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STUDENT RESEARCH SOCIETIES: THE WIDEST FORM OF TALENT DEVELOPMENT

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ABSTRACT

The form of talent development in higher education has existed for over seven decades and has consistently adapted to educational changes and met challenges. The Student Research Societies (SRS) were initiated by talented students who, with the help of their mentors, want to achieve more than what regular education could offer. The inception was followed by dynamic horizontal and vertical expansion. Nowadays, more than 10,000 students participate in the scientific student society movement in Hungary. A legally codified structure deeply embedded in higher education has emerged.

Students prepare scientific papers on topics of their choice with scholarly ambition, engage in research group activities, and present their findings at institutional SRS events. Based on recommendations from a professional jury, authors of worthy papers can participate in the biennial national conference. The National Conference of Student Research Societies (NCSRS) hosts competitions in 16 thematic sections accompanied by numerous community programs. Since 2023, the SRS has become an international event within the framework of the European Engineering Learning Innovation and Science Alliance program.

The SRS is a HIP that significantly enhances both students' learning experiences and outcomes, enriching many with the joy of research and scientific collaboration.

This paper examines the last decade of the Technological Sciences Section, analyzing the satisfaction surveys of the 2019, 2021, and 2023 NCSRS events. We compare the measurement results of the online event held during the pandemic in 2021 with those before and after COVID-19, examining how the pandemic has impacted scientific student association activities.

1 INTRODUCTION

Talent development in higher education can manifest in various forms. Specialized colleges within the public education system can be viewed as counterparts to those special collegiate groups whose material surpasses that of regular courses, deepening and broadening them. However, there are forms unique to higher education, such as specialized collegiate groups. Within these self-organized societies, students can delve into specific fields of study and, functioning as a professional community, engage with issues that interest them. In addition to contributing to the unfolding of talented students and facilitating their acquisition of valuable experiences beyond the compulsory curriculum, members of these specialized collegiate groups also engage in supportive activities. They organize consultations for their peers, participate in university programs promoting disciplines, and visit high schools for career orientation purposes, among other activities. Thus, they offer not only academic but also personal and professional development opportunities for students.

Another important pillar of university talent development is scientific student society activities. The Student Research Societies (SRS in Hungarian TDK) built upon university self-educational societies, have a history spanning more than seven decades. This activity, often referred to as a proper introduction to scientific research, is characterized by the relationship between the student and their mentor.

1.1 Brief history of the SRS movement

The Student Society movement in Hungary emerged in the early 1950s, spurred by teachers and students seeking greater academic freedom. Initially led by Natural and Technological Science Societies, it soon expanded to other fields, fostering research and creative endeavors despite bureaucratic constraints.

The movement gained momentum with the first National Conference of Student Research Societies (NCSRS) in 1955, bolstering student engagement in scientific research. Despite political pressures, it maintained its domestic character, contributing to the elevation of academic standards.

By the 1970s, the movement saw rapid growth, necessitating operational regulations and standardized rewards. The establishment of the National Conference of Student Research Societies (NCSRS) in 1973 further structured the movement's activities.

In subsequent decades, universities actively supported student scholarly pursuits, reflected in the expanding NCSRS (National Conference of Student Research Societies) participation. László Leindler's insights underscored the transformative journey of students towards becoming researchers, emphasizing the role of mentorship and language proficiency.

Structural changes in the 1980s, including the reorganization of NCSRS, marked a shift towards institutionalization and autonomy. The 1990s witnessed further evolution, with increased participation and diversification of sections (Anderle 2011).

Government support in 2013 formalized state backing for Student Societies, aligning with structural changes in higher education. The transition to a three-cycle system highlighted the need for early talent identification, addressed through initiatives like the National Excellence Program.

The New National Excellence Program and the Roska Tamás Scientific Lecture Institution provided additional support, fostering interdisciplinary collaboration and

internationalization. By the third millennium, the movement stabilized, embracing online platforms for organization and outreach.

The expansion of NCSRS to Hungarian institutions outside of Hungary (i.e. neighboring nations) in 2013. Since 2023, NCSRS has also been organized for member universities of the European Engineering Learning Innovation and Science Alliance (EELISA). This has underscored the movement's global reach and commitment to innovation. Despite administrative challenges, the movement persevered, adapting to technological advancements and societal needs.

In conclusion, the Hungarian Student Society movement has evolved into a dynamic platform for academic growth and international collaboration, driven by a commitment to excellence and social responsibility.

1.2 National conference of student research societies 2013-2023

The NCSRS is an event of outstanding importance on a national level, combining multiple elements of talent nurturing and development. It is a conference where students can present their scientific achievements, which may have taken several years to accomplish. However, it is also a competitive event, as the awarding process follows strict rules. Also, it serves as a community-building occasion with numerous cultural and sports programs. And all of this is just the pinnacle of the complex talent nurturing process, which can begin when a high school student meets their mentor or when a university student selects an SRS topic of interest. (See Figure 1)

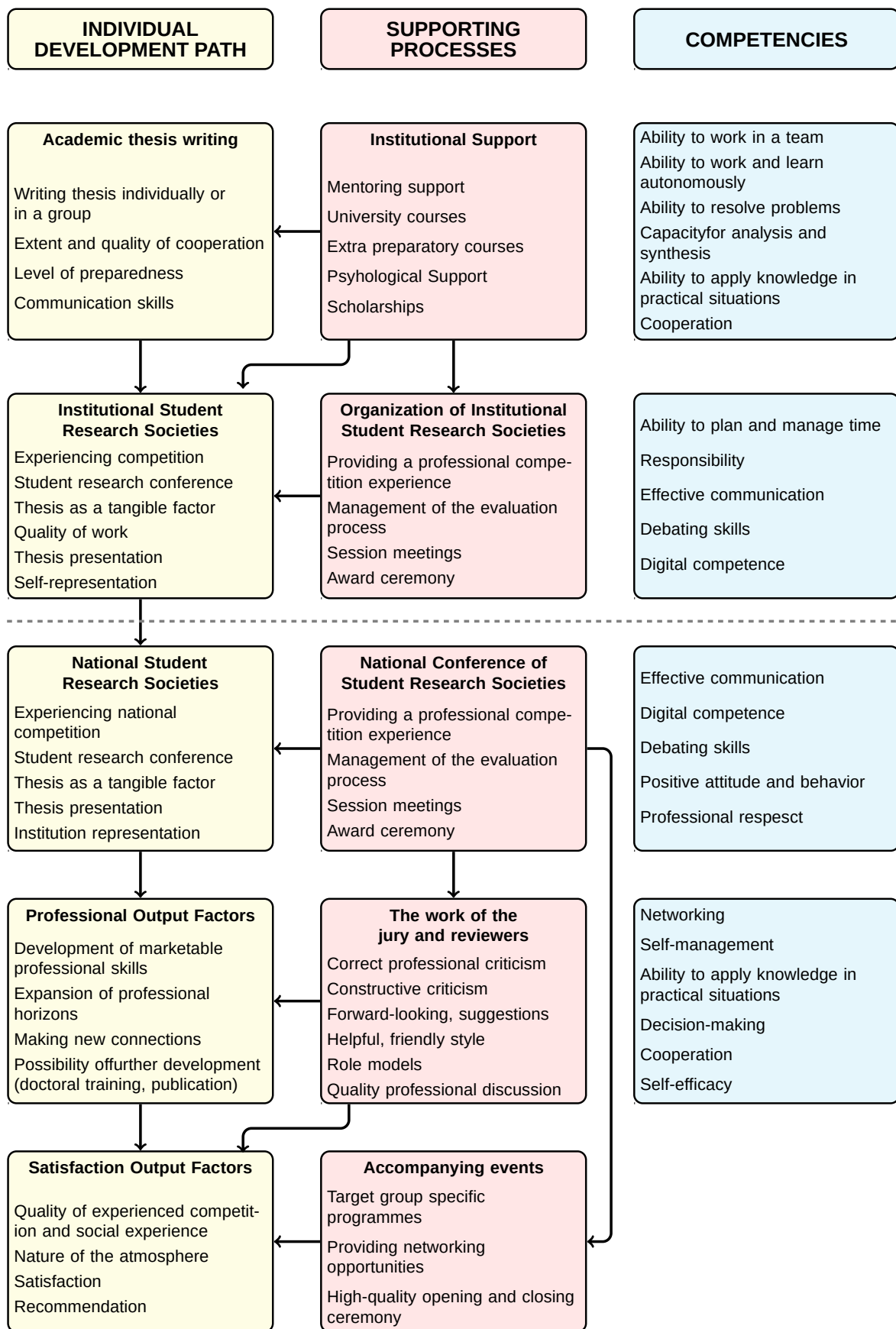


Figure 1: The multifaceted nature of SRS activities. (Kolozsár et al. 2024)

In addition to competencies, it is worth discussing the rich array of abilities and skills that are developed through SRS activities. For our analysis, we will use the work of Kolchina and colleagues, who examined which skills are developed in the context of various activities of student societies (Kolchina et al. 2021). Study of the soft skills development in the framework of the activities of student communities. *Propósitos y Representaciones*, 9(2), 34. The preparation of scientific student papers and the presentation of results significantly contribute to the development of both hard and soft skill groups such as Professional skills (according to the specifics of the activity), Analytical/Research skills, Flexibility/Adaptability skills, and Leadership skills.

1.3 Competition and conference combined

Over the more than seventy years, a ritual has been established for how the biennial conferences, each lasting 3-4 days, unfold. Beyond the opening and closing events, there are many activities that enrich such an event. Personal encounters can facilitate the birth of new relationships and friendships, while cultural, sports, and other activities can alleviate the tension of competition and provide entertainment. The NCSRS differs from a large-scale conference series not only because of the competition but also because it offers a much wider range of optional programs. Besides the traditional city tours, it's common, for example, for choirs to form, performing at the closing event, and there are running races and communal folk-dance classes.

Just as scientific conferences are of fundamental importance to researchers, providing opportunities for meeting and networking with professionals working in similar fields, the same applies to students. NCSRSs foster scientific dialogue among students, where they can discuss their new ideas, theories, and research findings. Throughout the evaluation process and during the presentation of results, they can receive constructive feedback, contributing to the further development and refinement of research projects. Additionally, conferences offer opportunities to learn about new research directions and trends, as well as to expand professional networks and establish collaborations (Carter et al. 2019)(Kondratenko et al. 2022). Students can leverage the experiences gained here in the job market: they can work on real problems in their projects, learn to work in teams, and improve their presentation skills. Such supplementary events accompanying the competition also benefit supervisors, where they can share their experiences and challenges related to supervision. Such academic interactions are essential for the development of the scientific community and the dissemination of knowledge.

Daniel Lynch and his colleagues analyzed the impact of case study competitions on logistics and supply chain on the experiences of participating students, jury members, and alumni of the competitions. Using both quantitative and qualitative analyses, the study demonstrates how these competitions influence students' careers and educational experiences (Lynch et al. 2022). It is not uncommon for students to work independently or with peers on a research project and then present their findings. Many universities around the world organize conferences and competitions for this purpose. What makes the practice in Hungary unique is that these competitions culminate every two years in a single large event involving all higher education institutions in the country.

2 METHODOLOGY

2.1 The evaluation process

The organizers send the submitted entries to at least two reviewers, who evaluate them on the online platform. The presentations of the papers are organized into thematically optimal sections, each containing a minimum of 5 and a maximum of 15 papers. Sectional juries determine the ranking based on written evaluations and oral presentations. According to the rules of NCSRS, one-third of the presented papers in each section can receive first, second, or third place. Only one first place can be awarded in a section. Second and third places may be awarded multiple times, but the number of students ranked second or third may not exceed one third of the total number of entries in a section. Only first place winners in each section are eligible to compete for the most prestigious student awards, the Pro Scientia, Pro Arte, and Junior Pro Scientia Gold Medals. A total of ca. 50 of these are awarded biennially (Szendrő and Cziráki 2009).

The question arises: how does the regulation of the number of winners affect the students? Does it dampen the spirits of participants that even though they might have produced the best paper in their field, they did not receive the first prize? Mihaly Csikszentmihalyi analyses the utility of competition in the context of achieving the "flow" state in his book "Flow: The Psychology of Optimal Experience." (Csikszentmihalyi 1990). When a student is fully immersed in research activities, they can experience "flow." According to Csikszentmihalyi, competition is beneficial when it promotes this state, supporting individual challenges and skill development. However, if competition causes excessive stress or hinders individual development, it goes against the experience of "flow" and becomes detrimental.

3 RESULTS

3.1 Satisfaction measurements

By processing the results of satisfaction surveys, we examined the extent to which participants were satisfied with the professional implementation of the conference and how much their participation in the NSRS contributed to their professional development. The National Council of Student Research Societies deems it essential that the continuous improvement efforts receive feedback. Therefore, in 2019, 2021, and 2023, an online satisfaction survey was conducted. Below, we will analyze the results obtained in the three Technological Sciences Section of the NCSRS. We will specifically address how the pandemic has impacted the SRS activities within the Technological Sciences Section. Respondents were asked to rate the extent to which the statements applied to them and to answer questions. (In 2019 and 2023, a Likert scale ranging from 1 to 6 was used, and in 2021, a Likert scale ranging from 1 to 10 was employed in the measurements, which we considered in our calculations.)

The questions analyzed across all sections and years were as follows (See Table 1):

Q1: *I am satisfied with my own performance.*

Q2: *I had the opportunity to learn about research and research results of people my age.*

Q3: *By learning about others' research, I gained a lot of knowledge.*

Q4: *By learning about others' research, I got many new ideas for continuing my own research.*

Q5: *I felt the section I participated in was professionally coherent.*

Q6: *My own presentation fits professionally into the section.*

Q7: *I received useful feedback from the jury.*

Q8: *After my presentation, the jury asked questions.*

Q9: *During the section meeting, the jury treated me as a partner during my presentation and subsequent discussion.*

Q10: *The written critiques I received for my work were fair and helpful.*

Q11: *I can learn from the written critiques; they help me in my further work.*

Q12: *I gained useful professional connections.*

Table 1: The distribution of responses from the 2021 survey.

	1	2	3	4	5	6	7	8	9	10
Q1	0.66%	3.29%	2.63%	2.63%	3.29%	7.24%	9.87%	29.61%	13.82%	26.97%
Q2	0.66%	1.32%	3.95%	3.95%	5.26%	5.92%	7.24%	31.58%	9.21%	30.92%
Q3	2.63%	3.95%	7.24%	4.61%	11.84%	10.53%	17.76%	17.76%	10.53%	13.16%
Q4	11.84%	10.53%	15.79%	9.87%	9.87%	11.18%	11.18%	9.21%	3.95%	6.58%
Q5	4.61%	3.95%	11.18%	4.61%	10.53%	14.47%	11.84%	15.13%	9.21%	14.47%
Q6	4.61%	1.97%	11.18%	5.92%	3.95%	10.53%	7.24%	13.16%	13.16%	28.29%
Q7	7.24%	3.95%	6.58%	5.92%	3.95%	6.58%	9.87%	15.79%	9.21%	30.92%
Q8	3.95%	5.92%	5.26%	3.95%	2.63%	1.32%	4.61%	16.45%	7.89%	48.03%
Q9	2.63%	1.97%	3.29%	2.63%	1.32%	3.95%	5.26%	23.03%	13.16%	42.76%
Q10	1.97%	3.29%	3.95%	3.29%	4.61%	4.61%	8.55%	17.76%	15.13%	36.84%
Q11	3.29%	3.95%	7.89%	3.29%	6.58%	4.61%	5.92%	15.13%	12.50%	36.84%
Q12	21.05%	9.87%	11.18%	7.89%	10.53%	7.24%	7.24%	9.21%	6.58%	9.21%

We can conclude that the majority of students were very satisfied with the professional execution of the event. However, it should be noted that despite the organizers emphasizing the importance of students building valuable professional connections and being open to learning about their peers' work, 21.05% of respondents felt they did not gain useful professional experience (Q12), and 11.84% felt they did not receive new ideas for continuing their own work. In the second part of our analysis, we were curious to see if satisfaction changed due to the online nature of the conference during the pandemic, and how participants' opinions evolved when things returned to "norma". The distribution of responses to individual questions was not normal, so we used the Mann-Whitney U test to examine if there was a significant difference in responses to the questions in the various surveys. At a significance level of 0.05, the critical value is 1.96. The obtained Z values were always smaller than 1.96 in absolute value, indicating no significant difference between the responses to the examined questions in the two conferences compared.

The questions analyzed (see Table 2) across the Technological Sciences section in 2021 were the following:

S1: The lockdowns have made it difficult to conduct scientific work at the appropriate level.

S2: I didn't have access to the necessary tools for my research.

S3: Maintaining communication with my supervisor has become more difficult.

S4: My supervisor had more time to assist with my research.

S5: I had more time for my SRS research.

S6: I gained better access to literature and databases.

S7: I wouldn't have even started my SRS if it weren't for the coronavirus and the resulting lockdowns.

S8: The institutional/departmental SRS conference was held online, and participating in it was a positive experience for me.

Table 2: The distribution of responses from the 2021 survey about Covid-19 related questions in the Technological Sciences section

	1	2	3	4	5	6	7	8	9	10
S1	15.12%	12.79%	11.63%	5.81%	10.47%	16.28%	6.98%	13.95%	1.16%	5.81%
S2	25.58%	8.14%	12.79%	4.65%	3.49%	17.44%	5.81%	11.63%	1.16%	9.30%
S3	25.58%	11.63%	11.63%	8.14%	6.98%	12.79%	10.47%	9.30%	1.16%	2.33%
S4	25.58%	15.12%	18.60%	17.44%	11.63%	4.65%	1.16%	4.65%	1.16%	0.00%
S5	19.77%	19.77%	10.47%	6.98%	16.28%	11.63%	4.65%	6.98%	2.33%	1.16%
S6	52.33%	20.93%	9.30%	5.81%	4.65%	1.16%	2.33%	0.00%	2.33%	1.16%
S7	77.91%	6.98%	2.33%	2.33%	5.81%	0.00%	1.16%	2.33%	0.00%	1.16%
S8	11.63%	6.98%	3.49%	11.63%	10.47%	10.47%	6.98%	13.95%	10.47%	13.95%

It is evident that the audience's commitment to SRS is strong (S7) and that the pandemic did not significantly hinder student research work, although it did pose some challenges.

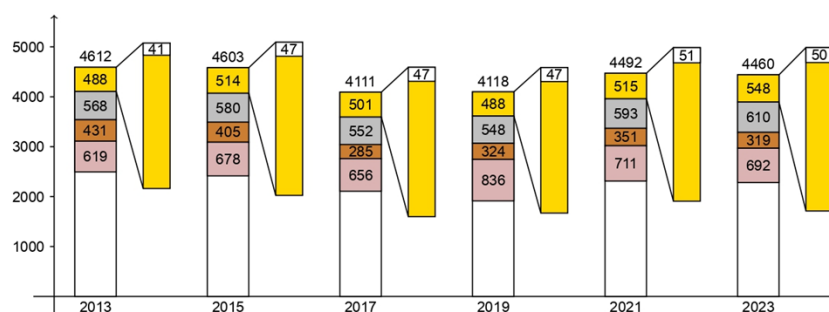


Figure 2: The most important numbers of the last six NCSRS conferences of the past decade

Figure 2 above where the x-axis represents the years, while the y-axis represents the number of submissions. Yellow represents the first, grey the second, brown the third, and mauve indicates the number of special prize winners. For first prizes, we also included the number of Pro Scientia, Pro Arte, and Junior Pro Scientia Gold medalists. It is worth noting that the Covid-19 pandemic did not deter the talents; the number of participants did not decrease. Detailed analyses revealed that while there was a decline in experimental fields due to closures, growth was observed in other

scientific areas. This can also be explained by the fact that other activities, even entertainment opportunities, were restricted during online education, especially during quarantine, which created the opportunity for students to focus on preparing their submissions. For the Technological Sciences Section, we also marked the number of first, second, and third-place winners corresponding to the color codes used in the previous figure (see Figure 3).

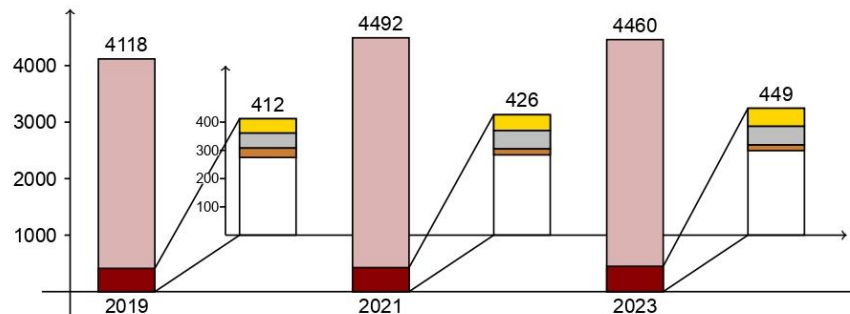


Figure 3: The number of participants in NCSRS (higher bars) and within that, the number of participants in the Technological Sciences Section across the years of satisfaction measurement

Engaging in scientific work as a student can significantly influence participation in doctoral programs. The research experiences gained through SRS activities enhance students' scientific skills and even increase their chances of enrolling in doctoral programs. As a result, students are better prepared for the challenges of doctoral studies and the world of scientific research.

4 SUMMARY

The SRS is a Higher Impact Practice (HIP) in pedagogy that significantly enhances both students' learning experiences and outcomes. From the perspective of modern engineering education, these conferences align with the trend of employing student-centered, project-based learning methodologies that focus on solving real, multifaceted engineering problems. The SRS movement supports the development of skills such as teamwork, communication, global awareness, professionalism, and social responsibility. Additionally, the conferences contribute to the internationalization of education and address future challenges in engineering training. SRS participants acquire individual and collaborative learning and research experiences that they can later leverage in academia and the job market. In the mentor-mentee relationship, the supervisor guides the student's progress, considering their individual abilities and needs.

All of this is practically implemented across virtually every higher education institution in Hungary, deeply embedded in academic activities. The SRS (Student Research Societies) is not only part of the research activities between student and mentor instructor but also deeply integrated into higher education. Participation in the SRS movement (as supervisors, organizers, reviewers) is a factor in academic advancement, and achievements in the NCSRS influence institutional accreditation. While science is important at the NCSRS, what is even more crucial is conveying to students the joy of understanding the world a little bit better and showing them how to stay engaged in this "flow" for as long as possible. This is also an educational task within higher education, setting an example, and perhaps, it's the most beautiful aspect of it all. In their work titled "The XXXIII National Conference of Student Research Societies: SRS Remains the Main Base for Scholar Training," Cziráki

Szabina, Szabó István, and Szendrő Péter conclude with the following thought (Cziráki, Szabó, and Szendrő 2019):

"The enduring success of SRS is built on a slow evolution while respecting traditions and addressing an existing demand for students' acquisition of additional knowledge. Of course, committed educators and researchers are needed who tirelessly strive to assist young talents. Thanks to them, students gain broader knowledge and skills, thus better positioning themselves for research careers or employment in other sectors upon completion of their higher education studies. Therefore, the saying 'SRS is eternal!' is not just a slogan but a fact."

5 Acknowledgement

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