Data from Hungary do not give cause for optimism either. The ratio of STEM students has fallen slightly, from 26.5% to 26.2%, despite considerable efforts. At the same time, it is favourable that the education sector was able to grow by more than 2 percentage points, increasing the proportion of participants in teacher training to 12.5% (Figure 1).

Figure 1 Ratio of students enrolled in tertiary education by field of education in EU28 and in Hungary, 2015–2019



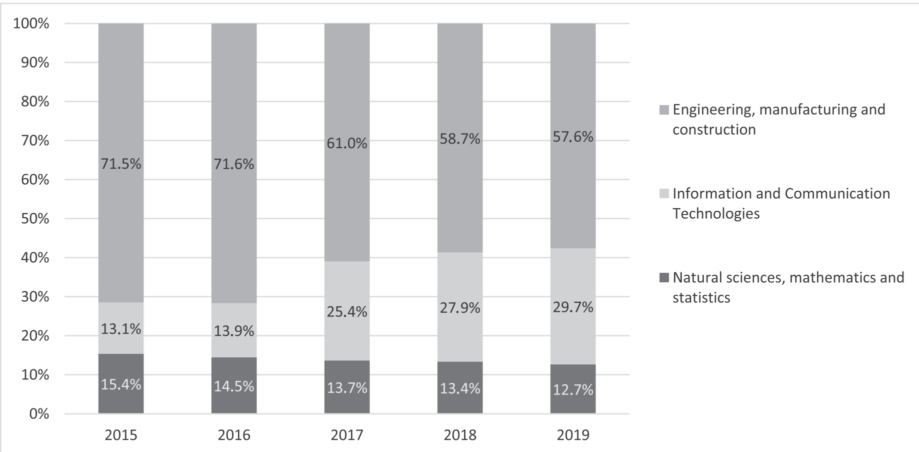
EU 28	2015	2016	2017	2018	2019
Other	64.0%	64.1%	64.0%	64.0%	64.0%
Education	7.2%	7.5%	7.5%	7.5%	7.3%
STEM	28.8%	28.4%	28.5%	28.5%	28.7%

Hungary	2015	2016	2017	2018	2019
Other	63.2%	62.0%	61.0%	61.4%	61.3%
Education	10.3%	11.4%	12.3%	12.2%	12.5%
STEM	26.5%	26.6%	26.7%	26.4%	26.2%

Source: own figure based on EUROSTAT data
https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=educ_uoe_enrt03&lang=en

Furthermore, an interesting phenomenon can be observed in Hungary: a kind of rearrangement has taken place within STEM areas. On the one hand, the proportion of students in Engineering, manufacturing and construction within STEM fields dropped significantly from 71.5% to 57.6%, but the scale of students in Natural sciences, mathematics and statistics is even more worrying. Starting from the already very low base (4.1% within all students, 15.4% within students of STEM fields), the popularity of this area has decreased significantly (to 3.3% within all students and 12.7% within students of STEM fields), which projects serious problems in this field in the long run. On the other hand, the growing popularity of Information and Communication Technologies has somewhat offset the decline of other STEM areas. The ratio of students enrolled in the ICT has increased significantly within STEM areas, from 13.1% to 29.7%, so more than twice as many undergraduates studied in this field in 2019 as four years earlier (Figure 2).

Figure 2 Ratio of students enrolled in different fields of study within STEM areas in Hungary, 2015–2019



Source: own figure based on EUROSTAT data https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=educ_uoe_enrt03&lang=en

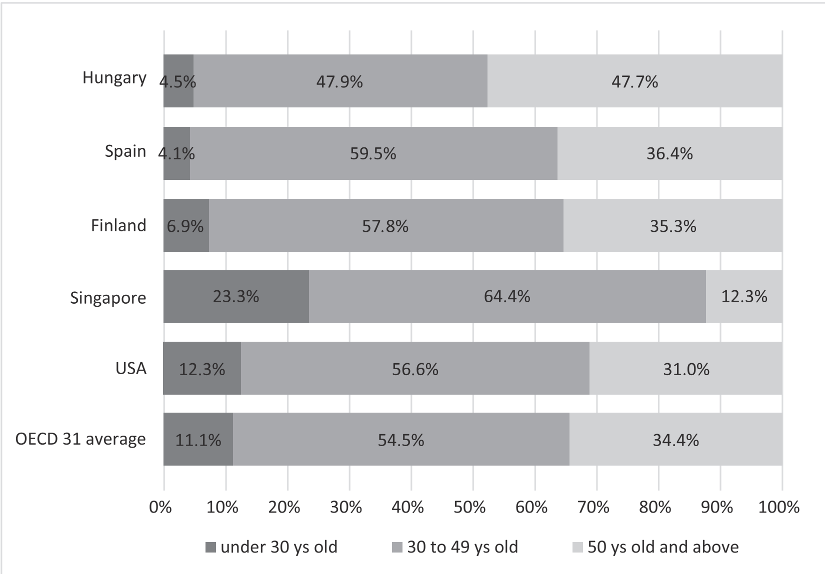
It can be highlighted that the main strength of the STEM career orientation is that education and economy treat the topic as a priority issue worldwide. Many actors (companies, chambers, NGOs) are active in this field; this is a serious opportunity for the further development of activities. As a weakness, we must point out the lack of coordination of initiatives running in parallel. The most serious threat to successful STEM career orientation is that its primary arena, education, is forced to focus primarily on other problems affecting the entire system, which in many cases even threaten its effective operation.

2. TRENDS IN THE PUBLIC EDUCATION

In the next part of this study, two of the most significant challenges of education are analyzed. First, we examine the ageing of teachers, and then we focus on the educational methodology often used by them.

The average age of teachers is a further cause for concern worldwide. In OECD countries, the proportion of teachers over the age of 50 is more than three times (34.4%) that of professionals under the age of 30 (11.1%). The situation is particularly worrying in Hungary, where the ratio of teachers under the age of 30 is only 4.5%, while those over the age of 50 make up almost half (47.7%) of the total (Figure 3).

Figure 3 Age of teachers in some OECD countries, 2018



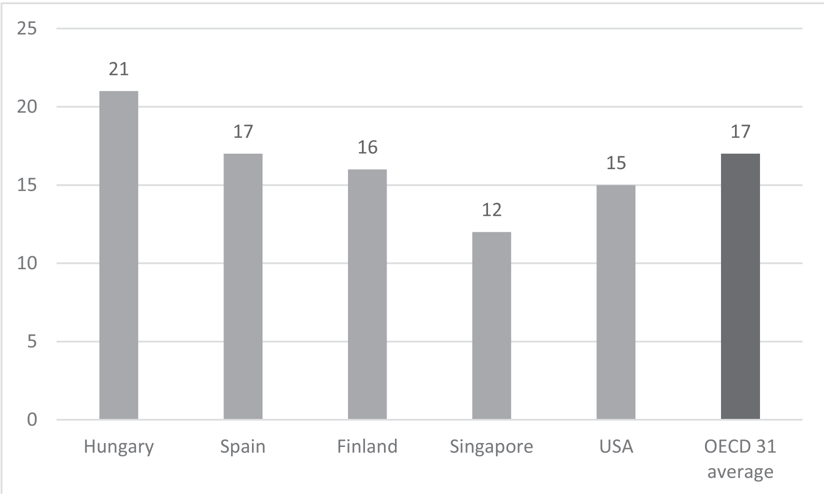
Source: own figure based on TALIS (OECD Teaching and Learning International Survey) 2018 Results Teachers and School Leaders as Lifelong Learners https://read.oecd-ilibrary.org/education/talis-2018-results-volume-i_1d0bc92a-en#page1

Given the high average age of teachers, it is not surprising that they typically have been working in this profession for a long time (on average 17 years), while Hungarian teachers have even more significantly, 21 years of teaching experience (Figure 4). It is worth noting, that in Singapore, which is traditionally very successful in the major international education surveys, the rate of teachers under the age of 30 (23.3%) is more than twice the OECD average (11.1%) and more than five times higher than in Hungary (4.5%).

Although the number of participants in teacher training has slightly increased in recent years, the lack of STEM teachers is a serious challenge for Hungarian public education. For many years, only a few dozen teacher candidates have been enrolled for physics and chemistry, which, together with the average age of educators, is causing a dangerous decline in the number of STEM teachers. Due to the lack of qualified educators, it is typical in some rural areas that Physics and Chemistry teachers cover an entire district, commuting between 3–5 villages and schools. Obviously, this working method can only be a temporary emergency solution. The efficiency of the work of a commuting Physics teacher appearing once a week in a school is presumably far behind that of colleagues in contact with students on a daily basis.

The experience of teachers working in public education for decades is a rare treasure. At the same time, it may be questionable how teachers approaching retirement use the achievements of state-of-the-art teaching methods in their everyday activities and the extent to which they take into account expectations of the labour market.

Figure 4 Teaching experience of educators (years) in some OECD countries, 2018

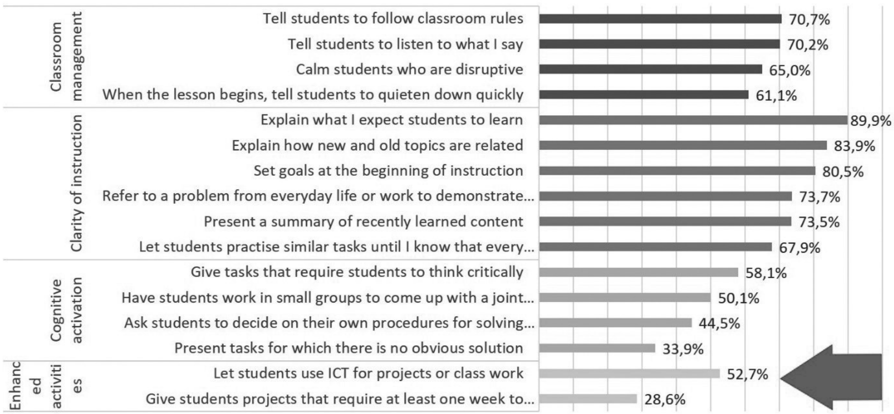


Source: own figure based on TALIS (OECD Teaching and Learning International Survey) 2018 Results Teachers and School Leaders as Lifelong Learners https://read.oecd-ilibrary.org/education/talis-2018-results-volume-i_1d0bc92a-en#page1

Figure 5 paints an instructive picture of teaching practices that educators "frequently" or "always" use in their classroom, according to their own assessment. Not surprisingly, the vast majority regularly explain what is expected to be learnt and how old and new topics are related. At the same time, just over half of the educators let students use ICT for project or class work, only one-third present tasks for which there is no obvious solution, and barely a quarter of teachers work together with their students on projects that require at least one week to complete. These data also confirm that there is a huge gap between the methods often used by public education and the needs of employers. It is also crucial to examine the methods of education because, according to the students' assessment, pedagogical virtues of a "good teacher" are the most important, far exceeding the importance of factors such as knowledge, personality or humour (Füzi–Suplicz, 2016). Several research papers (Julia–Antoli, 2019; Kennedy–Odell, 2014) have confirmed that students are motivated and engaged in their learning when they can actively participate in tasks that could be linked to real-life objects and problems. Science education initiatives using these methods can be particularly effective.

Based on the ageing of the teaching community and the analysis of frequently used methods, it can be stated that these two significant challenges of education threaten the expected effectiveness of STEM career orientation. In this situation, any initiative that supports the work of educational actors in these matters is particularly important, so in the next chapter a promising practise will be presented that can provide a solution to these challenges.

Figure 5 Teaching practices of educators in OECD countries, 2018



Source: TALIS (OECD Teaching and Learning International Survey) 2018 Results Teachers and School Leaders as Lifelong Learners https://read.oecd-ilibrary.org/education/talis-2018-results-volume-i_1d0bc92a-en#page58

Note: Percentage of lower secondary teachers who "frequently" or "always" use the following practices in their class (OECD average-31).

3. A PROMISING INSTITUTIONAL MODEL: SCIENCE CENTRE

After processing the international and domestic literature of STEM education and career guidance and the secondary analysis of results of public databases, the study continues with the presentation of results and opportunities of a new type of institution, namely science centres, which can provide support for education facing significant challenges. This part of the paper is based on international literature, which is supplemented by the experience gained through the authors' decades of work experience in this sector and the database of Mobilis Science Centre.

Integration of a new institutional model into the operation of public education can be an effective solution for the deficiencies of application innovative teaching methods and the lack of STEM teachers. Science centres, as "new knowledge centres" of the 21st century, can play a key role in building a knowledge-based society. Representatives of this unique kind of institution previously focused on exhibition, care, and research of collections presenting science, and later begun to function as a modern museum of science and industry. One of the main functions of today's science centres is to support public education (Friedman, 2010). The unique exhibition tools and interactive playground of modern science centres provide an excellent opportunity for "teaching" its visitors in a playful and experimential way, steering the upcoming generation towards STEM careers. However, perhaps even more important is that science centres have all the required competences and experiences to support public education through the implementation of unique, innovative experiential pedagogy programmes.

Although the science centre is a relatively new type of institution, the impact assessment of its operation in Western Europe and North America dates back several decades. Most scientific results proved personal impacts of science centres, mainly by summarizing the effects on visitors' knowledge level and attitudes towards science and openness to STEM careers. In their extensive study, Falk et al. (2014; 2016) measured the impact of 17 science centres in 13 countries, involving more than 6,000 young and adult visitors. Visits to science centres were found to be positively correlated with levels of knowledge, understanding of science and technology, positive identification with science, and openness to related leisure activities. Bamberger and Tal (2008) measured the effects of using three interactive exhibits of the Israel Institute of Technology over two different time periods: one day after the visit and 16 months later. The authors proved that science centre visits have long-term benefits: one-third of test subjects were able to connect their experiences to their studies months after the visit, and memories caused by science centre exhibits did not fade even after 16 months. The presentation by Persson (2015) at the ECSITE 2015 Annual Conference can be considered as a summary of previous research. He summarized previous findings proving that science centres had a positive impact on the level of knowledge, attitudes, academic interest, school performance, and openness to STEM career of their visitors both in the short and long term. Based on the above research, we can state that science centres may become key players in STEM education worldwide in the near future, due to the applied innovative teaching methods and the challenges facing by public education.

3.1. MOBILIS SCIENCE CENTRE

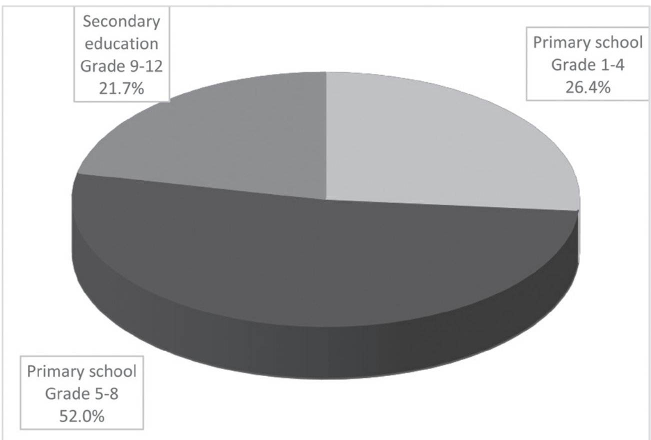
The Mobilis Science Centre, operating on the campus of Széchenyi István University (Győr, Hungary) since 2012, is a special economic development tool of its region. Its main goal is to form the technical and scientific attitude of schoolchildren living in the area of Győr. It regularly carries out career orientation programmes among primary and secondary school students, presents STEM professions and university trainings in a playful way, and disseminates scientific and innovation results of the university and the companies of the Győr Automotive Zone. The centre realized two major developments by the autumn of 2018: MobilITy-Győr Digital Experience Centre and Mobilis Student Lab. The main goal of these projects was to support the teaching methodologies of STEM subjects in public education, and to complete the pedagogical programmes of partner schools with experiential elements.

3.2. MOBILITY-GYŐR DIGITAL EXPERIENCE CENTRE

MobilITy-Győr Digital Experience Centre presents our entire digital world to its visitors. Mobilis considers it important that members of the upgrowing generation should not only routinely use certain features of their smart devices, but they should be able to handle technology by possessing diversified background knowledge. This is the purpose of MobilITy, which visitors can discover and try out the latest infocommunication and digital tools, build and programme robots, learn about the operation mode of smart homes, Virtual and Augmented Reality. The aim of MobilITy is to provide playful coding and programming sessions for its visitors. They can solve real-life problems by embedding them in a frame story, for which MobilITy intensively uses the method of storytelling. The pedagogical programme of study circles and summer camps is based on the same methodology.

Visitors of MobilITy are mainly school classes that take part in a 90-minute session. Students regularly attend study circles in the afternoon hours (e.g. LEGO robot programming, Arduino, Microbit, 3D design and printing, etc.) and families can try out the attractions of the centre on Saturdays. The popularity of MobilITy is well illustrated by the fact that it carried out 265 school group sessions in the first school year of its operation, with a total of 6,538 participants. The largest proportion of participants of school group sessions were upper primary school students, Grade 5–8. (Figure 6).

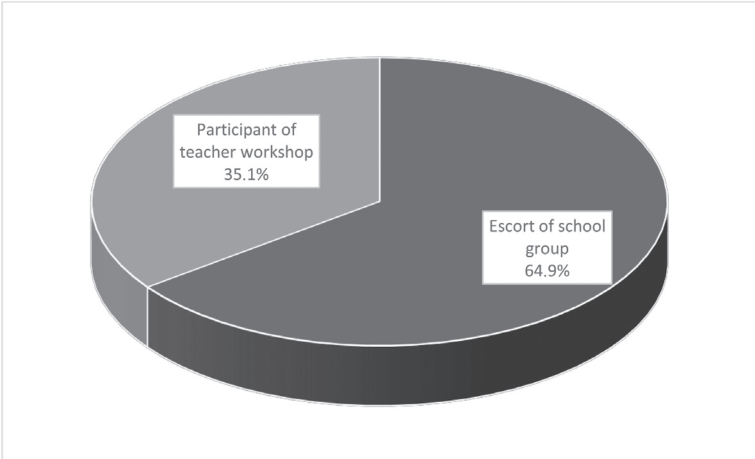
Figure 6 Ratio of school groups visiting MobilITy in the first school year, by age group, 2019



Source: Own figure based on data of Mobilis

MobilITy is particularly effective in reaching out to educators, with 743 teachers participating in its programmes in the first year of operation (Figure 7). Educators can learn about the attractions of the centre not only as escorts of school groups, but they can also regularly participate in unique professional programmes.

Figure 7 Educators visiting MobilITy in the first school year, 2019



Source: Own, based on data of Mobilis

Professional workshops for teachers aim to promote the regular use of ICT tools in class room activities. During these programmes, topics are provided that can be used in the everyday practice of educators, such as mobile applications in education or internet security.

3.3. MOBILIS STUDENT LAB

Mobilis Student Lab has also been operating since the autumn of 2018. Its aim is to raise the standard of STEM education, to develop and disseminate innovative, experiment-based teaching methods that promote experiential learning, and to improve the methodological skills of educators.

The establishment of the Student Lab was a major infrastructural development in Mobilis, with a new auditorium for 120 people, evoking the atmosphere of university lecture halls. In addition to that, Lab workstations with special equipment were established, where up to 3 groups of a total 90 students can carry out scientific experiments at the same time. Even more important was the methodological and curriculum development that was implemented together with 22 partner schools involved in the project. As a result of an ongoing consultation lasting for almost a year, a concept was developed, fully adjusted to the curricula and individual needs of partner schools. The pedagogical programme of the Mobilis Student Lab is based on the results of major international educational surveys (TIMSS[5], PISA[6]) and the recommendations of the literature. It focuses on the method of teacher and student experimentation, the use of ICT tools and development of innovative multimedia contents. Mobilis provides an opportunity for educators to participate not only in the planning of the programme, but also in the implementation of the sessions.

Figure 8 Summary of Mobilis Student Lab sessions, September 2018–February 2022

Source: Own, based on data of Mobilis

The volume of Student Lab sessions is well illustrated by the large number of participants (Figure 8). From 2018 Septermber until February 2022 9, 305 individual students have made a total of 98,919 visits to the Lab, so each of them attended more than 10 sessions on average. Student Lab sessions, taking place since the autumn of 2018, have totally transformed the operating model of the hosting science centre. On an average day, 5–7 school groups visit the Student Lab, then in the afternoon hours smaller groups of students take part in regular study circles, which focus on talent management or prevention of dropout.

Thematic Day is an outstanding programme type of Student Lab for several reasons. The uniqueness of science education in Grade 2–6 of primary school and its pedagogical significance are also exceptional; furthermore, most students participate in this type of session. This is an age-specific series of programmes consisting of three occasions in

[5] TIMSS (Trends in International Mathematics and Science Study) is a major international assessment that monitor trends in student achievement in mathematics, science, and reading.
[6] PISA (Programme for International Student Assessment) is a worldwide study by OECD to evaluate educational systems by measuring 15-year-old school pupils' scholastic performance on mathematics, science, and reading.

every semester. These 3-hours sessions always begin with a spectacular frontal science show, aimed at entertainment and having fun. After that, the sessions continue with independent student experimentation and measurements. The focus of student experimentation is on self-experience, design and performing own experiments and measurements, assisted by the demonstrators of Mobilis. The main goal of these sessions is to shape students' science perspective (e.g. by developing a particle approach) in order to be more effective in learning STEM subjects later on. This activity takes place in the special Lab workstations equipped not only with classical tools of scientific experiments, but also with simple, inexpensive objects, proving that scientific experimentation can truly be made a part of everyday life.

The topics of Thematic Days cover the full spectrum of phenomena recommended by TIMSS to learn until the end of Grade 4. Students joining as members of Grade 2–4 classes can learn about all the necessary phenomena in 1–3 years by the implementation of various pedagogical programmes. In Grade 5–6 the main goal of the Thematic Day is to prepare for the requirements of the STEM subjects (Physics, Chemistry) appearing later in Grade 7, and the project method is also used in this age group. The thoroughness and uniqueness of the Student Lab programme is demonstrated by the fact that Mobilis developed 37 different programmes only for this one type of session, in order to meet the needs of Grade 2–6 classes, joining at different stages to the project.

As the indicators of the above detailed projects show, services of Mobilis reached a significant circle of participants. The methodological skills of hundreds of teachers participated in the projects increased, which will hopefully be of excellent use in everyday school work as well. Furthermore, more than ten thousand students participated in experiential pedagogic programmes, which, in addition to increasing their knowledge level, could also raise their openness to STEM fields. In this way, initiatives of Mobilis greatly contribute to the development of STEM education in the Győr urban area, which will probably spread within a few years and result in an increase in the efficiency of STEM career guidance.

Educational partners also confirm the usefulness of the projects. According to the questionnaires evaluating the operation of Mobilis Student Lab, teachers stated that the Student Lab sessions fully correspond to the age characteristics of the students and the content can be well utilized during classroom work. "The high-quality sessions provide experiential learning for our students. The initiative perfectly supports efforts of our school in the field of developing scientific and digital competences" – reported the director of a partner school about experiences of her institution in a publication of Mobilis.

4. CONCLUSIONS

One of the main aims of this paper was to review the results achieved so far in the field of STEM career guidance. The analysis of public databases shows that, despite significant efforts, no breakthrough has been achieved in either Europe or Hungary. Numerous examples prove that public education, meanwhile, faces unprecedented challenges, so new solutions are needed to achieve our goals. A new type of institution, the science centre, can provide an effective solution for STEM education.

Activities of Mobilis prove that science centres could provide exceptional opportunities for public education. Thanks to the professional work of the Mobilis staff, the centre has become a nationally recognized methodological centre, a key partner of public education. MobilITy, applying innovative pedagogical methods and exclusive, high-prestige ICT-tools and devices, as well as the Student Lab with more than 5,000 state-of-the-art experiment-based sessions, integrated into the curriculum of partner schools, are a guarantee of high-quality STEM programmes.

The positive feedback of educators, school leaders and institution maintainers testifies that initiatives of Mobilis represent a special value to public education. Mobilis intends to continue its activities complementary to public education in the long run by utilizing experiences gained during the implementation of experiential education programmes. Special school sessions that meet the latest international standards can help not only the work of schools with various laboratory background and institutions struggling with STEM teacher shortages; Mobilis wants to be a reliable partner of the entire primary and secondary public education in the long run.

Bottom-up initiatives like Mobilis are extremely promising, but their limitations are also clearly visible. One of them is the number and geographical location of institutions capable of implementing similar projects. Due to the repetitive nature of the sessions, schools can only undertake regular participation if it requires a journey of no more than half an hour. This means that a network of at least several dozen institutions should be created and operated at the national level in order to make them available for a significant proportion of students. Another important issue is funding. MobilITy and Student Lab are developments financed by European Union projects, and the operation of them is guaranteed for a limited time. It is questionable which actor of the ecosystem is able and willing to bear the operating costs in the future. All in all, such actions can be really effective only if they meet top-down projects, covering the full spectrum of public education. Instead of isolated actions and individual initiatives, a more complex approach, an extensive system of long-term, consciously structured activities are required.

The establishment of similar institutions, long-term provision of their operating framework and integration of their activities into the public education system would be particularly useful, as based on the results of the initiatives presented here, they could be the answer to several challenges of education and increase the efficiency of STEM career orientation. If this were to be realized, the experiential education programmes of Mobilis and further science centres could also ensure the future of STEM education in Hungary.

NOTE

The basic idea of this paper is based on a previous study that was presented in the 5th RAED 2019 Conference and its proceedings: Rákosi, Sz.–Dőry, T. (2021) Present and future of STEM Education: The experiences of Mobilis Science Centre. In: *III Encuentro*

Científico Científico RAED Plataforma De Interculturalidad: Interacción Del Conocimiento Científico Multidisciplinario. Barcelona, Reial Acadèmia Europea de Doctors. pp. 251–266.

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