



Attendance of extracurricular activities in the field of natural sciences and the attractiveness of the content offered for extracurricular activities in biology in elementary schools

DAMIR SIROVINA¹
DANIELA PETRINEC^{2*}
PETRA TRAMONTANA³
GORAN KOVAČEVIĆ¹

¹ Department of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia

² University of Zagreb School of Medicine, Zagreb, Croatia

³ IV. gimnazija, Zagreb, Croatia

***Correspondence:**

Daniela Petrinec

E-mail address: daniela.petrinec@mef.hr

Keywords: extracurricular activities; motivation; teaching; practical work; self-actualization; microscopy

Abstract

Background and purpose: For many years, students' interest in the field of natural sciences has declined, which consequently results in decreasing numbers of professional staff in the mentioned field. The aim of this study was to examine the attendance of extracurricular activities in the field of natural sciences by elementary school students (age 13 and 14) in Zagreb and whether the teachers' expectations are in line with the students' preferences for the content offered as part of extracurricular activities in biology.

Material and methods: Using an anonymous online survey (Google Forms), data were collected on participation in extracurricular activities in the field of natural sciences and the attractiveness of the content of extracurricular activities. The respondents were 90 students in the 7th grade and 46 teachers of biology in Zagreb, 2020.

Results: Participation in extracurricular activities in the field of natural sciences among the surveyed students was very low. Students were attracted to content that includes simple practical work in the field of biology, including microscopy, but the perception of their interest by teachers is not in accordance with the real interests of the students.

Conclusion: The results of this research show that the share of the science field in extracurricular activities is low, and that the surveyed teachers are not aware of the students' wishes regarding the content offered in extracurricular activities. The conducted research can be a good basis for organizing and planning extracurricular activities in elementary school.

INTRODUCTION

Regular classes are the central part of the educational process, and besides them in schools there are also activities such as extracurricular activities, elective classes, and extra classes. Extracurricular activities include everything that takes place outside the curriculum. A large part of extracurricular activities is not related to school, but a good proportion of them take place in school because of the numerous advantages that help students achieve and develop their personality and skills (1,2). The level of self-confidence of students who participate in extracurricular activities is significantly higher than in those who do not participate (3), which is a very important reason for a serious approach to be taken to extracurricular activities.

Legislative bodies in Croatia have recognized this importance, as seen in Article 28 of the Croatian Primary and Secondary School Education Act (4) which states that: "The school curriculum determines the curriculum of elective subjects and extracurricular activities". The introductory part of the National Curriculum and Programme for Elementary Schools emphasizes the importance of extracurricular activities as the most effective way to suppress socially unacceptable behaviour and as an excellent foundation for student self-actualization and for individual research-based learning (5).

Furthermore, extracurricular activities are ideal for discovering students' interests and competencies in a pleasant environment and are also a space for students to choose more freely due to the absence of grading which can cause stress for students. In this way, teachers also get to know students and their interests and abilities better (6). The usual range of extracurricular activities in Croatian schools includes sports and recreational activities, musical activities, drama and literary workshops, art workshops and various groups in the field of natural sciences (physics, chemistry, biology). To improve the quality of such activities, it is important to ensure the following: support for the teacher-leader of extracurricular activities by the school administration in the performance of the extracurricular activities; the independence of the teacher in choosing the program; the involvement of students in extracurricular activities; and the professional training of teachers for this form of educational activities. Clearly defined goals, outcomes, methods, and social forms of performance are also important (7).

Many studies deal with the problem of the significantly reduced interest of students in the field of science (8,9). In line with these results is the observation of Potvin *et al.* (10) who state that students' interest in the field of science decreases with age, mostly on transition to high school (14- and 15-year-olds). A consequence of the above may result in the lack of professional staff in the mentioned field. Science teachers can be one of the key factors in solving the mentioned problem, because through regular classes and extracurricular activities they can greatly influence students' attitudes to science (11). It has been shown that school experience has no significant relationship with a student's future career choice in the science field (12–14). However, there are studies that point out that students who participate in extracurricular activities in the science field show greater motivation to pursue a career in this deficient field (15).

It can be assumed that teachers' clearer insight into students' expectations and their preferences in the choice of extracurricular activities is necessary for improving the quality of biology teaching, especially as part of extracurricular activities and in increasing interest in the field of the sciences. There are no studies in Croatia that show how many students are involved in extracurricular ac-

tivities in the field of science and/or whether the students' preferences regarding the content of extracurricular activities in biology are in line with the teachers' expectations about their interests. With this in mind, the aims of this research were to determine the share of extracurricular activities in the field of natural sciences among the extracurricular activities that elementary school students attend and to examine if the preferences and/or expectations of teachers and students match regarding their opinion of the attractiveness of some of the content of extracurricular activities in biology.

MATERIALS AND METHODS

Sample and sampling

Data on participation in extracurricular activities in the field of natural sciences among elementary school students and the attractiveness of the content that could be offered as part of extracurricular activities in biology in elementary school were collected using an anonymous online survey. The survey was conducted online in June 2020 using Google Forms. From the sample of the surveyed students and teachers, only the surveys that were completely filled out were selected, which encompassed 90 students and 46 teachers from elementary schools in Zagreb. The survey was completed by seventh-grade students (13- and 14-year-old students) of three elementary schools in Zagreb.

Instruments

The questions selected for this research are part of a more extensive survey on the choice of extracurricular activities in elementary and high schools in Zagreb. The survey for students differed from the survey for teachers in some parts, but most of the questions used for this research were composed in such a way that direct comparisons of teachers' and students' responses were possible. Some of the questions in the survey offered the answers "yes" or "no", some questions had a choice of answers, and the key questions relating to the choice of certain activities in biology class had multiple-choice answers: "yes", "probably yes", "maybe", and "no". The third type of questions were unified into "positive attitude" for "yes" and "probably yes", and "negative attitude" for "maybe", and "no" to provide another angle of view.

Statistical analyses

In order to calculate the mean values of the obtained results and the differences between students and teachers, the STATISTICA 14.0 software package was used. In order to calculate the differences in students' and teachers' thoughts about the attractiveness of certain content of extracurricular activities, we summed up the selections in two groups, positive (yes and probably yes) and negative (no and maybe), and then compared the data using the χ^2

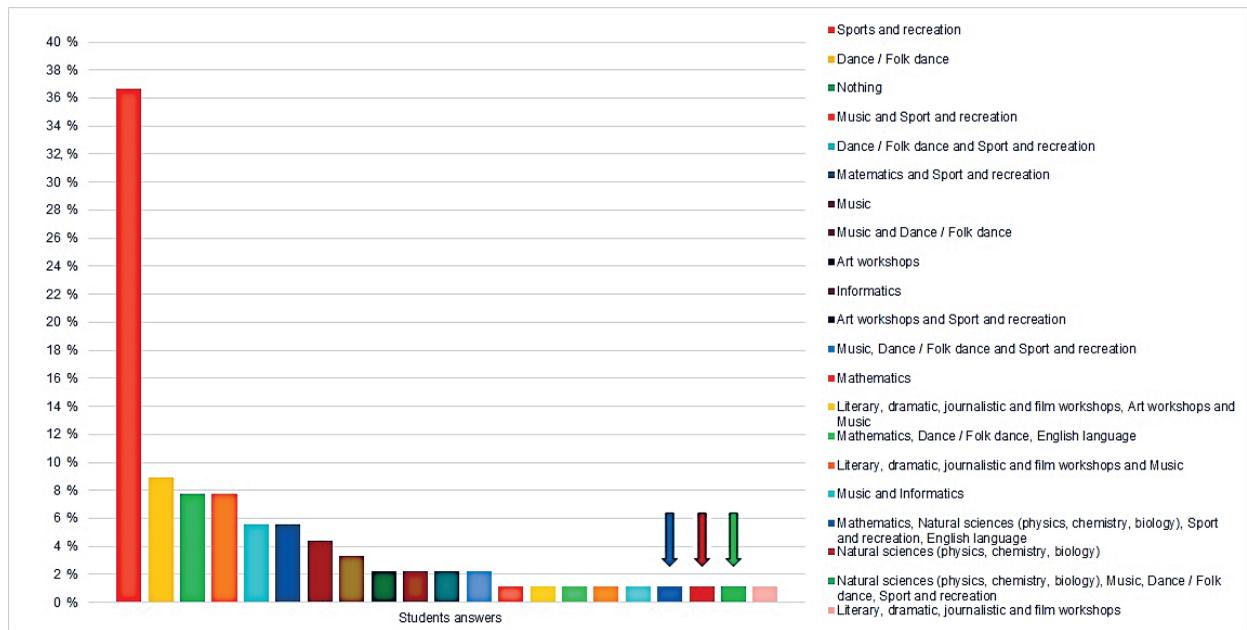


Figure 1. Participation in the field of extracurricular activities of the surveyed students; the red arrow shows the natural sciences field exclusively, while the blue and green arrows show the natural sciences field in combination with others extracurricular activities.

test. Statistical significance was reduced to $p < 0.05$. The Psychometrica online calculator (16) was used for effect size calculation. Effect margins were set in accordance with recommendations on the site, 0 to 0.2 = no effect; 0.2 to 0.5 = small effect; 0.5 to 0.8 = intermediate effect; 0.8 and higher = large effect.

RESULTS

The largest percentage of surveyed students (36.67%) were involved in extracurricular activities in the sports and recreation area. After that, sports and recreation activities combined with other activities were attended by 24.44% of students. Next, 22.22% of the surveyed students were involved in artistic activities. A total of 3.33% of the surveyed students were engaged in computer science activities or computer science in combination with other extracurricular activities, and 2.22% of students were involved in mathematics activities or mathematics in combination with other activities. Activities that include natural sciences were chosen by only 1.11% of students and another 2.22% of students chose activities that included natural sciences in combination with other types of activities. Some of the students (7.78%) declared that they were not involved in any extracurricular activities (Figure 1).

Responding to the question "What is the probability that students would choose extracurricular activities in biology next year if they were to solve problems and prepare for a biology competition", 34.45% of students and 52.17% of teachers answered "yes" and "probably yes".

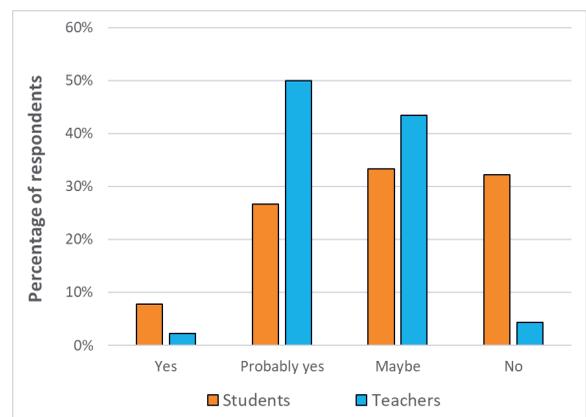


Figure 2. Percentages of respondents responding to the question "What is the probability that students would choose extracurricular activities in biology next year if they were to solve problems and prepare for a biology competition?"

Almost a third of the students (32.22%) and only 4.35% of the teachers chose "no" (Figure 2).

Statistical analyses of the differences between students' and teachers' answers showed statistically significant differences ($p = 0.0462$). A comparison between the positive and negative attitudes of students and teachers towards the proposed activity can be seen in Figure 3. Calculated effect size is small ($d = 0.3469$).

Microscopy or performing simple experiments in extracurricular activities in biology would be attractive. As many as 30% of students answered "yes" and another

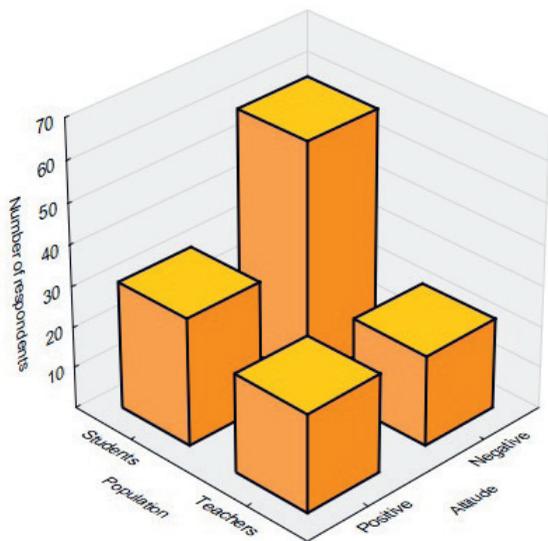


Figure 3. Comparison of the results grouped into positive ("yes" and "probably yes") and negative ("no" and "maybe") categories between students' and teachers' answers to the question "What is the probability that students would choose extracurricular activities in biology next year if they were to solve problems and prepare for a biology competition?"

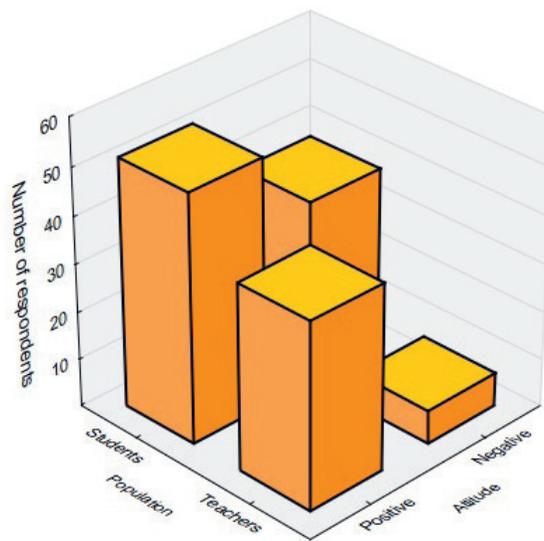


Figure 5. Comparison of the results grouped into positive ("yes" and "probably yes") and negative ("no" and "maybe") categories between students' and teachers' answers to the question "What is the probability that students would choose extracurricular activities in biology next year if they performed microscopy or simple experiments during extracurricular activities?"

27.78% answered "probably yes" (Figure 4). The "yes" and "probably yes" answers in combination were chosen by 84.78% of teachers (Figure 4).

In this case, too, after grouping the results and statistical processing, statistically significant differences ($p=0.0015$) were observed in the opinions of students and teachers (Figure 5). Calculated effect size is intermediate ($d=0.5643$).

If they were to engage in research work in extracurricular activities in biology with the use of laboratory

equipment and microscopes, about 59% of the students would certainly or probably choose this type of course. In this case, teachers expect up to 80% of students who would certainly or probably choose such extracurricular activities (Figure 6).

The results grouped into two categories according to the probability of choosing extracurricular activities depending on the proposed activity are shown in Figure 7, and the differences between the attitudes of students and teachers are statistically significant ($p=0.0119$). Calculated effect size is small ($d=0.4413$).

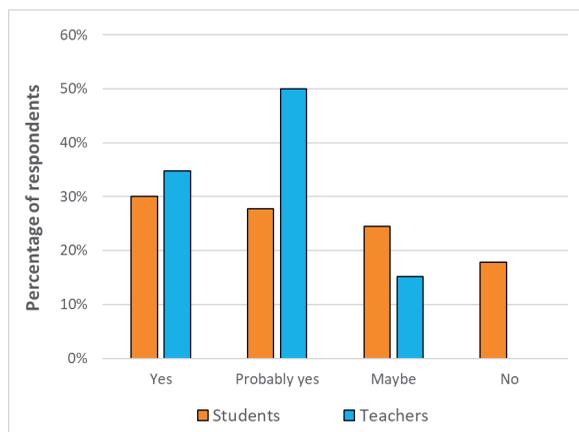


Figure 4. Percentages of respondents responding to the question "What is the probability that students would choose extracurricular activities in biology next year if they performed microscopy or simple experiments during extracurricular activities?"

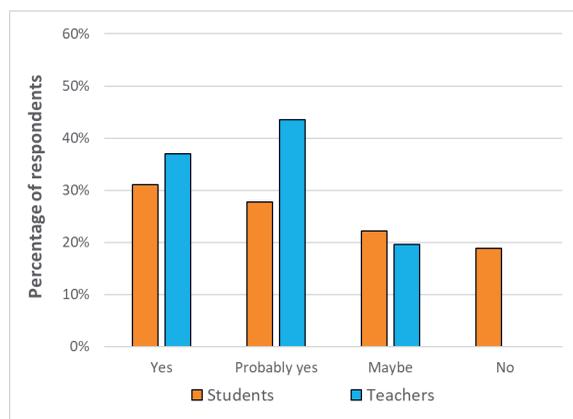


Figure 6. Percentages of respondents responding to the question "What is the probability that students would choose extracurricular activities in biology next year if they were engaged in research work using laboratory equipment and a microscope?"

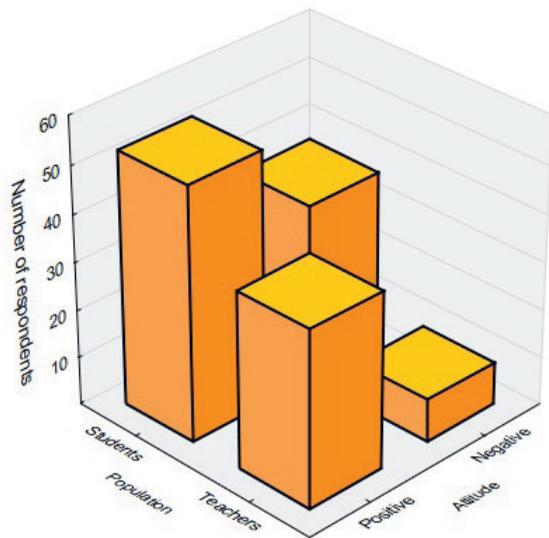


Figure 7. Comparison of the results grouped into positive ("yes" and "probably yes") and negative ("no" and "maybe") categories between students' and teachers' answers to the question "What is the probability that students would choose extracurricular activities in biology next year if they were engaged in research work using laboratory equipment and a microscope?"

If the class were to investigate the behavior of animals, such as, for example, cnidarians or insects, a total of 42.22% of students would certainly or probably choose extracurricular activities in biology, while teachers expect that 62.04% of students would certainly or probably choose extracurricular activities with such content (Figure 8).

As in the other responses, in the answers related to the attractiveness of activities that included research in animal behavior, grouped into two categories according to the probability of choosing extracurricular activities (Figure 8).

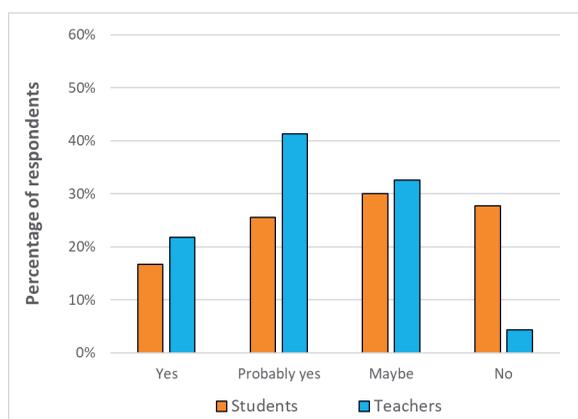


Figure 8. Percentages of respondents responding to the question "What is the probability that students would choose extracurricular activities in biology next year if they were to study the behavior of animals such as cnidarians or insects?"

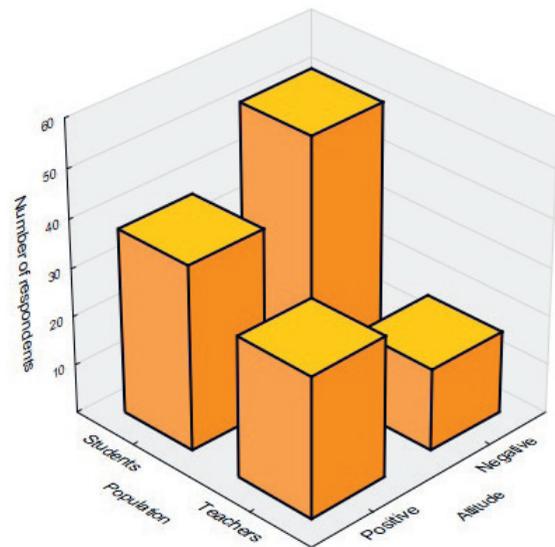


Figure 9. Comparison of the results grouped into positive ("yes" and "probably yes") and negative ("no" and "maybe") categories between students' and teachers' answers to the question "What is the probability that students would choose extracurricular activities in biology next year if they were to study the behavior of animals such as cnidarians or insects?"

ure 9), a statistically significant difference between students' and teachers' answers was observed ($p=0.0216$). Calculated effect size is small ($d=0.402$).

DISCUSSION

An anonymous survey conducted on a sample of 90 elementary school students aged 13 and 14 showed that the largest number of students (36.67%) are engaged in extracurricular activities in the field of sports and recreation, which is the vast majority of students involved in extracurricular activities (Figure 1). A national survey of American families showed that 57% of students between the ages of 12 and 17 report participating in sports activities, which is the vast majority as well (17). Furthermore, in some studies in which students stated that they engage in multiple activities (18), 75% are also involved, besides in other activities, in sports activities, which is in line with our results, where 77.42% of students are engaged in sports activities besides other activities.

According to Munro and Elsom (11), participation in extracurricular activities in the field of natural sciences among students is very low, which is in line with our results where only 3.33% of the surveyed students participate in them. Besides, the interest of students in continuing their education and/or pursuing a career in the field of natural sciences is declining (8,9,19,20). Therefore, it is desirable to increase the interest of students in biology, chemistry, and physics. Although Šorgo and Špernjak (12) showed that the content of basic elemen-

tary and high school biology and teaching classroom experience actually do not have a significant effect on the choice of career in the STEM field, it has been revealed that students who participate in extracurricular activities in the science field show greater motivation to pursue a career in this field (15). This still gives hope that improving the quality of extracurricular activities and offering content that will be interesting to students and that will provide a good insight into the natural sciences could be a useful attempt to increase students' interest in this area. This is precisely why we believe it is important for teachers to be aware of the interests and wishes of students. Statistically significant differences between students' and teachers' opinions about the attractiveness of certain activities, recorded in our study, show that teachers are not well acquainted with students' affinities. Our study indicates that teachers do not realize that some of the offered content does not attract certain, sometimes many, students. These differences lead to the conclusion that extracurricular activities in biology composed of undesirable activities will not attract students to biology or the field of natural sciences but might even repel them. It seems that, among other things, checking student affinities before creating a curriculum of extracurricular activities would be a good basis for attracting more students. This is particularly important in the field of natural sciences because interest in this field is declining.

Our results indicated that activities involving microscopy are quite attractive to students, so it should be ensured that schools are well equipped with microscopes. Ruščić *et al.* (21) showed that, although most schools have microscopes, teachers use them only occasionally because they do not have enough of them, and in many cases schools have only one microscope. Based on this information, we can conclude that it is necessary to encourage teachers and all stakeholders in the management of schools to better equip them, which would create the basis for organizing activities that could present biology and the natural sciences field in a better light and thus attract a larger number of students.

CONCLUSION

Participation in extracurricular activities in the field of natural sciences among the surveyed elementary school students in Zagreb is low but is in line with world trends. Teachers' expectations regarding the attractiveness of certain content are not in accordance with the real interests of students for these contents, and therefore there is a need for a better insight into the interests of the students. Students are attracted by content that includes practical work, especially microscopy. If teachers leading extracurricular activities in biology were better acquainted with the preferences of students, and if schools were better equipped with microscopes so that they could carry out activities that are interesting to students, it is

likely that extracurricular activities in biology, and thus in science, would include more students than they currently do.

Acknowledgements: *Special thanks to Croatian Microscopy Society for the support and cooperation during this research.*

REFERENCES

- Oberle E, Ji XR, Guhn M, Schonert-Reichl KA, Gademann AM 2019 Benefits of Extracurricular Participation in Early Adolescence: Associations with Peer Belonging and Mental Health. *J Youth Adolesc.* 48(11): 2255–2270. <https://doi.org/10.1007/s10964-019-01110-2>
- Farb A, Matjasko J 2005 The Role of School-Based Extracurricular Activities in Adolescent Development: A Comprehensive Review and Future Directions. *Review of Educational Research.* 75. <https://doi.org/10.3102/00346543075002159>
- Lake R 2015 23 energizing extracurricular activities statistics. Credit Donkey. Retrieved from <https://www.creditdonkey.com/extracurricular-activities-stats.html> In: Shaffer M 2019 Impacting Student Motivation: Reasons for Not Eliminating Extracurricular Activities. *Journal of Physical Education, Recreation & Dance* 90: 8–14. <https://doi.org/10.1080/07303084.2019.1637308>
- Zakon o odgoju i obrazovanju u osnovnoj i srednjoj školi, Članak 28. (NN 94/13, 152/14, 68/18)
- Petković M 2016 Teachers and students - co-creators of extracurricular activities. Master's thesis. Faculty of Education, Josip Juraj Strossmayer University of Osijek
- Martinčević, J. 2010. Extracurricular activities as a factor of education for a leisure time. *Život i škola* LVI 24: 34–0.
- Mlinarević V, Brust M 2009 The quality of the implementation of the school's extracurricular activities. III. Tehetseg Nap: Az eljárs = III. Dan talenata: zbornik radova = The 3rd talented pupils' day: proceedings. In: Majorosi, Imre (ed.). Kanjiža: Bolyai Farkas Alapítvány: 25–32.
- Osborne J, Simon S, Collins S 2003 Attitudes towards science: a review of the literature and its implications. *Int J Sci Educ* 25(9): 1049–1079. <https://doi.org/10.1080/0950069032000032199>
- Gottfried AE, Marcoulides GA, Gottfried AW, Oliver PH 2009 A latent curve model of parental motivational practices and developmental decline in math and science academic intrinsic motivation. *J Educ Psychol* 101(3): 729–739. <https://doi.org/10.1037/a0015084>
- Potvin P, Hasni A 2014 Analysis of the Decline in Interest Towards School Science and Technology from Grades 5 Through 11. *J Sci Educ Technol* 23: 784–802. <https://doi.org/10.1007/s10956-014-9512-x>
- Munro M, Elsom D 2000 Choosing Science at 16: The Influence of Science Teachers and Career Advisers on Students' Decisions about Science Subjects and Science and Technology Careers. NICEC Briefing
- Šorgo A, Špernjak A 2020 Biology Content and Classroom Experience as Predictors of Career Aspirations. *Journal of Baltic Science Education* 19(2): 317–332. <https://doi.org/10.33225/jbse/20.19.317>
- Šorgo A, Dojer B, Golob N, Repnik R, Repolusk S, Pesek I, Špur N 2018 Opinions about STEM content and classroom experiences as predictors of upper secondary school students' career aspirations to become researchers or teachers. *Journal of Research in Science Teaching.* 55(10): 1448–1468. <https://doi.org/10.1002/tea.21462>
- Virtič M P, Šorgo A 2022 Lower secondary school experiences as predictors of career aspirations toward engineering, and production

- and processing occupations. *European Journal of Engineering Education*: 1–18. <https://doi.org/10.1080/03043797.2022.2033169>
15. Stringer K, Mace K, Clark T, Donahue T 2019 STEM focused extracurricular programs: who's in them and do they change STEM identity and motivation? *Research in Science & Technological Education*: 1–16. <https://doi.org/10.1080/02635143.2019.1662388>
 16. Lenhard W, Lenhard A 2016 "Calculation of Effect Sizes." *Psychometrica*. <https://doi.org/10.13140/RG.2.2.17823.92329>
 17. National Survey of America's Families (NSAF) 1997 Benchmarking measures of child and family well-being. NSAF Methodological Reports. Rep. No. 6: Assessing the new federalism: An urban institute program to assess changing social policies. Washington DC: Urban Institute
 18. Feldman A F, Matjasko J L 2007 Profiles and portfolios of adolescent school-based extracurricular activity participation. *Journal of Adolescence* 30(2): 313–332. <https://doi.org/10.1016/j.adolescence.2006.03.004>
 19. Guvercin O, Tekkaya C, Sungur S 2010 A cross age study of elementary students' motivation towards science learning. *Hacettepe Univ J Educ* 39: 233–243
 20. Potvin P, Hasni A 2014 Interest, motivation and attitude towards science and technology at K-12 levels: a systematic review of 12 years of educational research. *Stud Sci Educ* 50(1): 85–129. <https://doi.org/10.1080/03057267.2014.881626>
 21. Ruščić M, Vidović A, Kovačević G, Sirovina D 2018 The Use of microscope in School Biology Teaching. *Resolution and discovery* 3: 13–16. <https://doi.org/10.1556/2051.2018.00054>