IMPACT ASSESSMENT OF THE TELERIK ACADEMY SCHOOL PROGRAM

AMERICA FOR BULGARIA FOUNDATION

Global Metrics Ltd.

Telerik School Academy

This report was commissioned by The America for Bulgaria Foundation (ABF) and was developed by the Global Metrics team: Radostina Angelova, team leader; Keith Kershner, editor and consultant; and researchers Marina Dimitrova, Desislava Ilieva, Katerina Georgieva, Ralitsa Dimitrova.

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CONTENT

I. EXECUTIVE SUMMARY

The main objective of the Telerik Academy School (TAS) is to provide free training to children from an early age to build the necessary skills and knowledge for a future career in the digital field. The TAS has identified the need to train children in technology, to spark their curiosity and love for education, to prepare them for the professions of the future, to foster their interest in learning, and to help them become digital leaders, sought-after professionals, and active citizens of tomorrow.

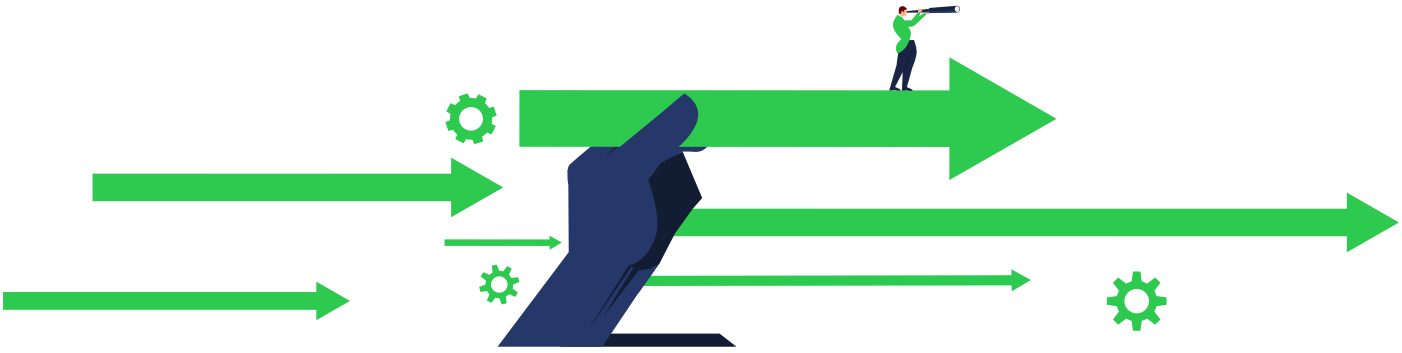
The purpose of the evaluation is to determine whether the Telerik Academy School (TAS) has had the intended impact on its target groups. The assessment is based on qualitative and quantitative research methods for collecting data from TAS alumni, their parents, and teachers, as well as analyses of data from surveys conducted earlier by TAS among teachers and students before and after their participation in the Academy courses.

For the purpose of this study, the participants were split into three groups: 1/ juniors (TAS alumni who are currently in the grade 4th -7th); 2/ seniors (TAS alumni who are currently in the grade 8th -12th); and 3/ 18+ TAS alumni (former participants who were 18 years or older at the time of the assessment).

The empirical data and the collected evidence allowed us to draw the following main conclusions:

→ **Program Implementation** – The program has achieved its main goals to develop and implement a training program that provides free digital education for children throughout Bulgaria.

Since 2011, the TAS program has reached out to 14,357 unique students. 5,553 (39%) of these were trained in the past three school years with ABF support. The cost of a TAS student was BGN 350, of which BGN 198 was ABF contribution. During the 2020/2021 school year alone, the number of TAS participants constitute 0.4% of the total number of 4th-12th grade students in the country.



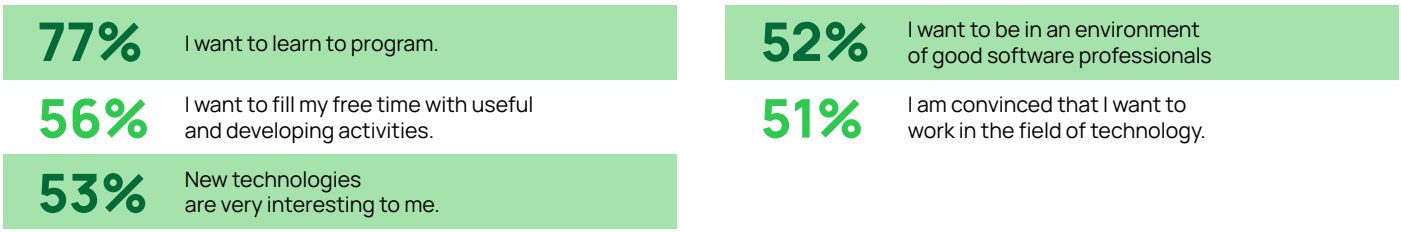
ABF involvement has changed the profile of participating students. Before 2017, the senior students prevailed (71% to 91% in different years). After 2017, the share of junior students varied between 66% and 79%.

ABF support allowed the program to reach more communities (since 2011, the program has been offered in 41 settlements, 19 added after 2018 with ABF support)) and changed the ratio between the type of settlements where TAS was active. Sofia is no longer the leading city and

accounts for 35%-40% of the students, down from 90% in the early years. The share of students in regional cities grew from some 10% to 55% in the past three years. The share of participant from small towns grew from less than 1% to 10% in the same period, in line with the new program objectives.

→ Reasons for enrollment in TAS courses: The main reasons for participation in the program were related to the development of programing skills, desire for learning, interest in new technologies, and communication with good software professionals. Other reasons for participation in TAS included the positive image of TAS and individual plans for the future.

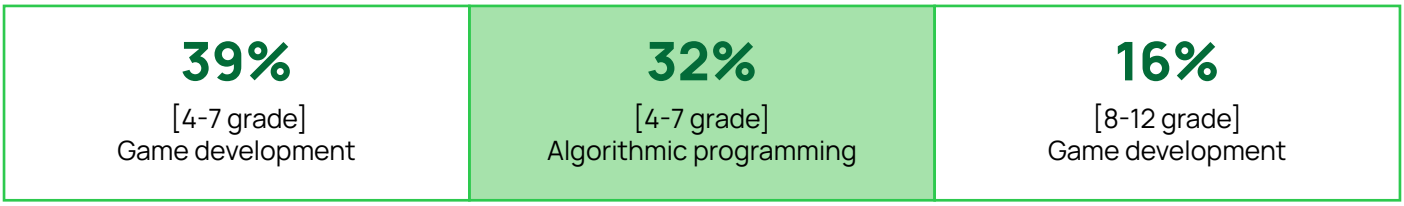
Figure 01: Why did you choose the programs of the TAS?
(Top 5 answers)



Source: "Welcome in TAS survey", TAS 2018-2019 and 2019/2020 school year

→ Typical Students' Journeys: Most of the students (65%) attended one course. The remaining 35% participated in two or more courses and only 10% attended five and more courses. Game development and algorithmic programming were the most attended courses.

Figure 02: The interest in the program is high
(2,000 and more participants per year):



→ Developing Sustainable Interest in IT: The TAS Program has contributed to a large extent to the development of participants' interest in programming and technology. According to 83% of the 18+ TAS alumni the program helped them realize their interest in IT and reinforced it for the other 17%. The results were similar for the 4th-12th grade students, though at a different ratio: the program helped 58% of them to realize their interests in IT and deepened it for 38%. The number of TAS participants who continue their secondary or university education in IT-related studies confirm the sustainable interest of the TAS participants in IT.

Participation of TAS students in Olympiads and competitions further reveals their interest in mathematics and IT. One-third of the TAS trainees took part in Olympiads and competitions in coding. Participation in Olympiads in mathematics varied depending on the age group: 79% for juniors and 64% for seniors. 85% of the juniors and 67% of the seniors stated that attend-

ing TAS has helped them perform better at competitions. In the last two academic years, TAS participants received 39 of the 64 award medals at national competitions. TAS trainees constituted 61% of the Bulgarian participants at the six international competitions in the past three years for which data was available.

Figure 03: The program is successful in developing sustainable interest in the IT field among students

68% of juniors plan to apply in secondary school with mathematical, programing or technological profile	**58%** of juniors and seniors claim that TAS helped them **realize** their interests in programming	**38%** of juniors and seniors claim that TAS helped them **strengthen** their interests in the field of programming

→ Continuing Studies at IT Related Schools or Universities: The program had a different level of impact on the participants' decision to continue their secondary or university education in IT related studies and mathematics. The effect is the strongest on the junior students and 75% of them confirm that TAS has influenced their decision in what school to apply after 7th grade. In addition, 68% of the junior TAS students are interested in continuing their secondary education in IT and mathematics.

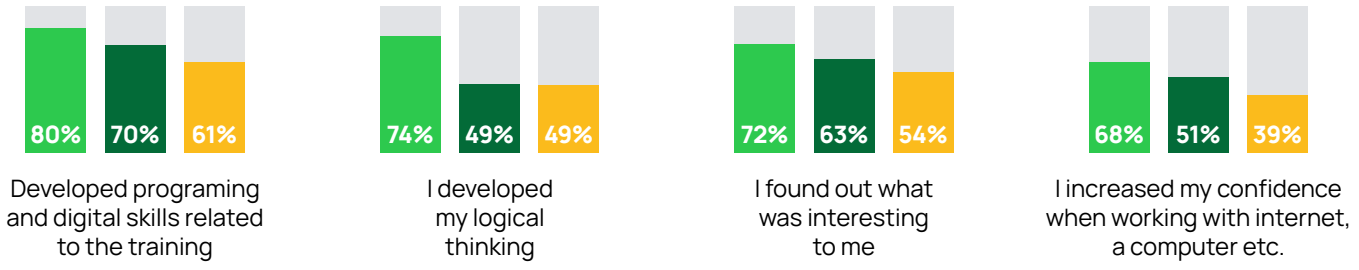
Forty-three percent of the senior students who attended TAS before 7th grade say that the program has influenced their decision in what school to apply after 7th grade. Nevertheless, 66% of them currently study in secondary schools with a profile in mathematics or IT. Further, 65% of the senior students stated that they would choose IT-related studies for their university education.

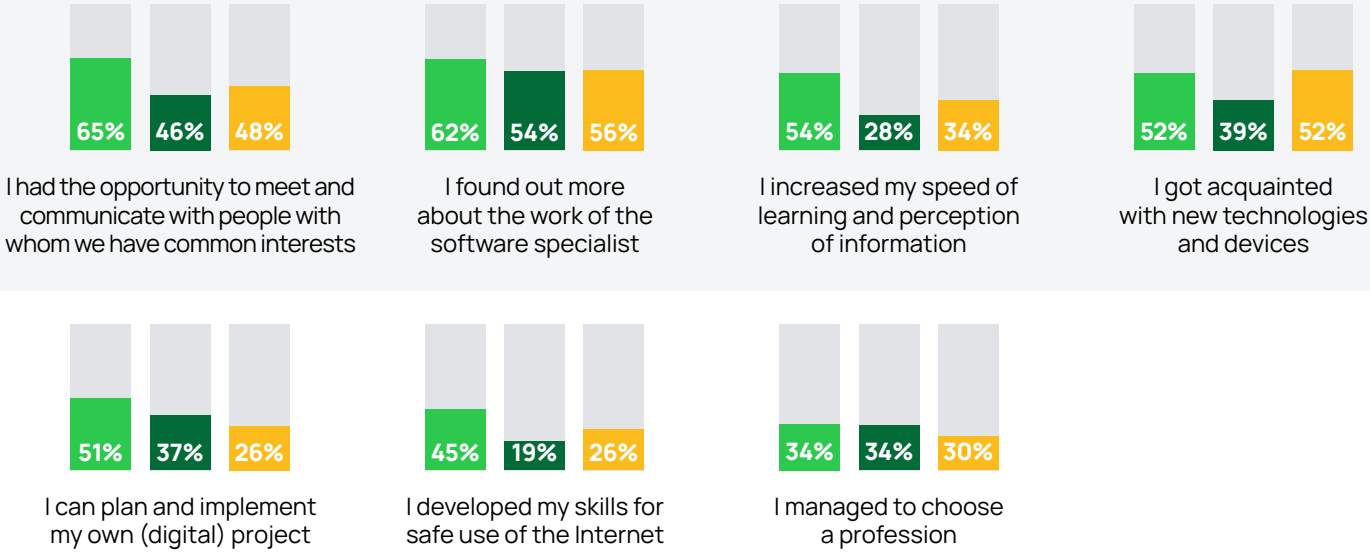
While 77% of the 18+ TAS alumni currently study IT related majors at university, a smaller number of participants in this group (41%) claim that the TAS program influenced the decision where to continue their higher education.

→ Skills development: TAS Program helped its trainees develop a wide range of skills. Junior students self-reported the highest number of acquired skills, probably because they entered the program at an early age when the influence of other factors on the development of their interests in the field of computers and technologies was still limited. This trend was valid for both participants in the junior age group and the TAS alumni who attended TAS courses when they were in the junior age group.

Figure 04: Which of the following things did you manage to achieve as a result of your attendance/participation in TAS?

Base: juniors, N=146; Base: seniors, N=151; Base: 18+ TAS alumni, N=123



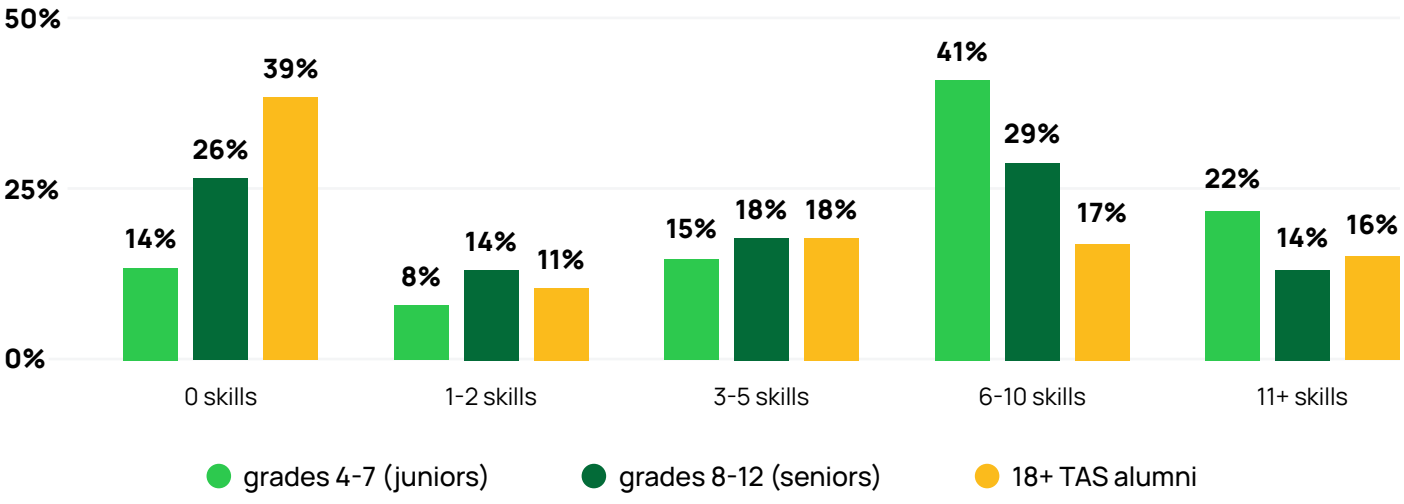


Source: Survey among TAS students and alumni

Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

Naturally, the share of respondents indicating individual skills was directly linked to the courses offered in each academic year and their educational content, which also changed throughout the years. The skills which junior trainees reported most frequently were: development of logical thinking (74%), programming skills (63%), game-making skills (55%), and increased speed of learning and processing information (54%). Simultaneously, students discovered their interest in the field of computer technologies (72%), increased their confidence when using computers and the Internet (68%), and took advantage of opportunities to communicate with their peers who have similar interests (65%). As part of the orientation to the world of technologies, trainees reported that during their training on the TAS Program they learned more about the work of software experts (62%) and acquainted themselves with new technologies and devices (52%). The answers provided by the other two groups were similar, but they indicated lower numbers of skills obtained.

Figure 05: Number of skills pointed out as obtained as a result of attendance/participation in TAS



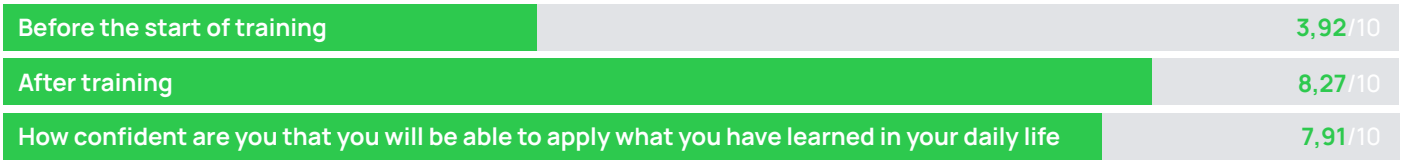
Source: Survey among TAS students and alumni

Share of respondents who score respective number of skills obtained with 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

The program achieved more significant results with the younger age groups in terms of development of interests, skills, and orientation as a whole, whereas it acted as a complementary training for the elder age groups. The finding can be explained by the fact that this is the age when key skills are formed and the change is more tangible. Besides, this time is the tipping point in growing personal interest in IT as a basis for the future development of IT-related skills.

Participation in the program had a direct impact on the trainees' self-assessment of their skills: by the end of the training their rating increased by 4.35 points (on the scale from 1 to 10) with regards to programming skills and knowledge. Confidence in applying skills obtained in TAS course on a daily basis was also high (average score 7.91 on the scale from 1 to 10).

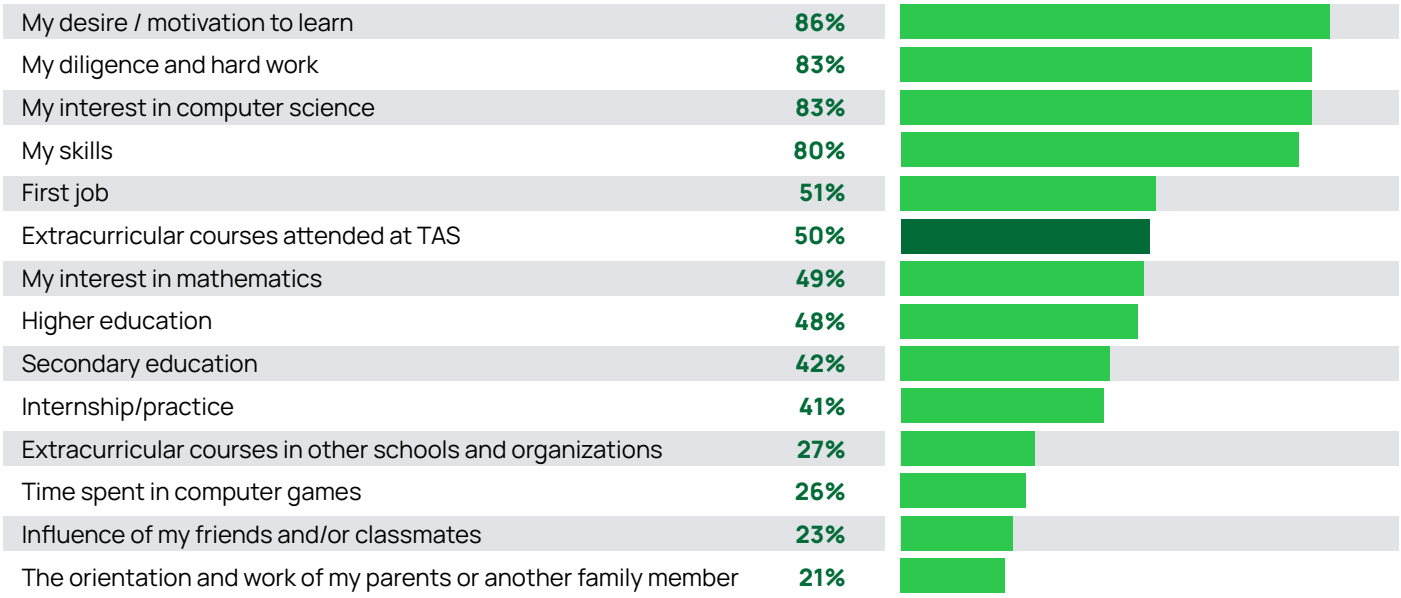
Figure 06: Self-Assessment of skills and knowledge before and after the program
On a scale of 1 to 10



Source: Survey among participants in 2017/2018, 2018/2019 and 2019/2020 school years

→ Factors That Influence the Career Development of the 18+ TAS Alumni: TAS is in the middle range of the factors that influenced the career development of the TAS students. The top four factors, each rated as highly significant for more than 80% of the students[1], were personal skills, efforts, and interest in computer science (motivation, desire, diligence, and hard work, etc.). The second group of factors mentioned were in the 50% range(See Figure 07). These included first job, TAS courses, interest in mathematics, higher education, secondary education, and internships. It means that next to personal factors, TAS courses were very important.

Figure 07: Which of the following do you think helped you to succeed?
Those who completed 12th grade and work in the field related to computer technologies, N=54



Source: Survey among TAS students and alumni

Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

[1] Those who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 is very high extent.

→ **TAS and the Labor Market:** TAS has a significant impact on the labor market in Bulgaria: In 2020, 93% of the estimated 1,850 18+ TAS alumni who had IT-related jobs worked in Bulgaria. This is equal to approximately 4,5% of the total number of people employed in the IT sector in Bulgaria, estimated at 38,000 in 2020[2]. This is a huge contribution of a single program that has been operating for ten years.

Even though the 18+ TAS alumni are young and most of them are still university students, their remuneration is competitive. For approximately 30% of them the monthly salary was above the average for Sofia for the Q2 of 2021 (BGN 2,072). 13% of the 18+ TAS alumni already earned net monthly salaries that were higher than the net monthly average salary in the IT sector in the country (BGN 3,344 in 2020). Most of them (68%) are junior experts or experts.

Figure 08: 18+ TAS alumni work in IT field

59% currently study at university.	**77%** study or graduated from an IT-related major.
57% of those who graduated secondary education were working	**14%** who already graduated higher education obtained their diploma abroad.
78% of those who worked had a job related to computer technology and programming.	**13%** of 18+ TAS alumni already receive net monthly salary that is higher than the net monthly average salary for IT sector in the country **For 2020 — 3,344 BGN per month**

Occupation of alumni (18+)

30% junior experts
38% experts
13% senior experts
6% team leads
6% managers
2% directors

Source: Survey among TAS students and alumni

[2] BASSCOM, Annual status report of the software sector in Bulgaria, p.7

→ Impact on the Teachers and Their Practices: Teachers considered their participation in the TAS as beneficial both for their contribution to the development of children's IT-related skills and knowledge and for the development of their own skills as teachers. A total of 91% of the Academy teachers indicated that they had improved their teaching methods by upgrading already known or learning new approaches. 94% of them applied what they learned in TAS in their regular practice: 38% of teachers applied them to a "very large extent" and 49% "to a large extent". Most of the teachers (87%) assessed the acquired and mastered methods as effective.

In a survey conducted during the academic period 2017-2019, 93% of the surveyed teachers responded that the influence of TAS on their teaching methods was very positive. 86% of the teachers said that they would recommend the training to a friend. The most valuable knowledge and skills that teachers developed during their training were related to different child-centered teaching approaches.

Both the quantitative and qualitative results showed that the teachers used the gamification approach in their work outside the Academy more often than other methods. The main modules offered at the Academy: "Accelerated learning" and "Digital literacy" were also often used outside the Academy.

Over 88% of the teachers supported the claims that participation in the TAS program created learning skills in students, increased their motivation, and offered knowledge that served as a basis for their next level of education. The same percentage of teachers also supported the statements that the trainings provided a successful start in participants' careers and in general for their choice of a professional field.

STRENGTHS AND WEAKNESSES

Several TAS values and challenges are outlined in the table below.

STRENGTHS

- The program contributed in many areas of skill formation, career orientation, and personal development of trainees. It strengthened their desire to continue in higher education in the field of programming and technology.
- The program was especially valuable for the junior students, for whom the program provides the basic skills needed for programming and development in the field of computer technology.
- Students shared that they had fun while learning, appreciated the skills they acquired and the opportunity to communicate with other peers who have similar interests. The majority of students participated with pleasure in TAS trainings, demonstrated high motivation for learning, and did their homework readily.
- A cumulative share of 72% of teachers supported the claim that the program had a great or very positive impact on the local teachers who were part of the program. Attitudes towards the positive impact on the local community were similar.

WEAKNESSES

- The complexity of the study material, as well as the speed of teaching was reported as a weakness by some students.
- There was a lack of mechanisms for giving feedback to parents of young students.
- Many students were looking for opportunities to upgrade but did not always know which courses were right for them and in what combination it was appropriate to take them. It would be good if teachers took some time to describe their courses (and those that they do not lead personally but are led by their colleagues).

LESSONS LEARNED

The TAS program is an example of a successful investment in human capital, which contributes not only to the individual development of participants, but also to the development of the local economic environment in small towns and regions. It also provides support for the sector with the highest added value in Bulgaria—IT. The coherent theory of change, together with appropriate resources (suitable teachers, effective trainings for them, and appropriate learning environments) and the quality of the courses for students give very positive results for all key target groups - students and teachers. Positive opinions were also reported by parents.

One of the biggest achievements of the program in the past three years is its outreach to smaller towns in the country where opportunities for developing the IT knowledge and skills of children are limited or even missing, or the financial barrier for doing it is high for the parents. TAS successfully combats these factors by offering free training at local level, thus creating the conditions for students in smaller settlements to learn and develop skills necessary for their future careers. This geographic expansion of the program should continue.

It is important to continue working with both, junior and senior students, as the training seems to develop different knowledge and skills in them, while solidifying the interest in IT in both groups. According to the teachers, the Academy successfully motivates students and encourages their further interests in information technologies in a friendly environment and using well-adapted approaches.

Another gap that TAS fills in is the early IT education of children. The Academy offers more advanced courses for juniors, while this happens at a later stage of education within the state educational system and with a limited scope. This helps the kids to gain knowledge and skills applicable in the future, regardless of the chosen professional track.

TAS SUSTAINABILITY PROSPECTS

The TAS model for future development is characterized by structure and logical consistency. It demonstrates the confidence and clarity with which the program team presents and plans its development in perspective.

The program team developed detailed plan for scaling operations and impact which envisage to double the number of students by 2024.

Figure 09: Plan for scaling operations

2017-2020 SY'17/18 – SY'19/20 (3 school years)	**Planned for 2020-2024** SY'20/21 – SY'23/24 (4 school years)
Total cohorts – 222	Total cohorts – 628
Total students – 6,024	Total students – 12,820

Source: TAS Planning for the future

In quantitative terms, the business plan incorporates a variety of reasonable potential sources of support. To finance the growth TAS developed 15 revenue sources with the goal of achieving sustainability by 2024: local supporters, general business, partners network, schools, parents, alumni, foundations, philanthropists, friends & family.

The variety of revenue sources guarantees that all possibilities will be explored and growth will continue, despite the continuing negative effects of COVID-19. This gives flexibility and different options for future development.

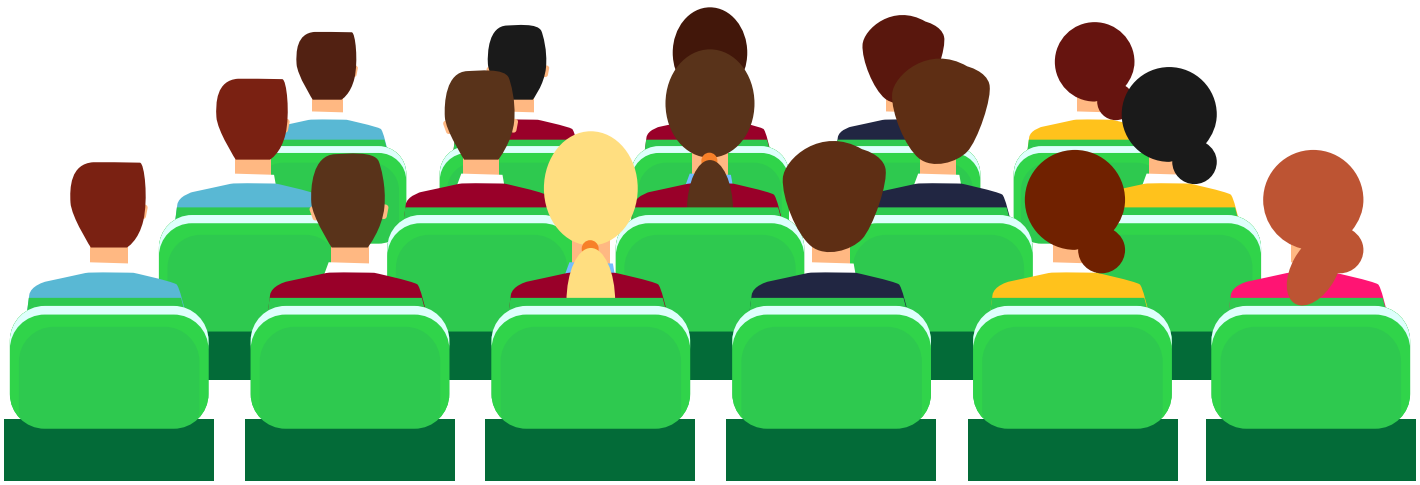
The planned scale for the number of trainings and trainees, as well as their territorial distribution are reasonable, proven to be realistic and well thought out, including the scope of regional cities and other settlements in the country.

Figure 10: Planned and actual number of students

	SY'17/18	SY'18/19	SY'19/20	TOTAL
Planned number of students	1,375	1,850	2,375	5,600
Actual number of students	1,648	1,996	2,179	5,823
	+19.9%	+7.9%		+4.0%

Source: TAS Planning for the future

Having in mind that the actual number of students from the previous period exceeds the pre-planned number by about 14% for the pre-COVID period (SY'17/18 and SY'18/19), we can conclude that TAS plans for the future are attainable and with high probability we can expect that the team will reach the goals for 2021-2024.



II. PROGRAM BACKGROUND

Since 2011, the Telerik Academy School has been the leading educational initiative developing the digital skills of children and young people in Bulgaria. During its work, the Academy has identified the need to train children and spark their curiosity and love for education transforming them from passive consumers of IT technologies to growth-minded professionals. By doing so, the Telerik Academy School aims to have impact on several levels – students, regions, business, and the whole country and its economy.

The main objective of the program is to provide free training to children from early ages to build the necessary skills and knowledge for a future career in the digital field. At the same time, the program aims to prepare the younger generation for the professions of the future, to foster their interest in learning, and to help make them digital leaders, sought-after professionals, and active citizens of tomorrow.

The development of digital skills, which is the core of the Telerik Academy School (TAS), is consistent with the vision and priorities of the America for Bulgaria Foundation, which has been supporting TAS since the 2017/2018 school year. The program has received two grants from ABF.

Figure 11: ABF Grant

Period of the grant	Amount of the grant	Share of the grant from the total project cost
January 2018 – January 2021 (36 months)	**1,100,000 BGN** (USD 628,000)	**52%**
January 2020 – January 2023 (36 months)	**930,000 BGN** (USD 521,944)	**29%**

Source: ABF/TAS project documents

On the level of individual student, the program offers free trainings that develop logical and creative thinking and a set of skills that prepare children not only for a career in a digital technology but, in a broader sense, for the jobs of the future. The broader opportunities for realization and advancement in careers should encourage young people to stay in Bulgaria and in their hometowns, which on the part of the local businesses, means that they will have skilled workforces that will help them grow. The preparation of a skilled workforce and support of local businesses and the sector with the highest added value will also have a positive influence on the whole country and its economy. As a whole, the program influences many stakeholders, like teachers, schools, parents, municipalities, and local communities.

The program has evolved during the years and currently consists of 7 training modules for two

age groups: grades 4-7 in Digital Science, Competitive Development, Game Development and Web Development and grades 8-12 in Digital Science, Game Development, and Web Development.

Figure 12: Expected outputs, short-term and long-term outcomes

Expected outputs	To establish functioning educational programs for students across grades with national coverage.
Expected short-term outcomes	To develop in its graduates sustainable interest in the Information Technology (IT) field after 1 year training and to increase the number of students that complete the training successfully.
Expected long-term outcomes	To maximize the number of graduates that continue their education in the IT field and/or are employed in the IT industry as a result of their participation in the program. To develop a sustainable TAS business model.

Source: ABF/TAS project documents

III. EVALUATION DESIGN AND METHODOLOGY

3.1 PURPOSE OF THE EVALUATION

The main objective of the contract is to conduct an impact evaluation of Telerik Academy School Program. The purpose of the evaluation is to determine whether the program has had the intended impact on the target groups.

3.2 SCOPE OF THE EVALUATION

The evaluation study is designed to provide answers to the following evaluation questions:

Q1. To what degree has TAS successfully implemented the program?

Q2. To what extent have TAS students improved their IT skills as a result of their participation in the program?

- What is participants' self-assessment of the skills developed?
- Do participants use these skills in further education and employment?
- What are their reasons for enrolment in program?

Q3. To what extent have TAS students developed a sustainable interest in the IT disciplines as a result of their participation in the program?

- Did the participation in the program change/develop interest in IT disciplines?
- Did the participation in the program change/develop interest in secondary and university education in the field of IT disciplines?

Q3.1. What has been the typical "student's journey" in the TAS and why? How many of the students have taken more than one course in the TAS?

- Is there pattern in student's participation in the program (correlation between choosing combination of modules vs. others)?

Q3.2. How many of the students have continued their IT education after their participation in TAS (in relevant high school, university, or another private academy)? To what extent has their participation in TAS contributed to their decision?

- What degree of education have they attained - professional bachelor/bachelor/master?
- Are there specialties that are more preferred by TAS graduates?

Q3.3. Are TAS graduates aged 18+ currently employed in the IT industry? What has been TAS contribution to the successful start of the career of those graduates?

- In what positions?
- What are their levels of income?

Q4. What has been the impact of the program on teachers' practices in their daily work at school, if any?

Q5. What are the sustainability prospects of TAS? Has the TAS done what they had planned to achieve in terms of sustainability and fund raising, and how successful have they been in achieving it?

- What is the business plan for development?
- Who are the biggest competitors?
- What is TAS unique selling point?

Q6. What are the main lessons learned for ABF from this investment?

3.3 METHODOLOGY

A mixed methods evaluation approach was used to depict the short and long term results and impact of the program.

1. Secondary data analysis - this method was used to review and analyze the grant`s interim and final reports and the quantitative data collected by Telerik Academy School, as has been provided by the Assignor. Through this method, the whole program was examined, its theory of change, expected outputs, short-term and long-term outcomes, implemented activities, and documented results achieved. The provided data was also used to identify the short-term effects of the program on both students and teachers and to evaluate the participants` satisfaction with the program.

2. Collecting primary data

- Quantitative survey among students that have participated in TAS: for the purposes of the evaluation a questionnaire was developed with the following content: demographic information, educational status, employment status, participation in TAS, participation in other programs/schools, social status, and standard of living.

- Quantitative survey among teachers that have participated in TAS: for the purposes of the evaluation a questionnaire was developed with the following content: demographic information, information about teaching career, difficulties encountered in TAS, skills developed, and outcomes of the trainings.

- Quantitative survey among parents of students that have participated in TAS: for the purposes of the evaluation a questionnaire was developed with the following content: demographic information, educational status of their child, employment status of their child, participation in TAS, and participation in other programs/schools.

- In-depth interviews with students that have participated in TAS were conducted.

- In-depth interviews with teachers that have participated in TAS were conducted.

- In-depth interviews with project team managing TAS were conducted.

The target groups are teachers, students, and parents of children who have participated.

For children aged 14 and bellow, parents were the primary respondents, and an additional simplified questionnaire was addressed to the children.

Figure 13: Sample size by target groups

Target group	Method	Respondents	Sample error
TAS students and alumni	Structured Questionnaire	420	4.7%
Parents of TAS students/alumni	Structured Questionnaire	517	4.2%
Teachers	Structured Questionnaire	63	2.2%
TAS students and alumni	In-depth interviews	20	-
Teachers	In-depth interviews	15	-

These samples were a good base for measuring the program impact and drawing conclusions on a general level. There were limitations on analyses within subgroups because in some cases the number of responses was insufficient for further analysis. Thus, the plan for analysis between cohorts and periods of the program was also limited.

Period of the fieldwork: teachers survey - 3 June to 5 July 2021; participant survey - 15 June to 5 July 2021; parent survey - 15 June to 5 July 2021; in-depth interviews - 11 June to 16 July 2021.

3. Case studies

Based on the in-depth interviews, six brief case studies of TAS participants were prepared. Three case studies present TAS alumni who are currently employed in the IT industry and for whom the TAS experience has played a key role for their professional orientation and successful career start. These case studies describe the path of the three TAS alumni from enrolling in the program, participation in it, acquiring knowledge and skills, completing the program and subsequent education and transition to employment. The case studies also present the factors influencing the path of the alumni and the role of the program. The other three case studies present TAS teachers, who regularly apply the knowledge acquired during the TAS training in their daily work at school. The case studies describe the process of acquiring this knowledge, its application in everyday work, and the results from it.

4. Description of typical "student's journey"

Based on the collected data from the surveys, secondary analysis of data provided by TAS, and in-depth interviews conducted by the evaluation team, a typical "student`s journey" through the TAS is described. The description outlines every step of the student from enrolling in the program to graduating from it.

5. Outcome mapping

Based on all collected information from secondary data analysis, quantitative surveys, and in-depth interviews, outcomes are outlined and structured in terms of expected outcomes vs. achieved outcomes based on the evaluation data. This allows the comparison between both and clearly shows if the implementation of the program has been successful in achieving its goals. This is also a base for the contribution analysis that shows the role of the program in the achievement of the outlined results.

6. Contribution analysis

This approach outlines the contribution that TAS has made to the achieved outcomes. The value of this analysis is that it gives a better understanding of why the results have or have not occurred, what was the role of the program in the achievement of these results, and what other factors played a role.

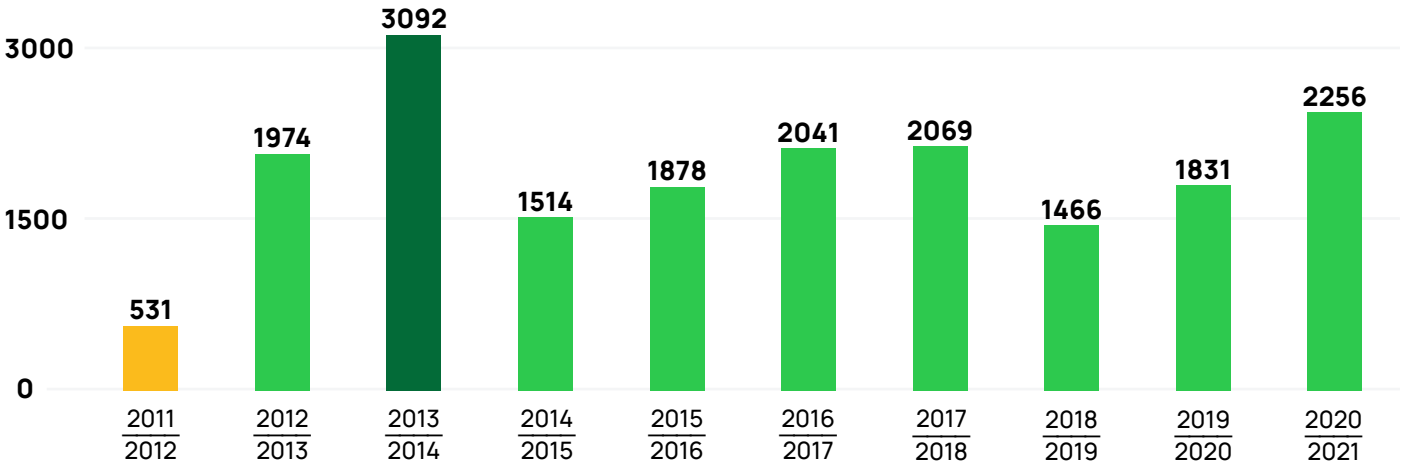
IV. FINDINGS AND ANALYSIS

4.1 PROGRAM IMPLEMENTATION AND RESULTS

Since 2011, TAS participants included 14,357 unique individuals who attended TAS courses. 5,553 (39%) of these were trained in the past three school years with ABF support. The cost of a TAS student was BGN 350, of which BGN 198 was ABF contribution.

The number of unique students per year increased gradually from 2014 to 2017, and, after a small decline, the trend again increased from 2018 to 2021. This trend followed the internal cycles and development of the program as well as changes in the program business model, management, and financing.

Figure 14: Number of unique students per school year



Source: TAS database

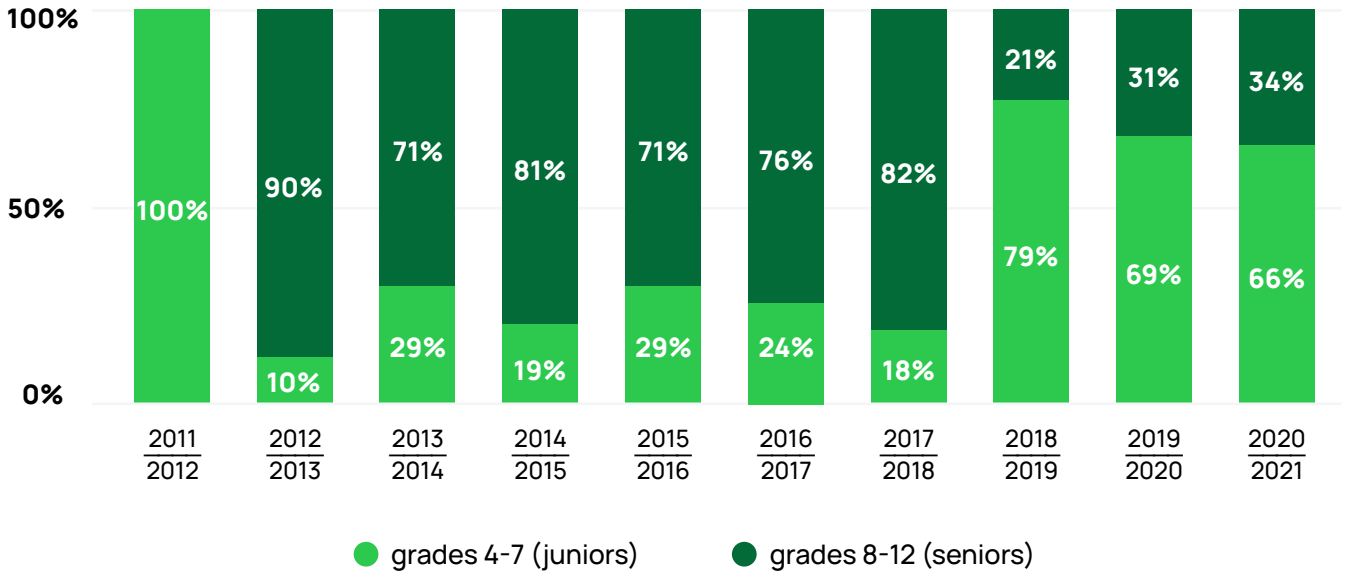
The average number of courses attended by a student was 2 (2.07) and the average number of hours was 108. There was moderate positive correlation between age of the students and the number of courses taken (r=0.279, p=.000).

This was based on the fact that courses for 8-12 grade students before 2017 were offered in small 25-hour modules, and also the fact that these cohorts have more years, respectively more chances to attend more courses.

ABF involvement has changed the profile of participating students. Before 2017, the majority of students attended courses for 8-12 grade (between 71% to 91% in different years), while after 2017, the majority of students were in 4-7 grade (79% and 69%).

This shift is very important and fits into the program goals as at early age skills formation is intense and program helped students' transformation from consumers into technological creators, developed their logical thinking and prepared them for the professions of the future.

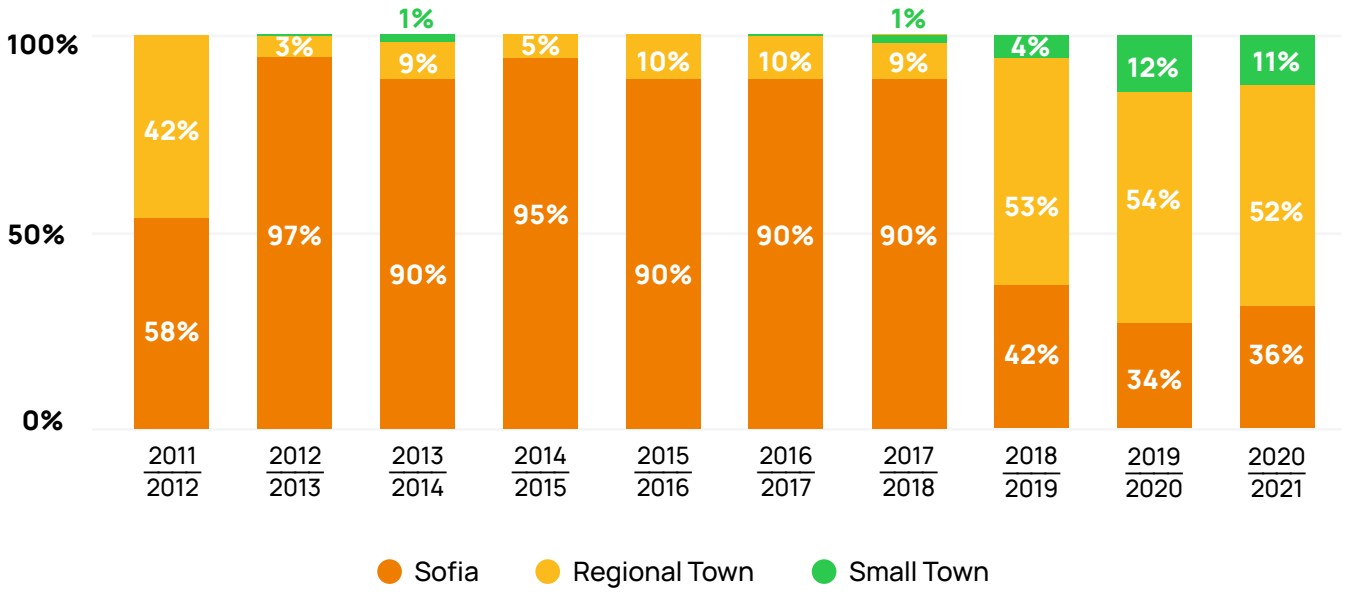
Figure 15: Share of 4-7 grade students and 8-12 grade students among total number of students



Source: TAS database

Since 2011, the program has been offered in 41 settlements on the entire territory of the country and covers the majority of regional cities (24 out of 27) and also 17 small towns, which contributes to better access of students from different settlements. In 2021, the program is offered in 31 settlements (among which 21 regional cities and 10 small towns). The spread of the program to regional and small towns is very significant after 2018, when ABF started to support the program. This totally changed the model of the program and completely fits its new goals. Still, the offering in some towns is relatively small compared to the potential users but by now we can conclude that the program performs well in terms of territorial coverage and content.

Figure 16: Share of TAS students by type of settlement for each school year



Source: TAS database

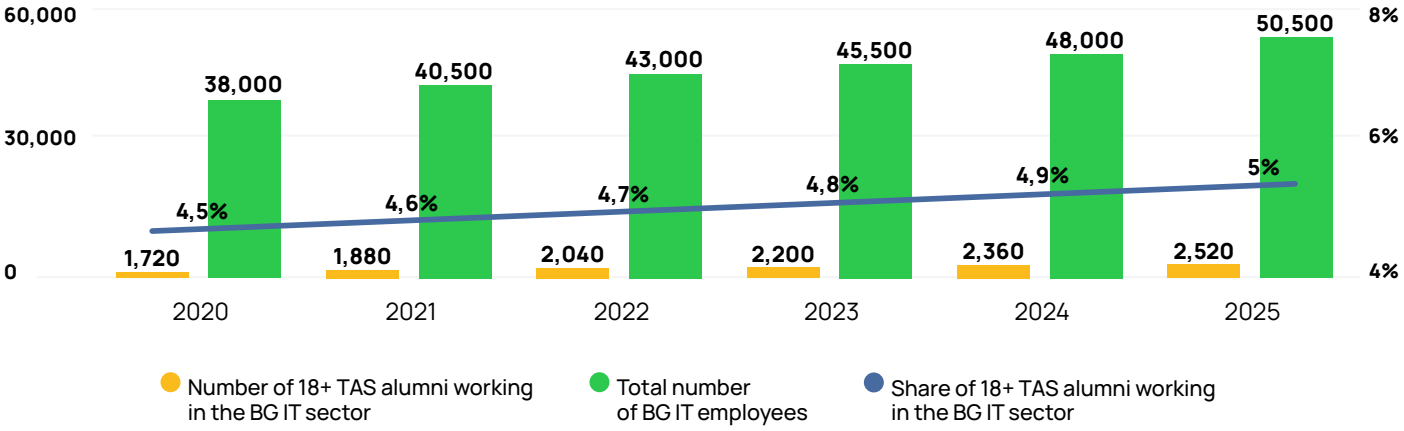
In 2020-2021 school year, the program had 65 teachers, 113 cohorts, and 2,256 (unique) students. It covered 0.4% of the total number of students 4-12 grade in Bulgaria, which for a small pilot program that offers training in a specific field and is privately financed, is a very good coverage. Also,

we must have in mind that according to expert estimation in the sector, the total number of IT specialists in Bulgaria in 2020 is 38,000[1].

It means that annual number of TAS students comprises approximately 4,5% of the actual workforce in IT sector and is very close to the number of annual new workplaces in the sector. That itself also shows the importance of the TAS program for the entire sector.

Based on TAS database and survey among participants we can estimate that the number of 18+ year-old TAS alumni is 29% of the total number of TAS students (4,160 TAS alumni). Among them, 57% are in employment, 78% of which (or 1850 alumni) work in a position related to computer technologies and programing[2]. Taking out the TAS alumni that work abroad, we can estimate that in 2021, TAS alumni who were in the labor market represented approximately 4,5% of the total employees in IT sector of Bulgaria. The others are still of school age. If the pace for growth of employees in the IT sector in Bulgaria keeps up, this share also can continue in coming years, when the new TAS cohorts will enter the labor market (assuming that the majority of the current 18+ TAS alumni who work will stay in the IT sector in Bulgaria and that approximately 10% of students from TAS cohorts are in the last years of their secondary education (11 and 12 grade) and enter the labor market in one or two years after completion of TAS courses[3]).

Figure 17: Role of TAS for IT labor market in 2020 and in the future (estimation)

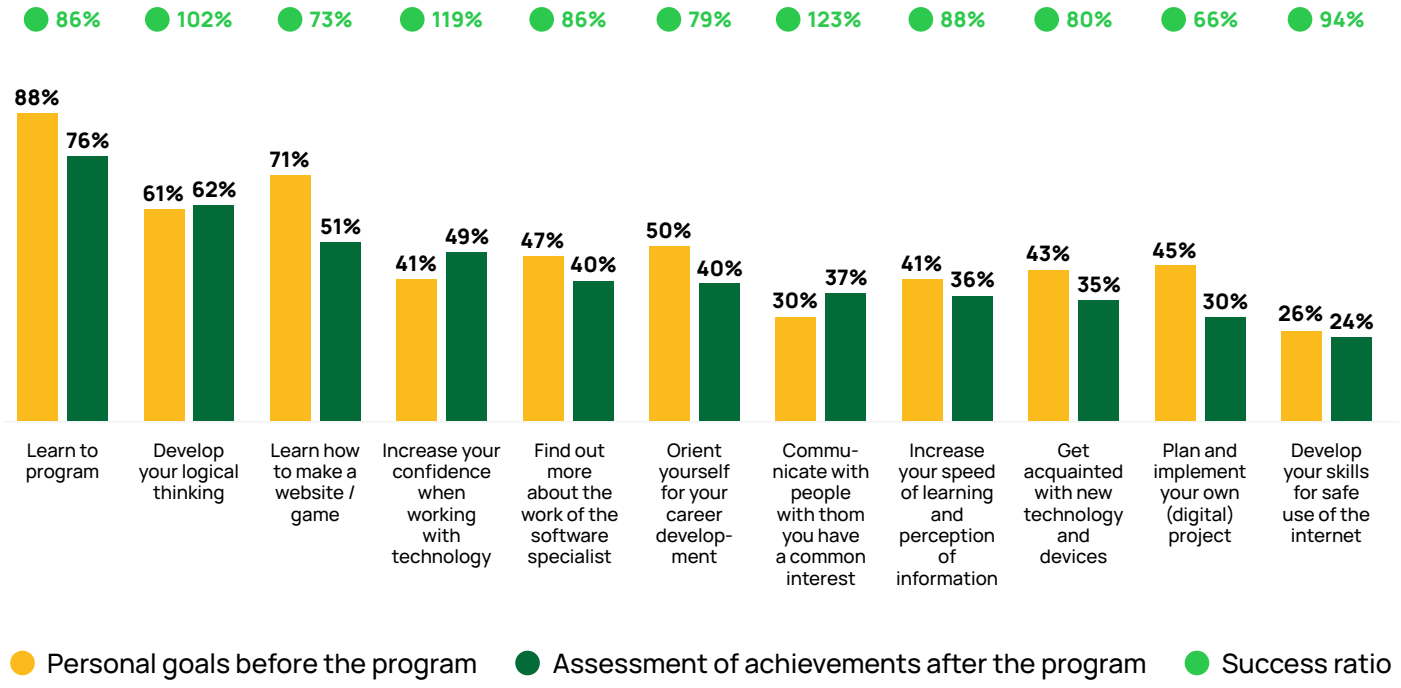


Source: own calculations based on BASSCOM data and TAS evaluation surveys and data

The self-assessment of personal achievement shows that the majority of the goals set by participants at the beginning of the program were achieved with high success ratio (calculated by share of those mentioned that they achieved the goal at the and over the share of those who set it at the beginning). In fact, 8 out of 11 goals were achieved by more than 80%. Only three goals were achieved with less than 80% but they are still high - success ratio over 66%. This means that the TAS program fit and met the expectations of the target students. This outcome can be further observed from the other surveys in the current evaluation that measure the skills developed and their usage in different environments, career prospects, and the role of the program.

[1] BASSCOM, Annual status report of the software sector in Bulgaria, p.7
[2] 93% of them worked in Bulgaria (approximately 1720 people).
[3] This share was stable in time.

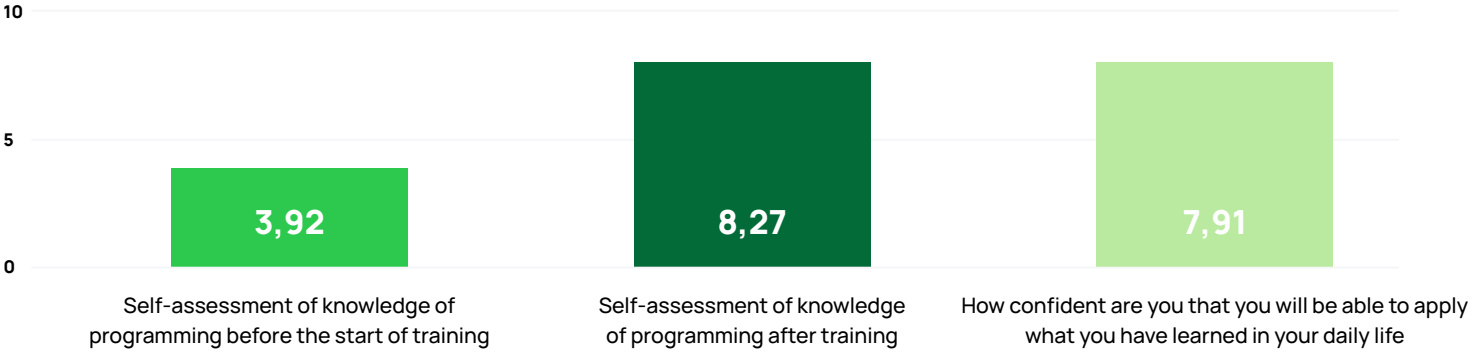
Figure 18: Personals goals set before start of the program and self-assesment of results achieved after the end of the program



Source: TAS survey among participants in 2018/2019 and 2019/2020 school years

The program added 4.35 points to the self-assessment of knowledge in programming of the participants as measured by a question on the student survey. In another question, students rated their confidence that they could apply what they have learned in life very highly (7.91 out of maximum 10).

Figure 19: Self-assessment of skills and knowledge before and after the program
(On a scale of 1 to 10)



Source: TAS survey among participants in 2017/2018, 2018/2019 and 2019/2020 school years

4.2. STUDENTS' JOURNEY

The successful implementation of the program and achievement of goals can also be illustrated through typical students' journeys.

65% of students attended only one course of TAS, 16% attended two courses, and 20% attend-

ed more than two courses. Some courses were short intensive trainings (of 25 hours/3 days), and this also leads to higher number of courses attended.

In general, the number of hours spent in TAS is another indicator that illustrates the intensity of the training and exposure of participants. It also indicates that individual students attended a limited number of TAS trainings. The reason for this is that the availability of courses outside of the capital city (Sofia) is not extensive and also that there is no upper level of the courses which makes the choice for advanced students limited. Some students need to repeat the course as their level and speed were lower than the others in the group. This also contributes to the share of students who did more than one course.

Figure 20: The interest in the program is high (2,000 and more participants per year)

39% [4-7 grade] Game development	**32%** [4-7 grade] Algorithmic programming	**16%** [8-12 grade] Game development
13% [8-12 grade] Web programming	**9%** [4-7 grade] Digital sciences	**7%** [8-12 grade] JavaScript programming
7% [8-12 grade] Digital sciences	**6%** [8-12 grade] Algorithmic programming	

Source: Survey among TAS students and alumni

Figure 21: The program is successful in developing sustainable interest in the IT field among students

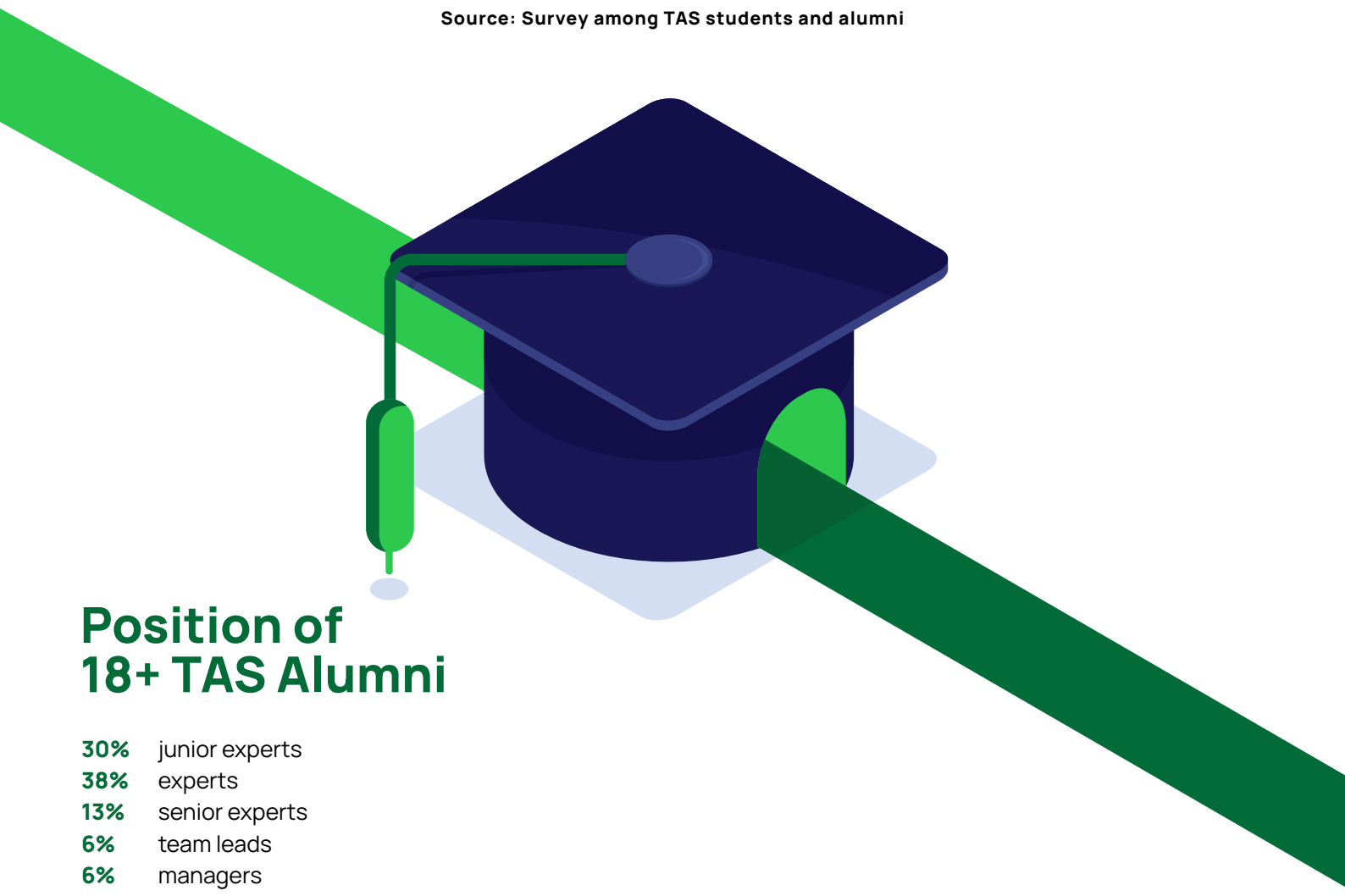
68% of juniors planned to apply in secondary school with mathematical, programing or technological profile.	**66%** of seniors were in secondary education with a profile in mathematics or programming.	**74%** of alumni completed secondary education with a profile in mathematics or programming.
54% applied knowledge and skills acquired during their training at the TAS in higher education.	**58%** of juniors and seniors, TAS helped them **realize** their interests in programming.	**38%** of juniors and seniors, TAS helped them **strengthen** their interests in the field of programming.
36% of juniors and seniors participated in programming competitions and Olympiads.	**79%** of juniors participated in mathematics competitions and Olympiads.	**64%** of seniors participated in mathematics competitions and Olympiads.

Source: Survey among TAS students and alumni

Figure 22: 18+ TAS alumni work in IT field

8% started to work while studying in secondary education	**7%** of those who graduated secondary school lived abroad.	**14%** earn between 1500-2500 BGN
57% of those who graduated secondary education were working	**14%** of 18+ TAS alumni who already graduated higher education obtained their diploma abroad.	**14%** earn between 2500-3500 BGN
78% of those who worked had a job related to computer technology and programming	**16%** of TAS alumni who were studying higher education were enrolled in university abroad	**13%** of 18+ TAS alumni already received net monthly salary that is higher than the net monthly average salary for IT sector in the country For 2020 net monthly average salary in IT sector in BG is 3344 BGN

Source: Survey among TAS students and alumni



Position of 18+ TAS Alumni

30% junior experts
38% experts
13% senior experts
6% team leads
6% managers
2% directors

Source: Survey among TAS students and alumni

The students' journey, current status, choices, and achievements show strong results of TAS for students and alumni in terms of:

- Further education in fields related to mathematics and programing both in secondary and tertiary education
- Participation in competitions and Olympiads
- Employment in IT sector
- Successful career start

Participation of TAS students in Olympiads and competitions further reveals their interest in mathematics and IT. One-third of the TAS trainees took part in Olympiads and competitions in coding. Participation in Olympiads in mathematics varied depending on the age group: 79% for juniors and 64% for seniors. 85% of the juniors and 67% of the seniors stated that attending Telerik Academy School has helped them perform better at competitions. In the last two academic years, TAS participants received 39 of the 64 award medals at national competitions. TAS trainees constituted 61% of the Bulgarian participants at the six international competitions in the past three years for which data was available.

As we will see from the TAS participant survey, the majority of students who participate in competitions and Olympiads share the opinion that the program helps them to perform better.

4.3. PROGRAM IMPACT ON STUDENTS

The program impact on students is presented by its effects on the three main student groups: 1/ juniors (TAS alumni who are currently in the grade 4th-7th), 2/ seniors (TAS alumni who are currently in the grade 8th-12th) and 3/ 18+ TAS alumni (former participants who were 18 years or older at the time of the assessment). In some analyses grade 8-12 students and 18+TAS alumni are analyzed by the grade level of courses they participated in (e.g. current 8-12 grade students who participated in TAS when they were 4-7 grade).

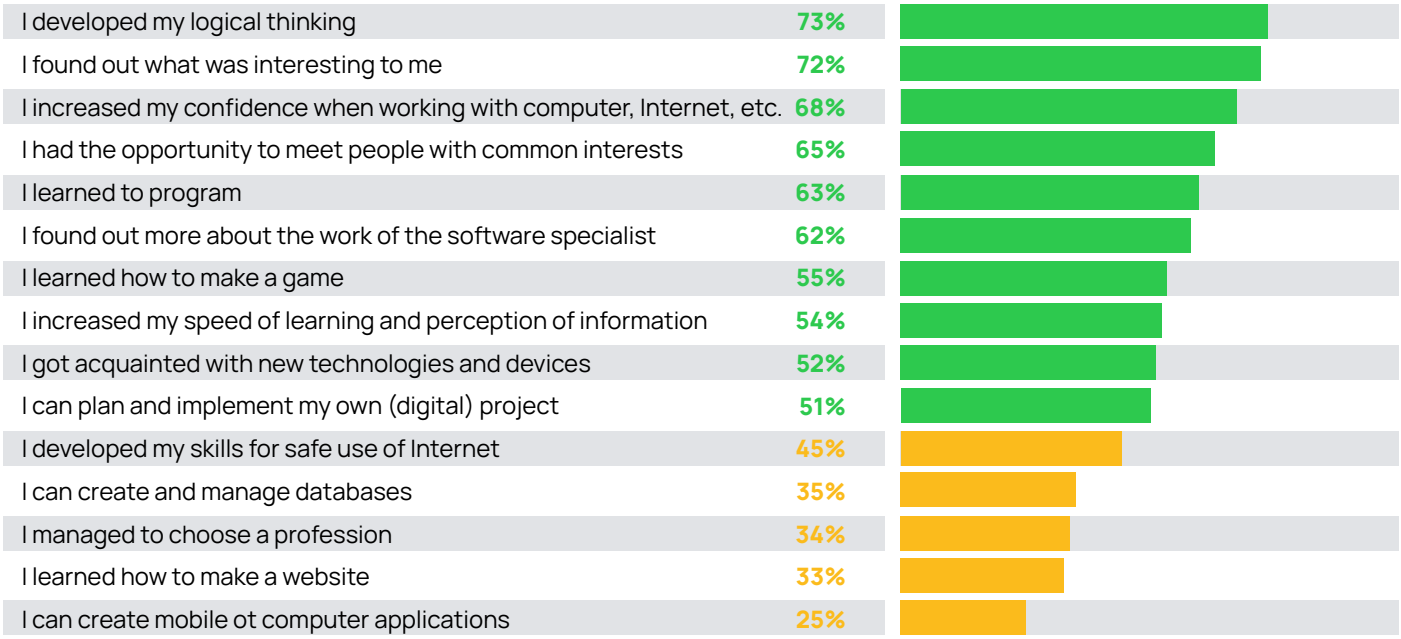
4.3.1. IMPACT ON GRADE 4-7 STUDENTS

4.3.1.1. Skills acquired through participation in the TAS programs

The Telerik Academy School Program contributes to the development of a wide range of skills among its graduates. The students in grades 4-7 self-reported average 7 skills and benefits that the TAS program provided. Compared to the older participants, this group benefited more in terms of skills, as they are in the beginning of their development in programming and computer science. Game development appears to be the most effective course in terms of developing the key skills (self-reported by grade 4-7 TAS students) – besides game development, this module more than the others helped students to learn programming, oriented them in computer world and its professions, and developed their logical thinking and their ability to plan and implement their own (digital) project.

Figure 23: Which of the following things did you manage to achieve as a result of your attendance/participation in Telerik Academy School?

(Base: grade 4-7 students, N=146)



Source: Survey among TAS students and alumni

Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

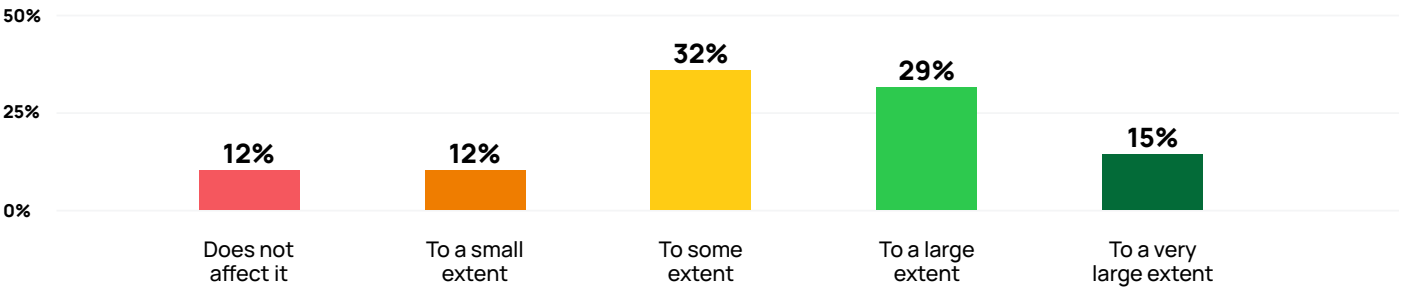
4.3.1.2. Role of TAS for pursuing secondary education in the IT field

66% of the TAS grade 4-7 students expressed interest in continuing their secondary education in the field of programing or mathematics (Figure 24d). The interest in programing and mathematics was equally split. For 75% of the grade 4-7 students, TAS had an impact on their plans where to apply after 7th grade (Figure 24a). For the majority of students, TAS helped them to realize their interest in programing and technology (58%), while for 38% it helped them to strengthen the interest they already had (Figure 24 b). The TAS students had also strong interest in continuing with computer systems and technologies in class or extracurricular activities and their participation in TAS contributed for it.

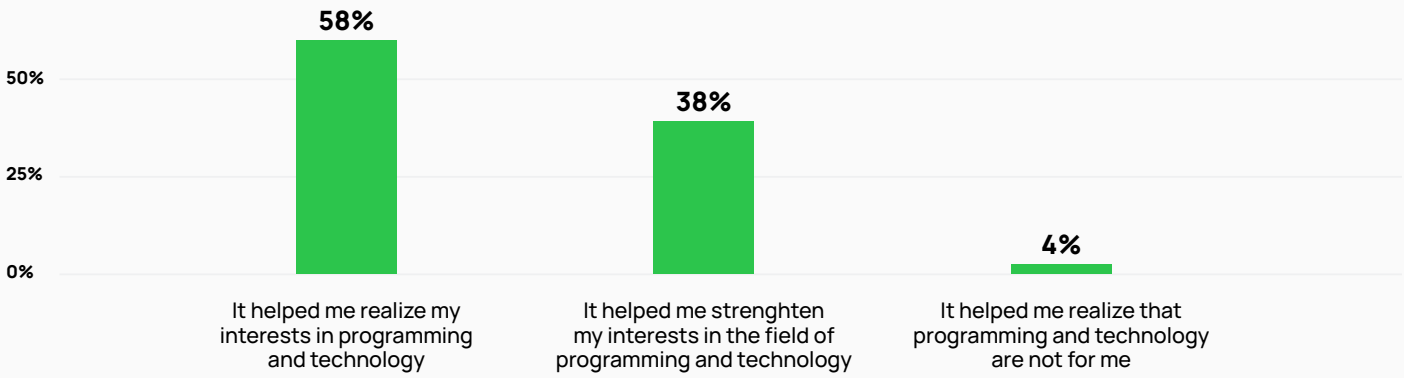
Figure 24: Grade 4-7 students' opinions regarding the role of the TAS program for pursuing secondary education in the IT field

(Base: 4-7 grade students, N=146)

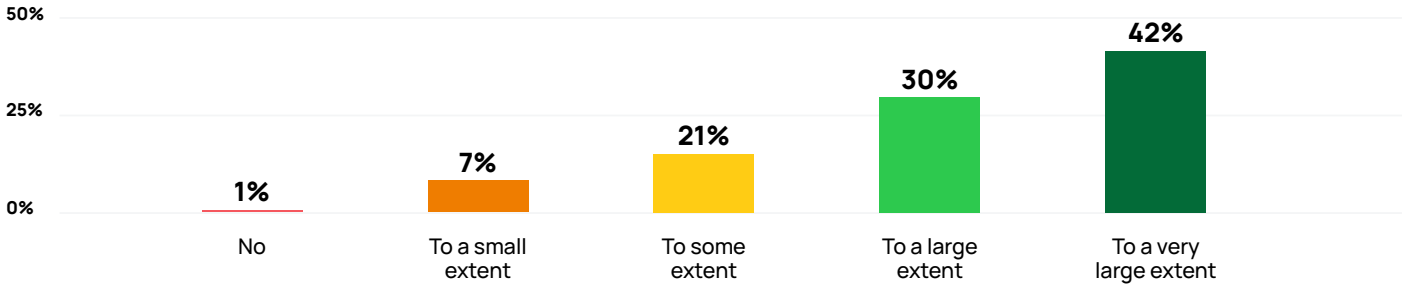
A. **To what extent has participation in the Telerik Academy School had an impact on your plans for where to apply after 7th grade?** (Answers among grades 4-7)



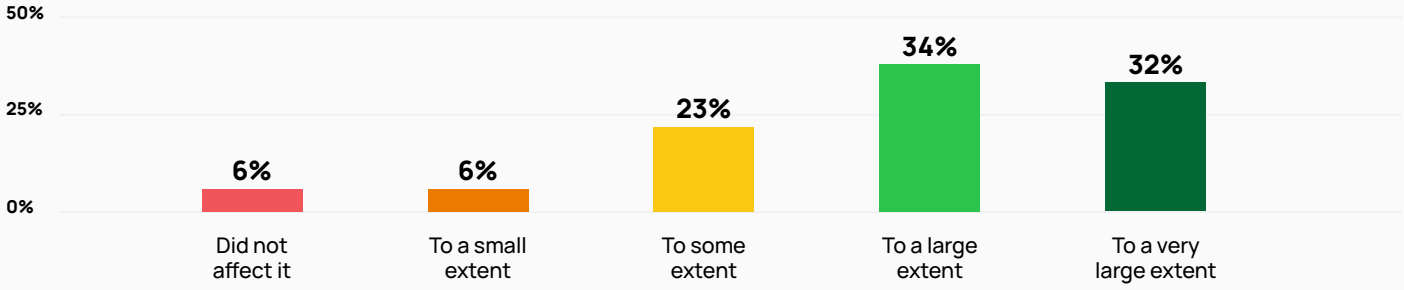
B. **How does your participation in the Telerik Academy School affect you?**



C. **To what extent do you want to continue with computer systems and technologies in class or extracurricular activities?**



D. **To what extent did your participation in the Telerik Academy School affected your plans to continue studying computer science in classroom or extracurricular activities?**



Source: Survey among TAS students and alumni

4.3.1.3. Participation of the TAS students in competitions and Olympiads

Approximately a third (33%) of grade 4-7 TAS students have participated in programming competition and Olympiads. This result speaks to their confidence of in participating in competitions that test out their programming skills. As the grade levels go up, the percentage of participation in programming competitions also slightly increases. For 8th to 12th graders that is 36.5%, and for those who have already graduated 12th grade the percent of participation in competitions is 37.7%.

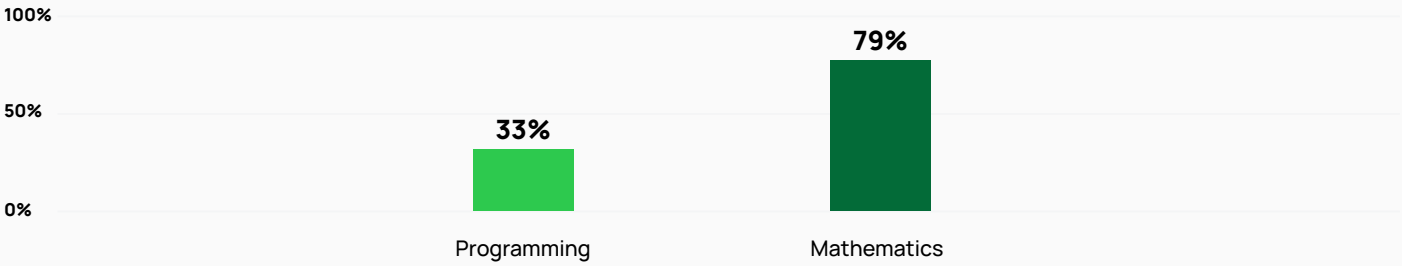
TAS helps mainly those students who participate in programming competitions and Olympiads (60% answer "yes" and 35% – "to some extent"), while those who participate only in mathemat-

ics competitions and Olympiads express moderate opinions regarding the role of the program in their performance in such competitions (27% "yes" and 51% "to some extent"). The share of those who participated in competitions and Olympiads in mathematics is bigger, but this is related to the availability of such competitions and Olympiads and the fact that there are traditions for these activities to be popularized (and to be suitable for) among wide number of schools and students. In fact, only a few students participated only in programming competitions and Olympiads - those who participate in programming competitions and Olympiads with 90-95% probability participate also in mathematics competitions and Olympiads. The opposite is not true – between 30-45% of each age groups are students of TAS who participate only in mathematics competitions and Olympiads and do not participate in programming competitions and Olympiads (this is related to tradition, communication and also organization of such events as well as if they are suitable for the majority of students who participate in TAS.

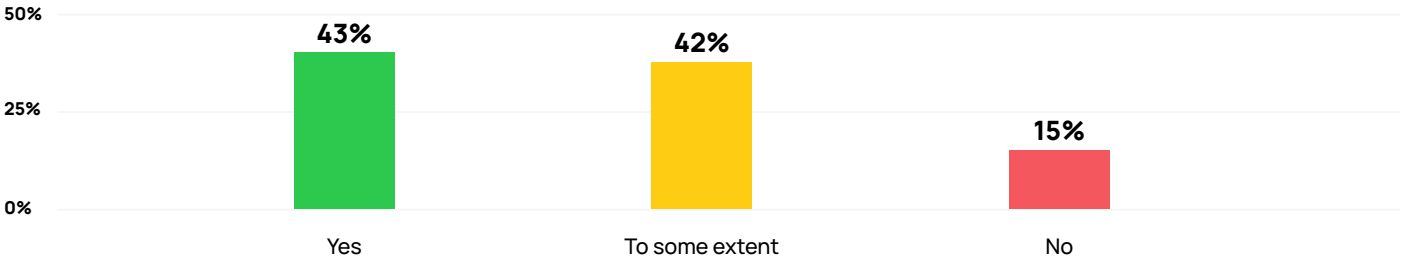
Figure 25: Participation of the TAS students in competitions and Olympiads

(base a: grade 4-7 students, N=146, base b: juniors that have participated in competitions and Olympiads, N=114)

A. **Have you participated in competitions and Olympiads?**



B. **Did what you learned at TAS help you to perform more successfully in programming and/or mathematics competitions and Olympiads?**



Source: Survey among TAS students and alumni

4.3.1.4. Parents' observations

Parents covered by the study present their own views on the effectiveness of Telerik Academy School through their children's experience in it.

The results of the survey among parents confirm the effects of the program measured by the other methods of the evaluation:

- Majority of students in recent years (after 2018) join the program for the first time when they are between 4th and 7th grade.

- Around 8-9% of students attend both 4-7 grade course(s) and 8-12 grade course(s).

- The most attended courses by 4-7 grade students are Game development and Algorithmic programming.

- The program helped students to realize their interests in programming and technology according to 55% of parents while 40% report that TAS helped their children to strengthen their interests in the field of programming and technology.

- According to the perceptions of the parents of students between 4th and 7th grade, the inclusion of their children in the program/programs of the Telerik Academy School influences the decision in which direction to continue their education. Over 85% of parents of students who are about to apply to a new school after 7th grade say that participation in TAS affects the planning and formation of their choice, and in 43.9% of them, it is in a large or very large extent.

- Students who are about to change schools after 7th grade are directed to high schools with a programming profile, Technological School "Electronic Systems" or mathematics high schools, including National High School of Natural Sciences and Mathematics. On the other hand, the parents of nearly a quarter of the youngest (4th grade) say that they have not yet made a decision for their child.

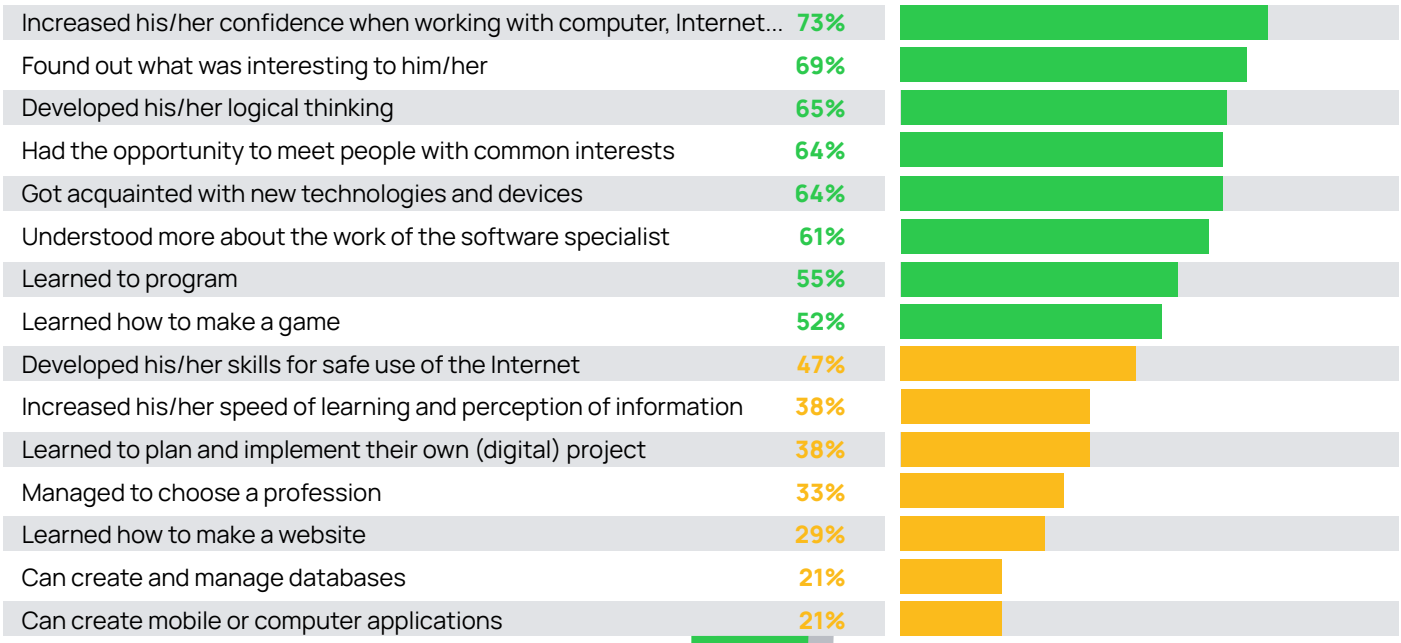
- According to 47% of parents TAS helped their students for competitions and Olympiads and other 37% report that it helped to some extent.

- Parents mention great variety of benefit for their children as a result of participation in Telerik Academy School. Beside programing skills including making a website, a game, the added value of TAS program of 4-7 grade students according to parents is that TAS's training increases children's confidence in working with computers and the Internet. Other positive aspects increasing children's speed of learning and perception of information and the opportunity to meet and communicate with people with whom they have common interests. According to the parents, the longer a child's stay in the program, the more positively it affects the development of specific skills.

- Extracurricular courses at Telerik Academy School are among top 7 factors that would influence career prospects of students according to the opinion of parents. Before TAS courses, according to the parents, are motivation and desire, skills, personal efforts and hard work, completed higher education and interests in computer science and mathematics.

Figure 26: Which of the following has your child managed to achieve as a result of visits/participation in Telerik Academy School?

(Base: Parents 4-7 grade, N=254)



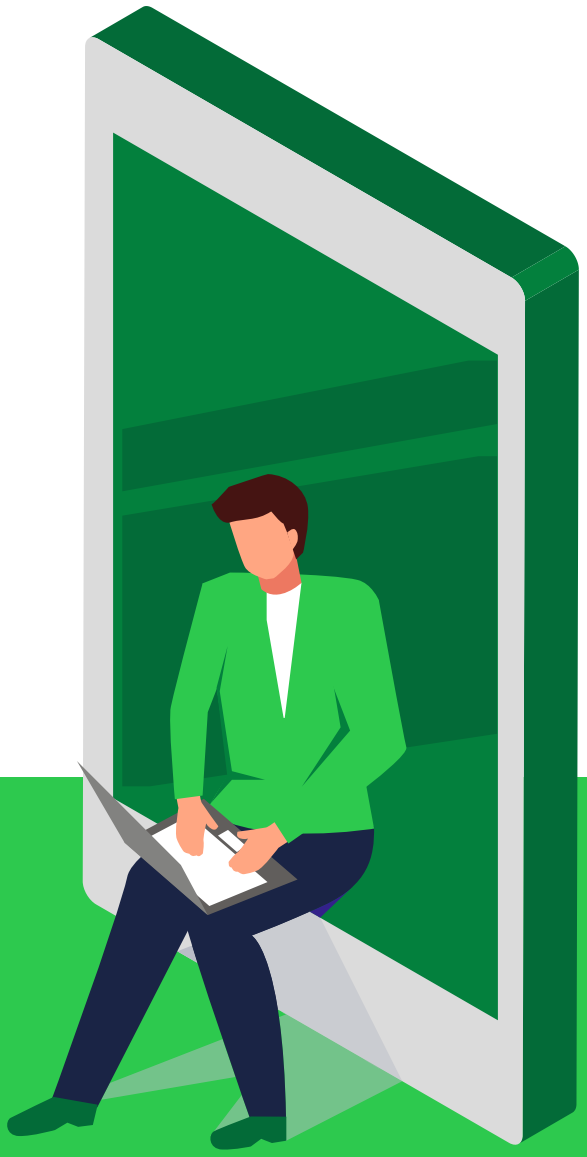
Source: Survey among parents of TAS students and alumni

4.3.1.5. Case studies

Alex

IT Veteran at 19

Alex was interested in technology before coming to the Telerik Academy School in 3rd grade, having taken computer sciences courses at the Sofia School of Mathematics starting at the same age and independently reading textbooks designed for higher grades. As a prominent student, Alex was attracted to the Academy by one of his Sofia School teachers who had moved to the Academy. Alex became a course assistant, helping students having difficulty. Alex conscientiously took on the role of assistant lecturer and helped anyone in need. He reports that his participation as an assistant teacher at Telerik helped him the most to develop his skills and knowledge. He has taken many Academy courses, which he credits with developing his knowledge of algorithms using C++ and competitive programming, but also skills for learning, communications, and teamwork. He started his first job at the age of 16 at Codix, had the experience of technology internships, and is now a student at Technical University-Sofia.



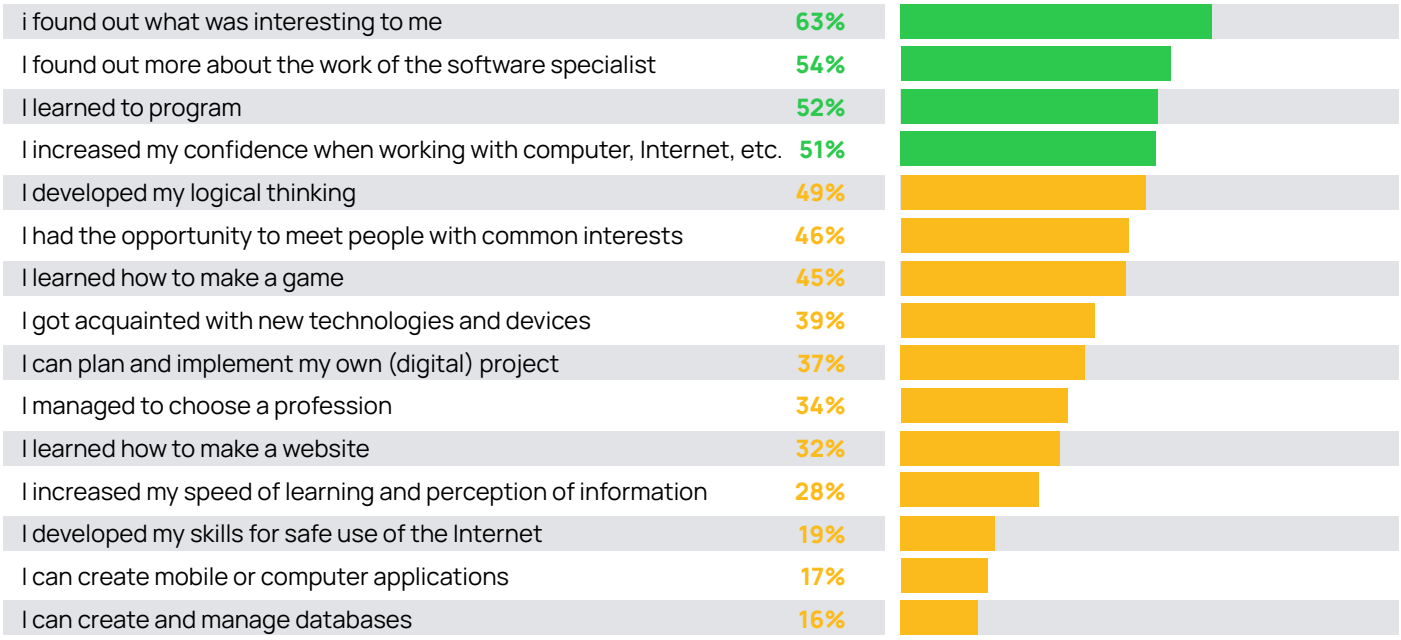
4.3.2. IMPACT ON GRADE 8-12 STUDENTS

4.3.2.1. Skills acquired through participation in the TAS programs

Like the junior age group of 4-7 grade, the 8-12 grade students also developed great variety of skills in TAS courses, but they self-report them with lower intensity compared to 4-7 grade students. The reason for this can be the fact that compared to the youngest group, 55% of the 8-12 graders participated in the program when they were only in grades 4-7, and their reflection on the effects of the program could have changed with time. Also, changes in the program could be reason for this difference. Grade 8-12 students had participated in 4-7 grade courses in the previous format of the program. Overall, the survey shows that the younger group associates the program more with specific skills and knowledge, while older group tends to self-report smaller number of skills. The change is less significant for 8-12 graders who already have more experience and one single program is less likely to influence their perception of how much they have learned.

Figure 27: Which of the following things did you manage to achieve as a result of your attendance/participation in Telerik Academy School?

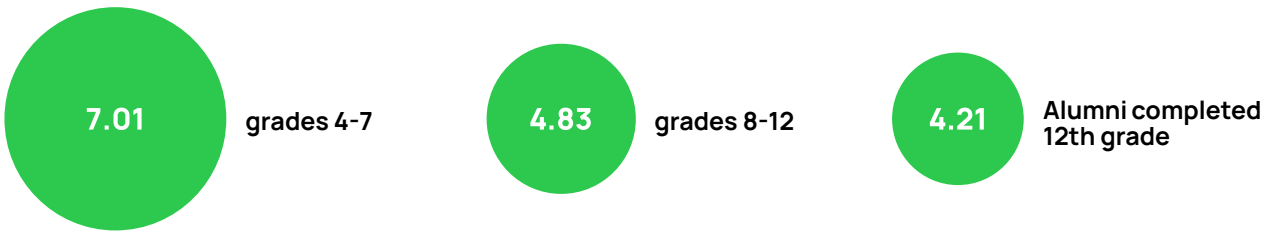
(Base: grade 8-12 students, N=151)



Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

Source: Survey among TAS students and alumni

Figure 28: Average number of skills self-reported by students and alumni



Source: Survey among TAS students and alumni

Calculations include only skills self-evaluated as 4 or 5 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

These results also depend on the specific courses attended and the courses offered (their content and composition), and the number of attendees in each type of course, and which exact years students attended TAS[4]. So, in addition to age group, the self-reported skills results are also dependent on the curriculum and learning content that was offered for different cohorts when and where. For example, the game development course was the main contributor for game development skills, and the share of participants in these courses determined the share of those who reported this skill. Besides the particular responses in terms of specific skills, the survey clearly shows that TAS program contributed for discovering personal interest in the field of IT, career orientation, and understanding of the work of software specialist.

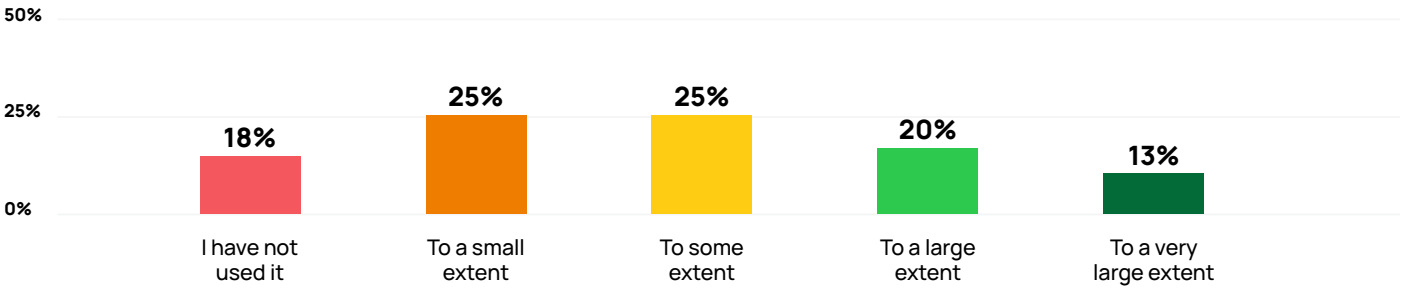
> **Comparing results between different age groups and cohorts, we can conclude that the impact on the grade 4-7 students is greater, as this is the age when key skills are formed and the change is more tangible, as well as this time being the tipping point in forming the personal interest and developing a base of programing skills for future development. The basic programing skills are developed in this age (logical thinking, key programing languages, etc.) while specific skills are developed in the later years.**

The knowledge and skills obtained from the TAS program are also transferable to other courses and projects at the secondary school where students study or studied in more than 50% of cases. (Figure 29)

Figure 29: Application of knowledge acquired in TAS programs

(Base: grade 8-12 students, N=151)

To what extent do/did you use what you learned in Telerik Academy School at various courses and projects at the secondary school where you study or studied?



Source: Survey among TAS students and alumni

4.3.2.2. Role of TAS for pursuing secondary and/or higher education in the IT field

As Figure 30c shows, the program boosted the interest of 8-12 graders in computer systems and technologies in class or extracurricular activities (87%) and helped them realize or strengthen their interest in programing and technology (96%, Figure 30b), but only affected to small extent the plans where to apply after 7th grade of those who participated before that in the program (32% - "did not affected" and 46% - "to small or some extent", Figure 30a).

[4] As the offering of TAS courses change in time

Students in 8-12 grades also would like to continue with computer systems and technologies in class or extracurricular activities. The TAS program affected to moderate extent their plans for where to apply after graduating from high school. Instead, it helped them realize or strengthen their interest in continuing in tertiary education in the field of programing and technology. 65% stated that they would choose a field related to computer technologies for their further university education.

> **Currently 7% of TAS students 8-12 grade are already employed.**

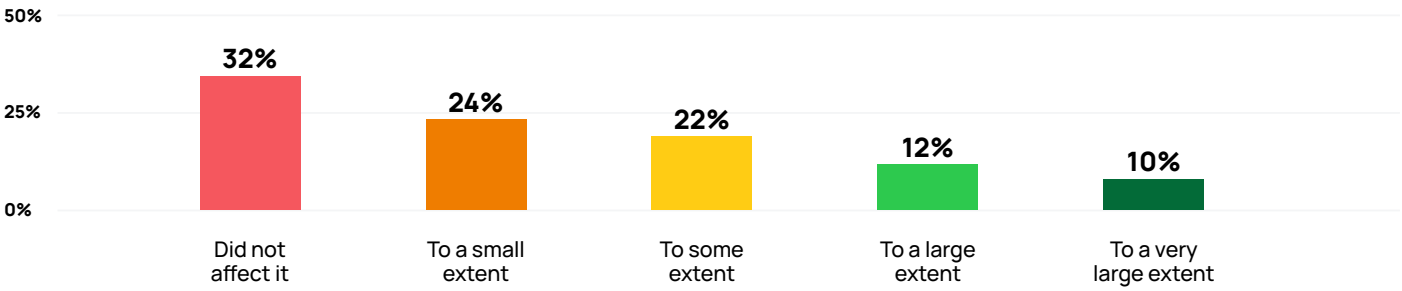
Students in 8-12 grades who attend or attended TAS program were currently studying in mathematics profile schools (41%) vs. 25% who were in programing in their secondary school. This is not so much a matter of preference but a matter of offering different profiles in the schools and locations in the country. This is another reason that the TAS program should continue to spread to regional and other towns and provide access to IT skills for young people.

> **66% of TAS students 8-12 grades are in secondary schools with profile in mathematics or programing.**

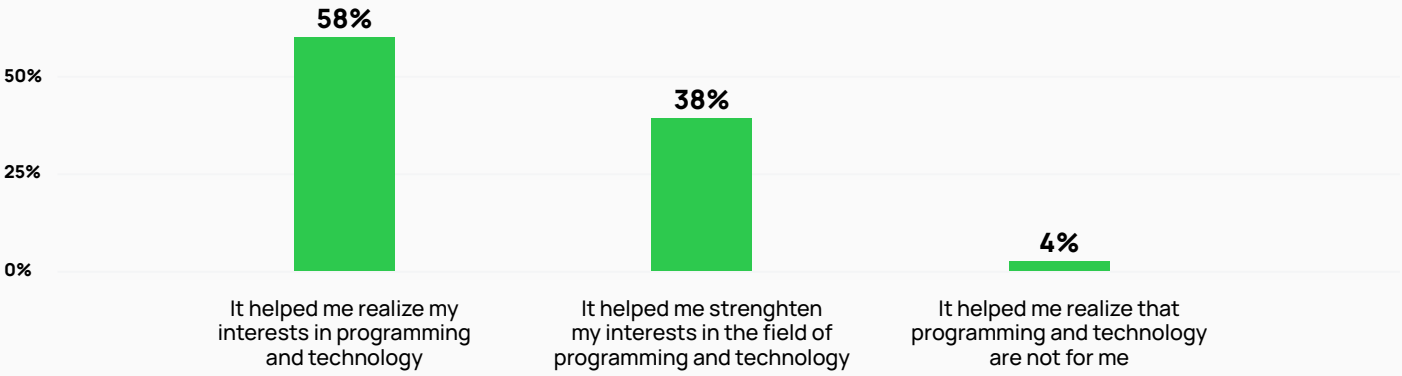
Figure 30: Role of TAS for pursuing secondary education in the IT field

(Base: 8-12 grade students, N=151), base a: grades 8-12 who participated in 4-7 grade courses, N=108)

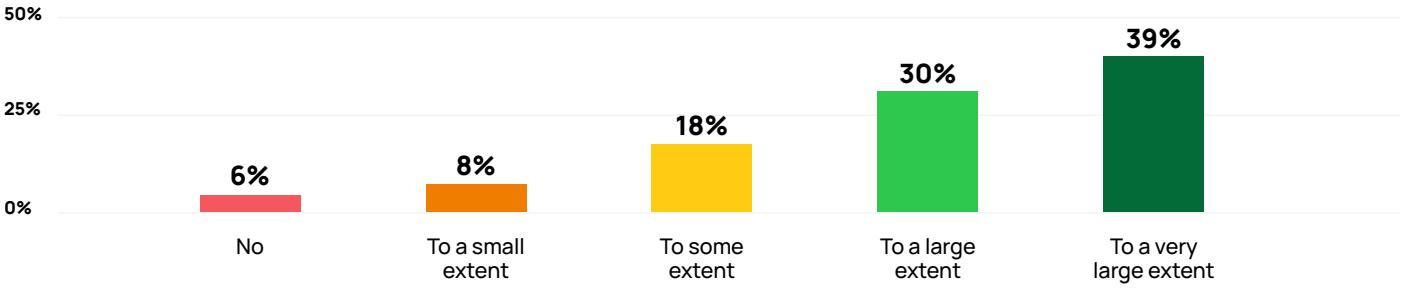
A. **To what extent did the participation in Telerik Academy School affect your plans for where to apply after 7th grade?**



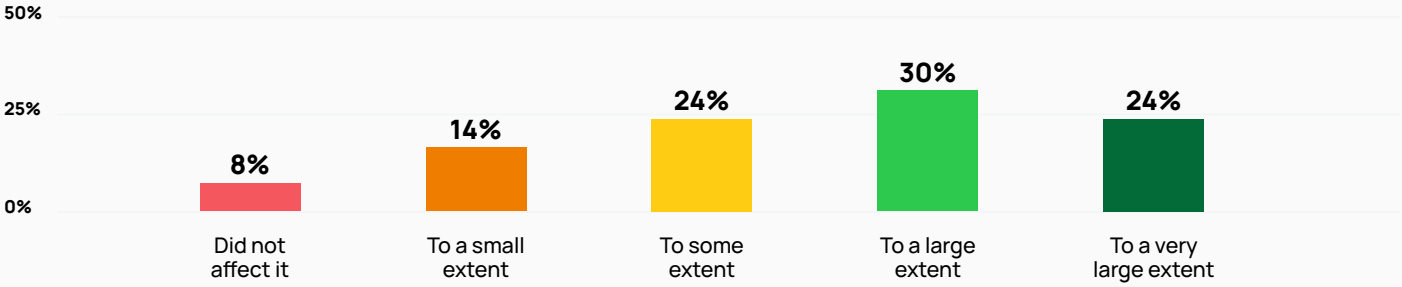
B. **How did your participation in the Telerik Academy School affect you?**



C. **To what extent do you want to continue with computer systems and technologies in class or extracurricular activities?**



D. **To what extent did your participation in the Telerik Academy School affect your plans to continue studying computer science in classroom or extracurricular activities?**



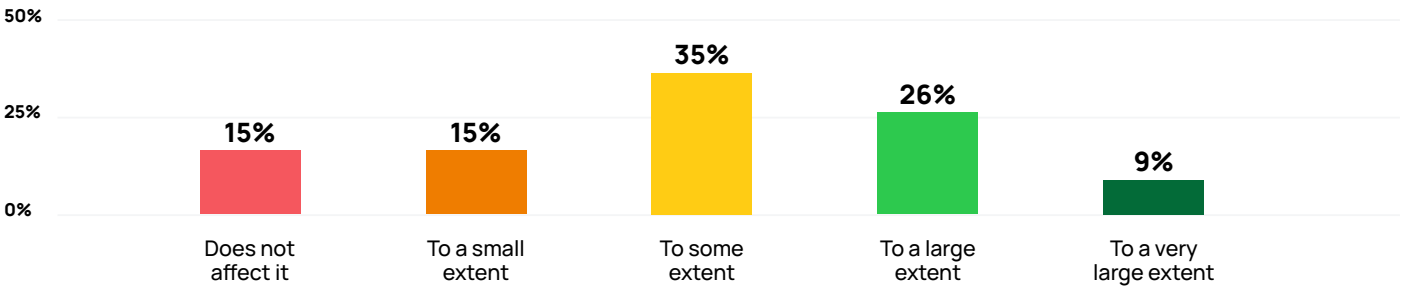
Source: Survey among TAS students and alumni

The TAS program affected to a moderate extent the plans of grade 8-12 students about where to apply after graduating from high school. 70% of the 8-12 graders responded with a positive answer but mainly in the middle points of the scale (3 and 4 in Figure 31). They expressed stronger opinions that they would like to continue with computer systems and technologies in class or extracurricular activities after they finish secondary school, Figure 30c.

Figure 31: Role of TAS for pursuing higher education in the IT field

(Base: grade 8-12 students, N=151)

To what extent does participation in TAS affect your plans for where to apply after graduating from high school?



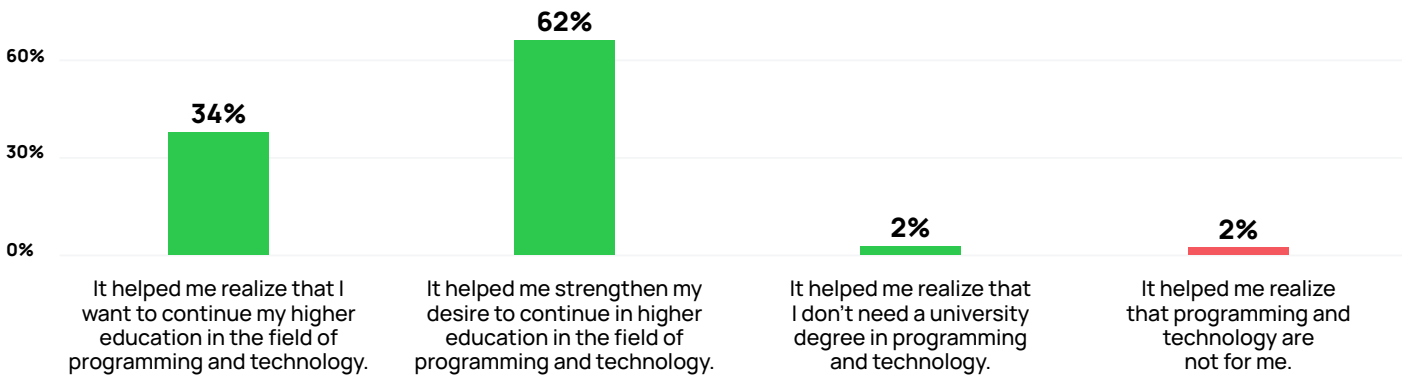
Source: Survey among TAS students and alumni

In fact, for this age group the TAS program helped the participants to realize their interests in programming and technology and also to strengthen their wish to continue in higher education in the field of programming and technology without being the primary factor for it.

Figure 32: Role of TAS for pursuing higher education in the IT field

(Base: grade 8-12 students, N=151)

How does your participation in the Telerik Academy School affect you?



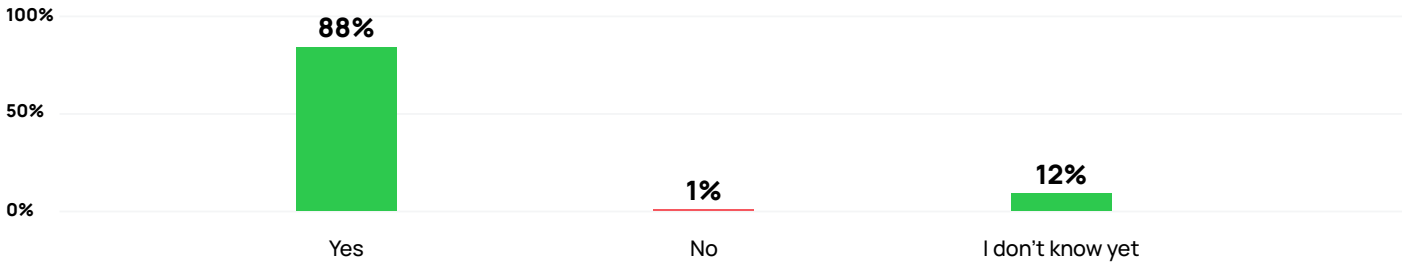
Source: Survey among TAS students and alumni

In fact, almost all participants (88%) would like to continue in university and most of the remaining 12% have not decided yet, Figure 33a. Two thirds of the 8-12 grade TAS students were sure that they wanted to continue in a field of higher education that is related to computer technologies. Those who hesitated are from all age groups and grades between 8 and 12 and are not concentrated predominantly among the junior group (Figure 33b).

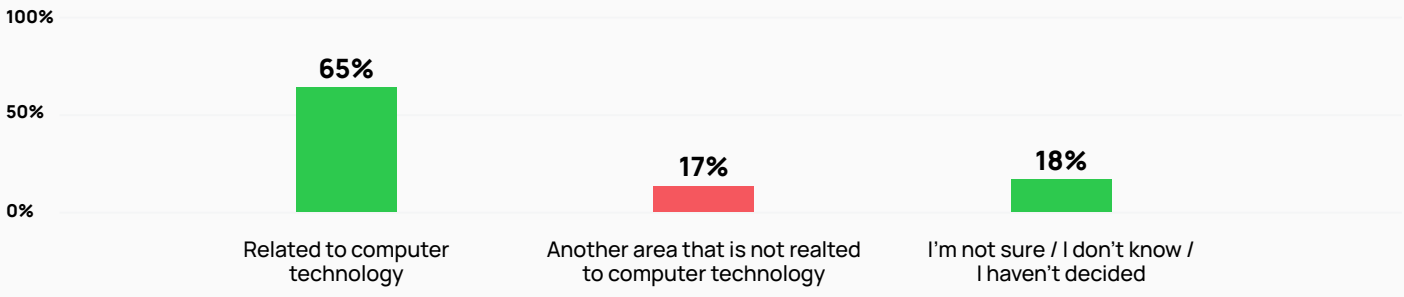
Figure 33: Plans for continuing higher education and chosen field of study

(Base A: 8-12 grade students, N=151; Base B: grades 8-12 who plan to apply or do not know, N=135)

A. **Are you planning to apply to a university?**



B. **Which field of higher education would you focus on?**



Source: Survey among TAS students and alumni

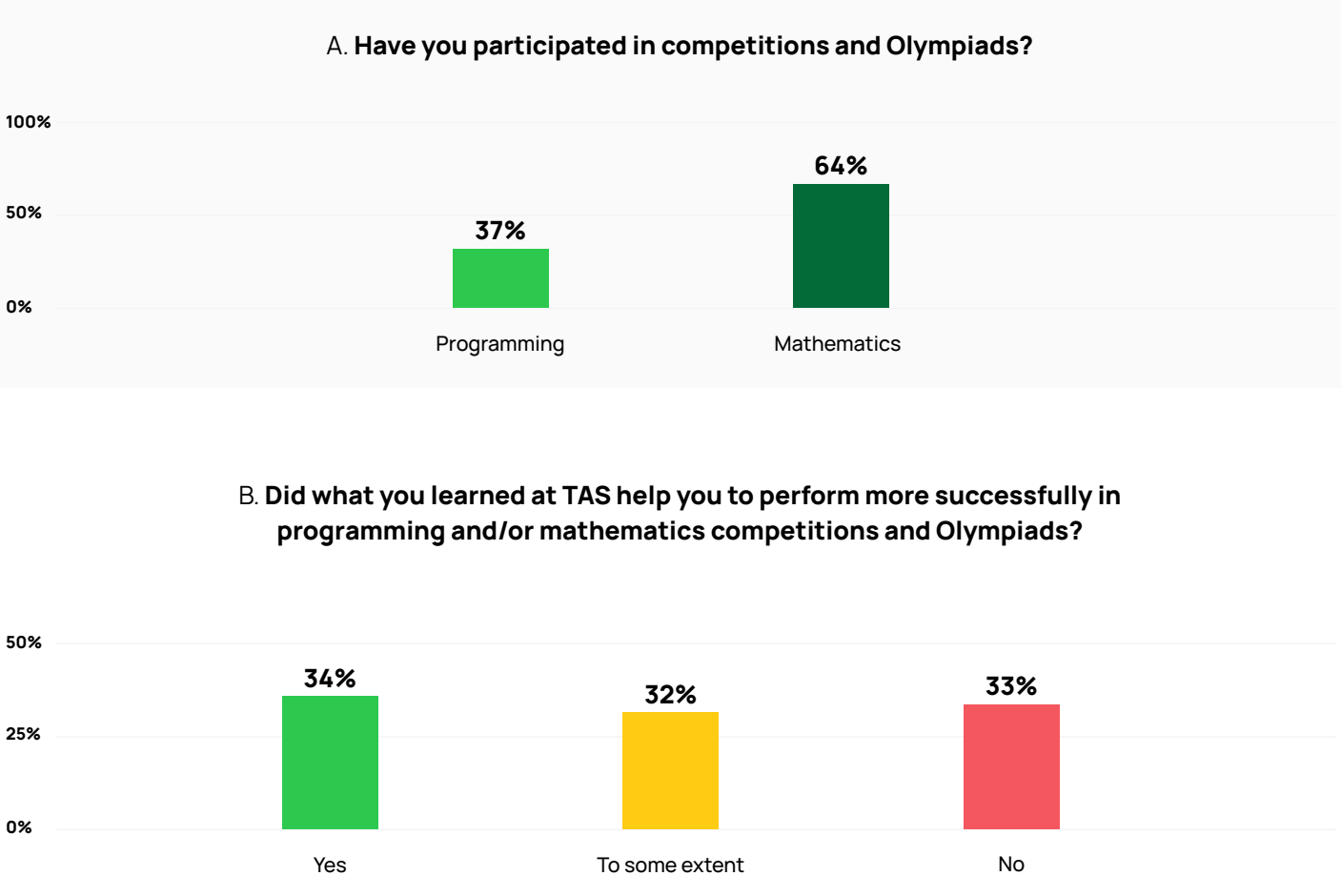
TAS alumni who are currently studying secondary education have indicated that they would mostly like to apply to a program that has something to do with computer technology (65%), 17% have decided to study something that has nothing to do with computer technology and 18% have not decided yet.

4.3.2.3. Participation of the TAS students in competitions and Olympiads

Like the other two age groups, students in grades 8-12 participated more in competitions and Olympiads in mathematics (64%) and less in programming competitions and Olympiads (37%). Those who participated in both were less than a third (27%). The participation in the competitions and Olympiads in mathematics was not dependent on the number of TAS courses taken. But participation in programming competitions and Olympiads was strongly related to the number of TAS courses taken. The more courses taken, the more likely students were to participate in programming competitions and Olympiads. The Telerik Academy School helped students to perform more successfully in programming competitions and Olympiads (57% - yes and 25% - to some extent") rather than mathematics competitions and Olympiads, but among the students that participated in the latter there were also positive effects from the program reported (30% -yes and 34% - to some extent).

Figure 34: Participation of the TAS students in competitions and Olympiads 8-12 grade

(Base A: 8-12 grade students, N=151, Base B: grades 8-12 who participated in competitions and Olympiads, N=96)



Source: Survey among TAS students and alumni

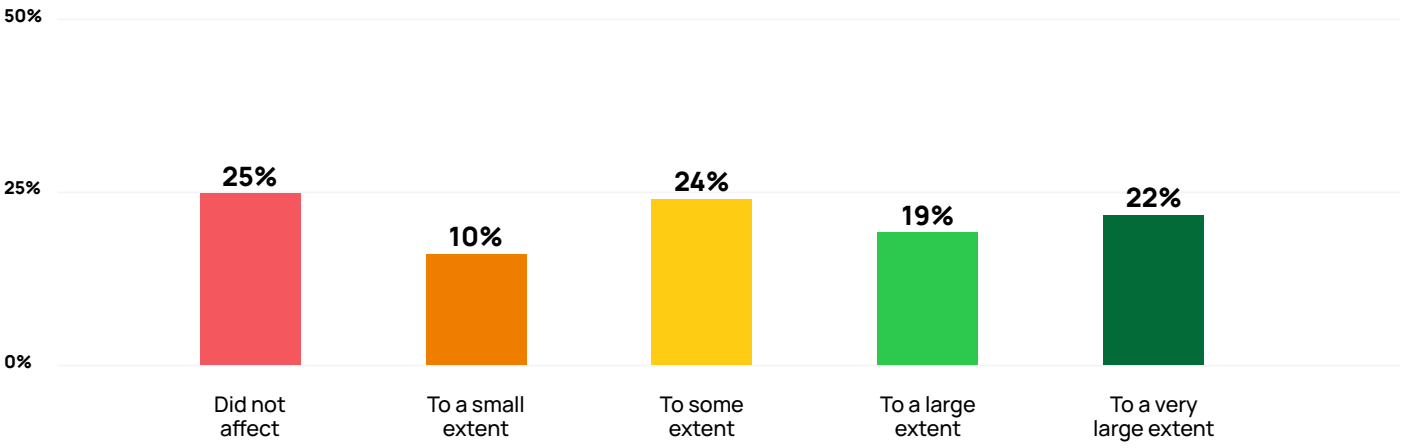
4.3.2.4. Parents' observations

The survey among parents of TAS students shows that the children who are between 8th and 12th grade, regardless of when they first joined the academy, study predominantly in mathematics high schools or high schools with a programming profile. Isolated cases of parents indicate that their children are educated on their own, at home, or in a school with an art profile.

Among those already in high school (current students in grades 8-12) who participated in the program for the respective age group, the majority of parents (75%) indicated that the academy has contributed to the choice of where the children should continue their secondary education (Figure 35). For a quarter of these older students, participation in the academy didn't affect the choice of high school, and most often the parents indicated that after 7th grade they continued their secondary education in a language high school with only a language or other additional profile in mathematics and programming.

Figure 35: To what extent has the participation of your child in Telerik Academy School had an impact on your child`s plans about where to apply after seventh grade?

(Base: Parents 8-12 grade, N=235)



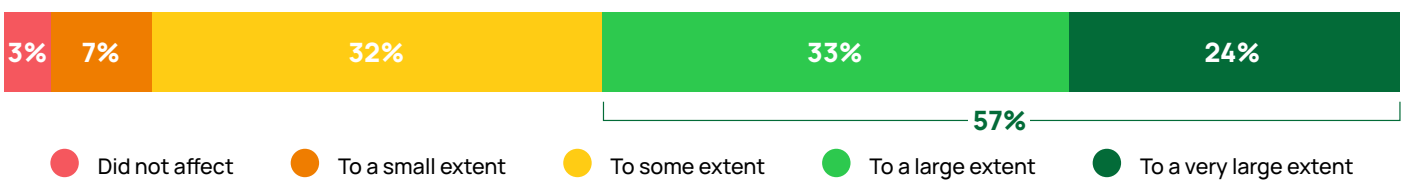
Source: Survey among parents of TAS students and alumni

The parents who indicated that the participation in the academy had an influence on their choice of the particular educational institution, they were asked to determine whether, continuing in the TAS program, also affected their plans for where to apply after high school. 90% of the responding parents are categorical that the program influenced post-secondary plans. (Figure 36).

Figure 36: Parents opinion regarding the impact of TAS program on child's plans for post-secondary school

(Base: Parents 8-12 grade, N=235)

Impact on your child's plans about where to apply after high school

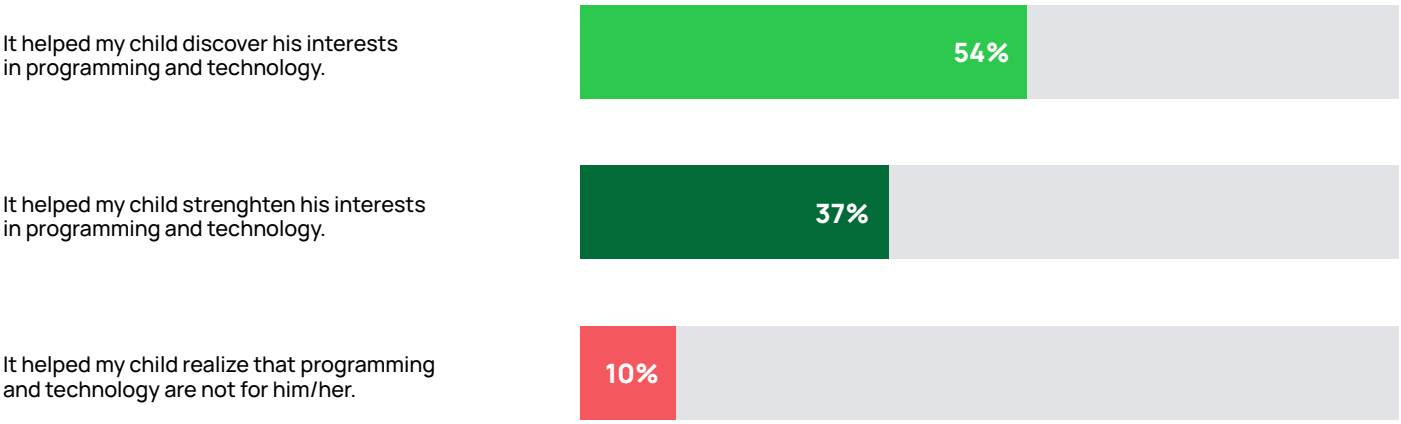


Source: Survey among parents of TAS students and alumni

Apart from the fact that we understand from the parents' answers to what extent the program/ programs of Telerik Academy School influenced their children's future plans for further education, they also provided information about the direction of this impact. For students between 8th and 12th grade, for whom participation in TAS has had the strongest impact, over half of parents indicated that thanks to the program their children have realized that they have an interest in programming and technology. Over a third of the parents reported that participation in the program contributed to the strengthening already identified interests. Less than 10% of the parents believe that the program helped their child understand that programming and technology are not for them.

Figure 37: Impact as a result of the child's participation in Telerik Academy School

(Base: Parents grade 8-12 , N=235)



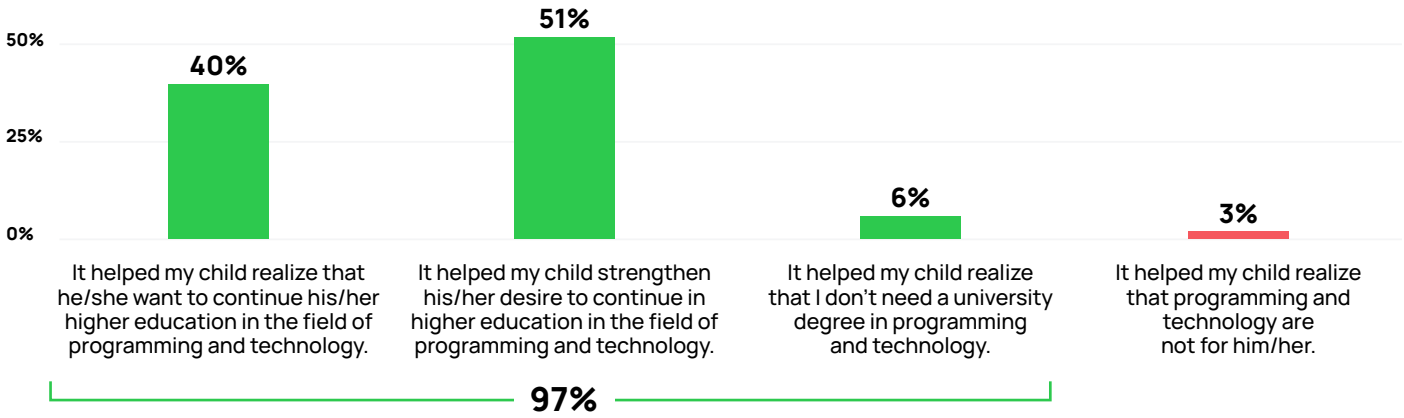
Source: Survey among parents of TAS students and alumni

Especially for high school students (grades 8-12), inclusion in age-appropriate programs of the Telerik Academy School contributed to the desire to study programming and technology during higher education. The vast majority of parents confirmed that being in the program contributed to strengthening the desire to continue higher education in the field. Small percentages of cases reported that participation in the training modules convinced the student that there is no need for higher education to be successful on the labor market in the field of programming and technology or that their child has realized that the areas studied are not of interest to him/her.

The overall assessment of the parents is that their children have developed basic digital skills while attending TAS classes and performing the tasks assigned to them. The majority of parents agree that, in addition to providing knowledge in a fun and interesting way, the program achieves increased interest and motivation in children, encouraging their creative thinking and developing their learning skills. Parents of grade 4-7 students reaffirm that training at the Telerik Academy School is an occasion for the child to discover interest in information technology. Parents of students between 8th-12th grade and those who have already completed their secondary education are more likely to point out that their children have become more independent in the preparation of their tasks, as a consequence of their program experience.

Figure 38: Impact on higher education plans as a result of the child's participation in TAS

(Base: Parents 8-12 grade, N=235)



Source: Survey among parents of TAS students and alumni

4.3.2.5. Case studies

Boyana

Finding her career

Boyana started at the Telerik Academy School with Java and TypeScript courses in 8th grade. This laid the foundation for a programming career, and she found that the Academy standards were challenging, but the experience focused her and made her work harder. She built a strong basic knowledge in the courses, but also needed to pursue more learning in her spare time to deal with more complex topics. The additional efforts she made during the training gradually introduced her to many topics in greater depth. The Academy helped her to know what kind of programming she wanted to do and which language to pursue. Boyana reports that it was the Academy that helped her discover her career interests. Today Boyana is pursuing a Bachelor's degree in Computer Science at one of the best universities in the UK. She is currently completing her year in industry/placement year as a Software Developer at IBM.

4.3.3. IMPACT ON 18+ TAS ALUMNI

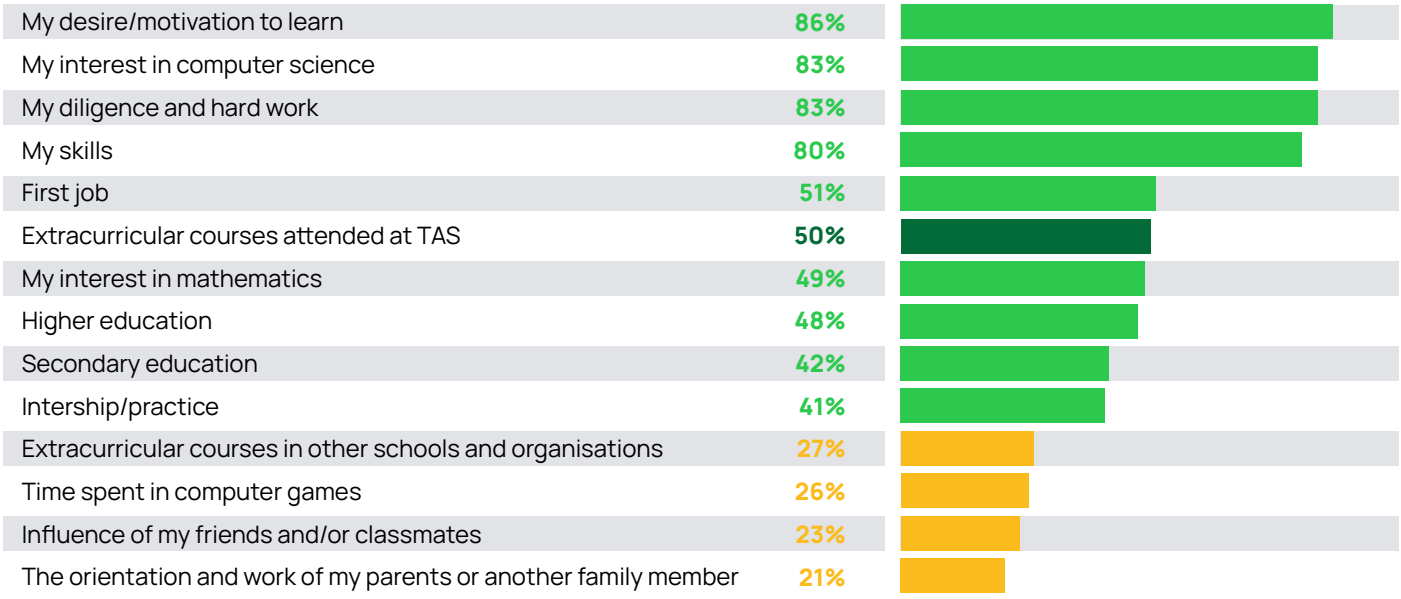
4.3.3.1. Factors that influence the career development of the TAS students

TAS is in the middle range of the factors that influence the career development of the TAS students. The top four factors, each rated as highly significant for more than 80% of students[5], are personal skills, personal efforts and personal interest in computer science (motivation, desire, diligence and hard work, etc.). The second group of factors are in the 50% range. These include first job, TAS courses, interest in mathematics, higher education, secondary education, and internships. It means that beside personal factors, TAS courses are very important.

Figure 39: Factors that influence the career development of the TAS students

(Base: 18+ TAS alumni, who completed 12th grade and work in the field related to computer technologies, N=54)

Which of the following do you think helped you to succeed?



Source: Survey among TAS students and alumni

Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

The third group of factors are shared between 20-30% of TAS students and they are other extracurricular courses, computer games, influence of friends and classmates or another family member. It is interesting to mention that extracurricular activities in other schools and organizations are mentioned almost two times rarely than TAS (27%/50%).

4.3.3.2. Skills acquired through participation in the TAS programs

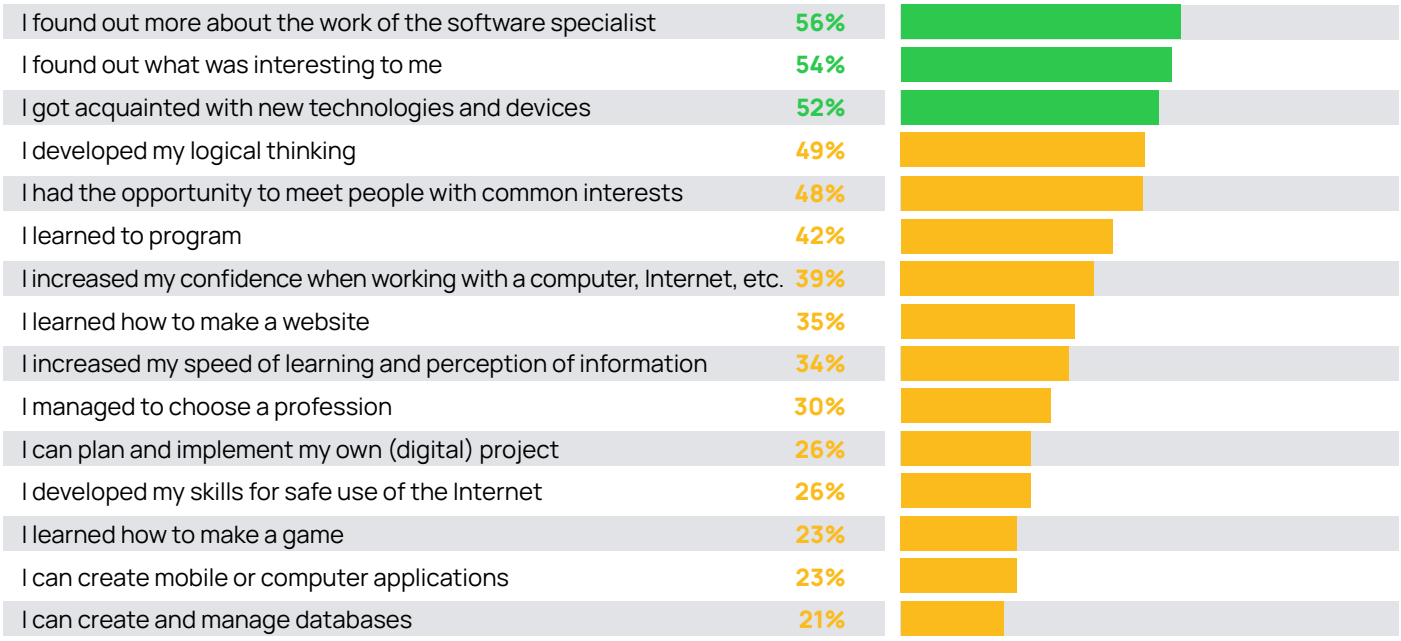
Similar to grade 8-12 students, the skills self-reported by 18+ alumni are mainly in career orientation, test of personal interests, and improvement of digital skills all over 50%. Opportunities to communicate with people with similar interests and logical thinking are mentioned as achieved by almost half of the respondents. This shows that TAS provides a lot of opportunities for stu-

[5] Those who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 is very high extent.

dents at school age for developing in the field of IT. Finally, the specific skills which are the focus of TAS courses are mentioned by between 20% to 42% of the respondents, but the total share of participants mentioning at least one of these skills is high (80% for juniors, 70% for seniors and 61% for 18+TAS alumni mention some specific for the training skills). See Figure 40.

Figure 40: Which of the following things did you manage to achieve as a result of your attendance/participation in Telerik Academy School?

(Base: grade 8-12 students, N=151)



Source: Survey among TAS students and alumni

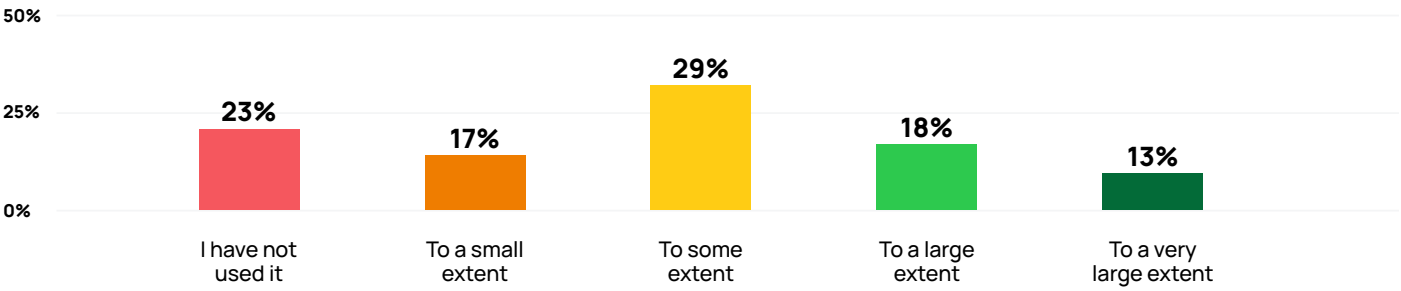
Share of respondents who score 5 and 4 on a scale from 1 to 5, where 1 is a very small extent, and 5 - very high extent

The 18+ alumni indicated that they used the skills and knowledge acquired in TAS in secondary (60%) and university education (54%).

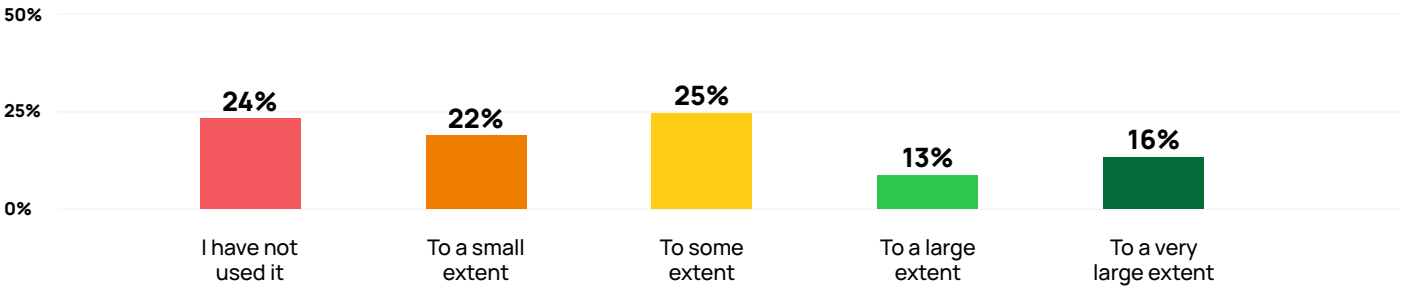
Figure 41: Application of skills obtained in TAS

(Base: 18+ TAS alumni, N=123)

A. **To what extent do/did you use what you learned in Telerik Academy School in various courses and projects at the secondary school where you study or studied?**



B. **To what extent do/did you use what you have learned in Telerik Academy School in various courses and projects at a university where you study/studied?**



Source: Survey among TAS students and alumni

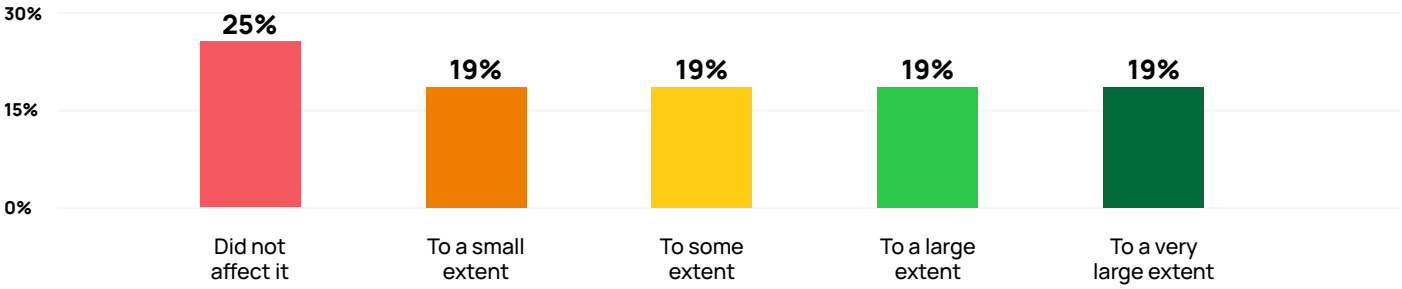
4.3.3.3. Role of TAS in pursuing secondary and/or higher education in the IT field

In fact, TAS gives opportunities for young people to try different programing skills and to test their interest in computer science. The program's effect on the decision whether to pursue secondary and/or higher education in the IT field was moderate with one third being highly influenced and 25% claiming that program did not affect their choice. For some students this decision is apparently more influenced by other factors, such as parents' interests, student predispositions, and interests before their enrolment. The program had a strong influence on students' realizing their interests in programing.

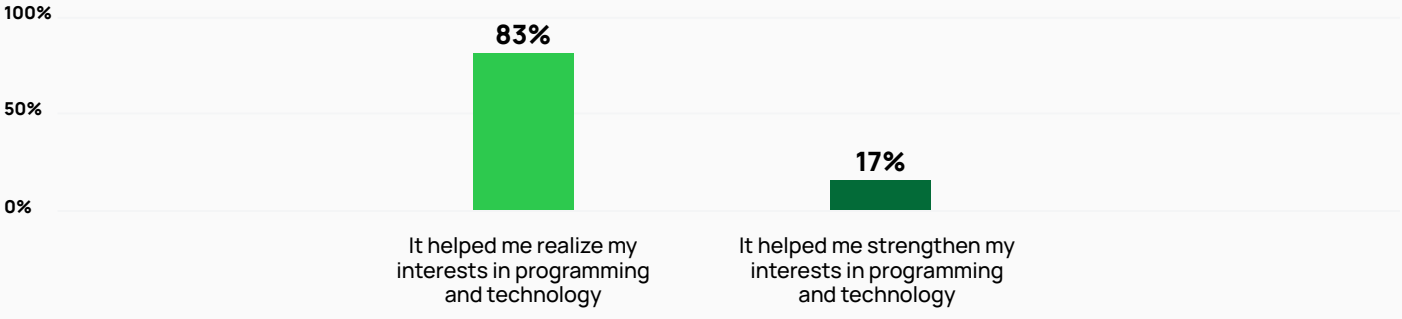
Figure 42: Role of TAS for pursuing secondary education in the IT field

(Base: 18+ TAS alumni, N=123), 18+ TAS alumni who participated in 4-7 grade programs, N=18)

A. **To what extent did the participation in Telerik Academy School affected your plans for where to apply after 7th grade?**



B. **How did your participation in the Telerik Academy School affect you?**



Source: Survey among TAS students and alumni

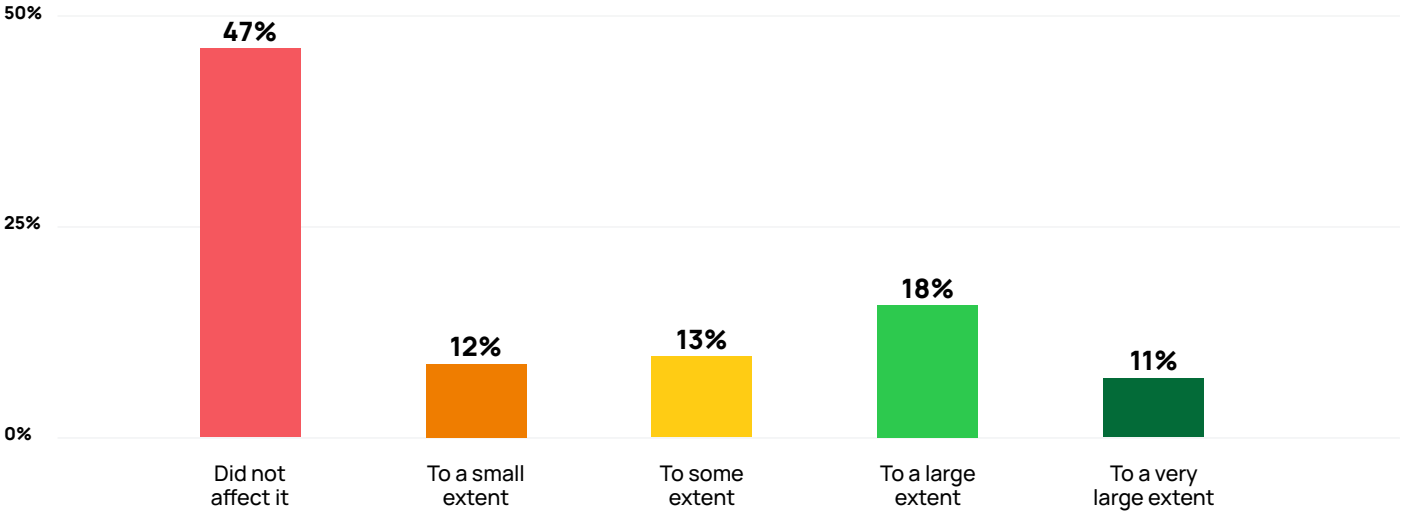
The proportion of those who studied or graduated in a specialty related to computer technology was high. Three fourths of 18+ alumni who were currently studying were in higher education in the field of computer science. Among program alumni, 51% of the bachelor's degrees and 33% of the master's degrees obtained were in the field of computer science. Of the TAS alumni who were not continuing their studies but planned to, 63% indicated that they would like to continue in a specialty related to computer technology. This is similar to the share of TAS alumni who are in secondary education and who have indicated that they would mostly like to apply to a program that has something to do with computer technology (65%).

From 26 students who are currently enrolled in bachelor's degree programs only 19,2%[6] were not enrolled in IT focused programs.

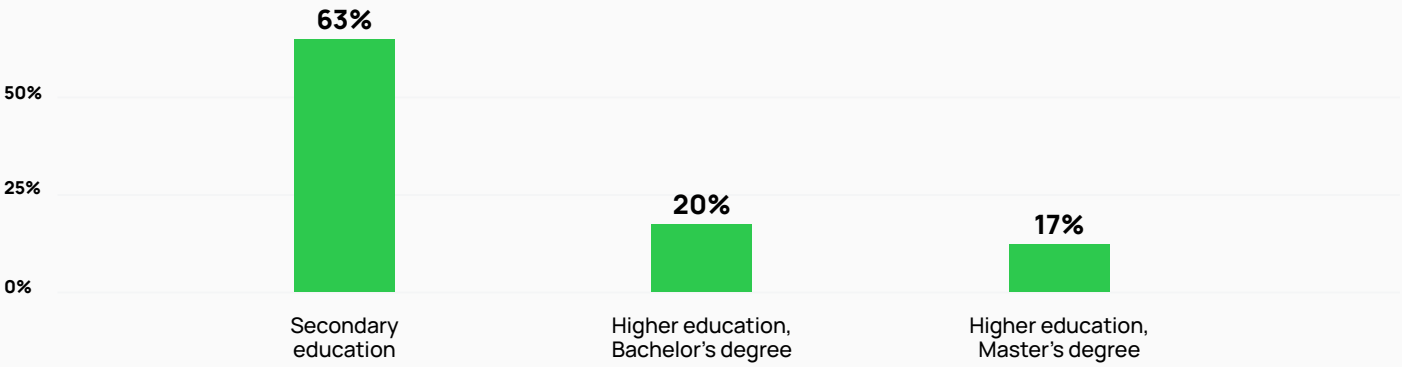
Figure 43: Role of TAS for pursuing higher education in the IT field for 18+ TAS alumni

(Base: 18+ TAS alumni, N=123)

A. **To what extent did participation in Telerik Academy School affect your plans for where to apply for tertiary education?**

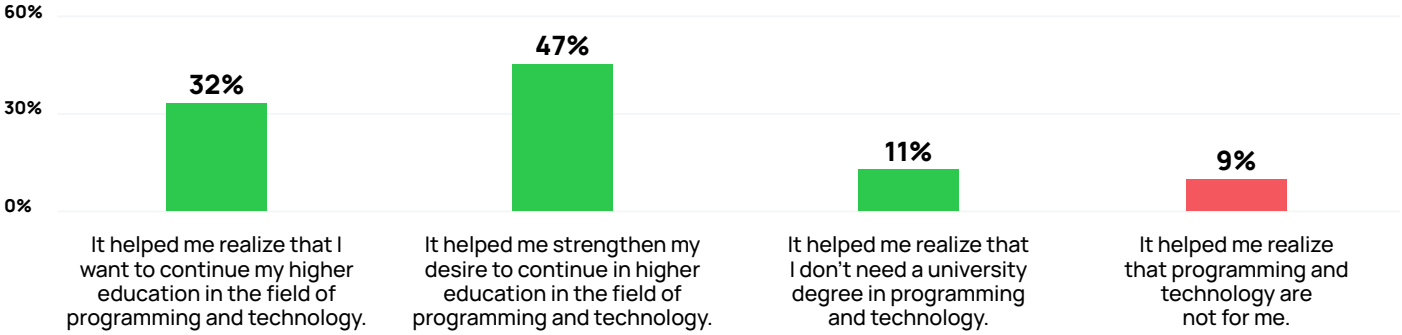


B. **What is your highest level of education?**



[6] 5 people

C. **How did your participation in the Telerik Academy School affect you?**



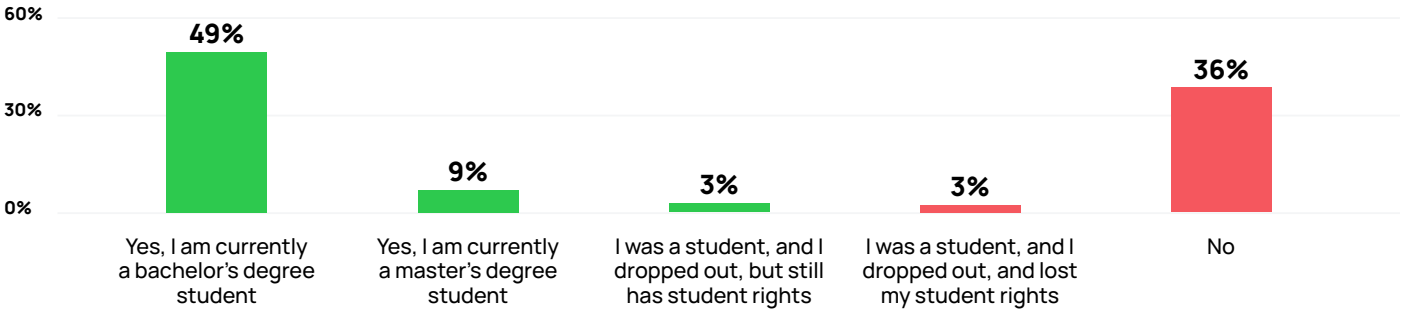
Source: Survey among TAS students and alumni

One third of alumni had already obtained a higher education degree (Figure 43B), while 58% were still studying in bachelor or master-level degree programs. The TAS program strengthens the desire of participants to continue higher education in field of computer science. Only 16% of 18+ TAS alumni were not in higher education or had not obtained a higher education degree. This is relatively small number, and the survey shows that the orientation of the groups for higher education is high, particularly in the field of computer science. Of the alumni who are currently university students, 16% are enrolled abroad and 84% are in Bulgarian university, at the same time 13% of those already graduated have bachelor or master-level degree from universities abroad and 87% from Bulgaria.

Figure 44: Current status of 18+TAS alumni

(Base: 18+ TAS alumni, N=123)

Are you currently studying higher education?

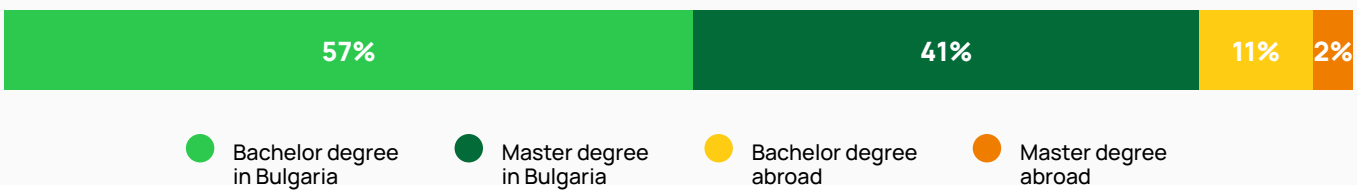


Source: Survey among TAS students and alumni

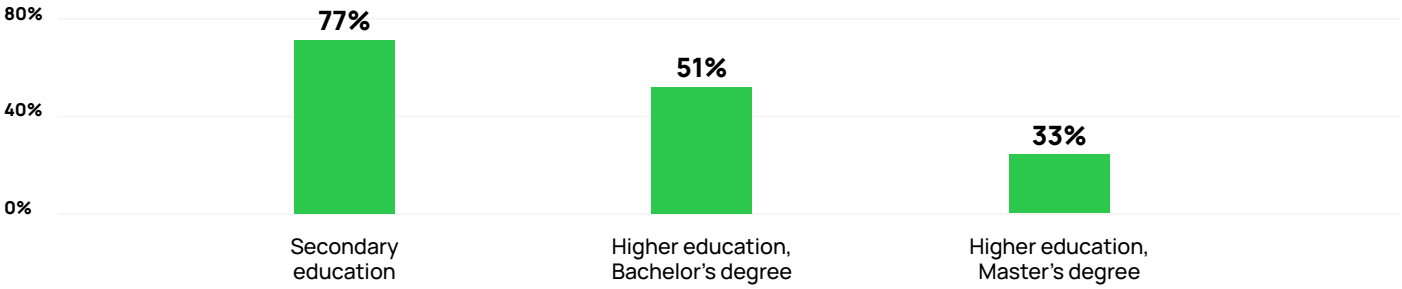
Figure 45: Current status of TAS alumni

(Base: 18+ TAS alumni, N=123)

A. **What levels of completed education do you have?** (among those with higer education)



B. **Share of people who study/graduated specialty related to computer technology as percent of the group**



The sum of the percentages is more than a hundred because some students obtain more than one degree.

Source: Survey among TAS students and alumni

The survey of alumni shows that more than three-quarters of 18+ TAS alumni have continued in higher education in the field of computer science or have already graduated. This is very strong support for the effectiveness of the TAS program for the early development of digital and programing skills and interests.

4.3.3.4. Participation of the TAS students in competitions and Olympiads

The share of 18+ TAS alumni who participated in competitions and Olympiads is similar in structure to other age groups but smaller in size. A total of 60% of 18+TAS alumni have participated in competitions and Olympiads; 56% in competitions and Olympiads in mathematics and 38% in programming. The lower share of participation could be due to the smaller number of opportunities available when these cohorts were of school age.

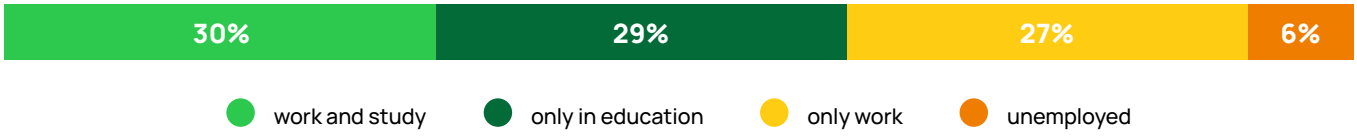
4.3.3.5. Role of TAS for a career in the IT field

The transition from education to labor market is not easy even for TAS alumni (not because they can't find job but because they search for something specific to their level and experience). 26% of all 18+TAS alumni have been jobless for some period of their lives after they started their professional career. Around 8% were without job for curtain period after they finished high school which is almost half of the national average (15.2% are unemployed in the age group 15-25 year old)[7]. These results show that even with good skills young people in the labor market may need more attention and support, career orientation, and linkages into the labor market. This need may be something to address as an element in TAS training goals.

At present the 18+ TAS alumni has the following profile:

Figure 46: Education and labor status of 18+ TAS alumni

(Base: 18+ TAS alumni, N=123)



Source: Survey among TAS students and alumni

[7] https://bit.ly/3iBkvkS

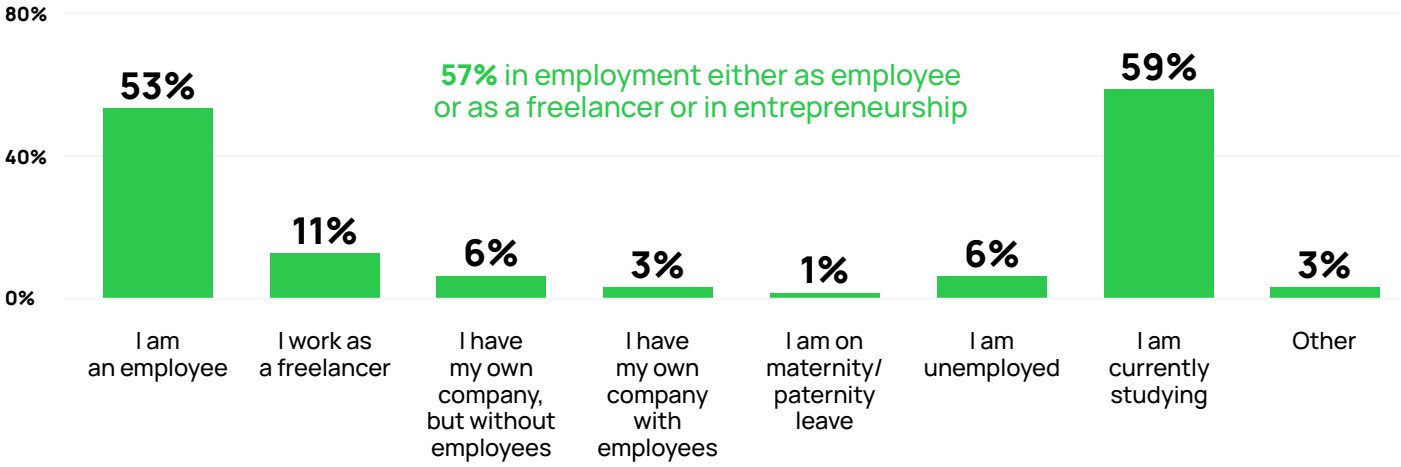
It is important to mention that among 18+ TAS alumni the share of unemployed is 6% which is similar to the country average 6.3%[8]. One percent are in maternity leave.

The work and study is very typical for this group and around half of University students among 18+ TAS alumni work which is close to the national average[9].

Figure 47: Status of 18+ TAS alumni

(Base: 18+ TAS alumni, N=123)

What is your current employment?



Some 18+TAS alumni are in two positions – employee and entrepreneurs or freelancers.

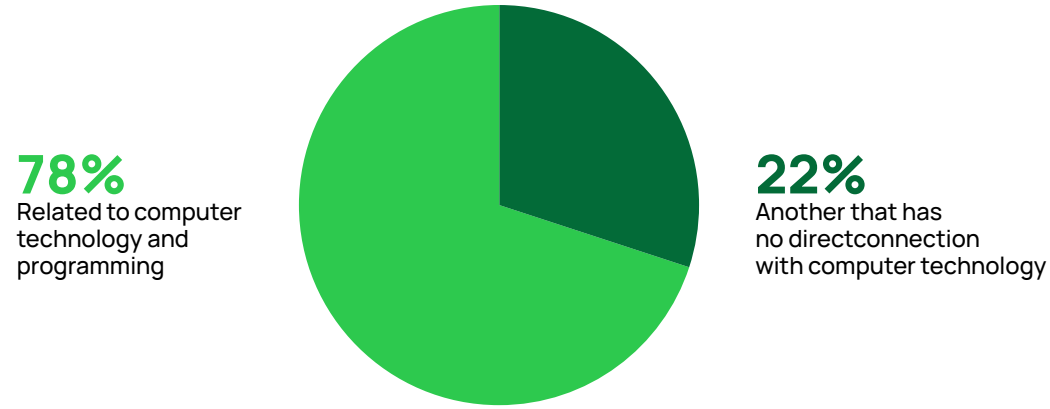
Source: Survey among TAS students and alumni

The achievements of TAS alumni are impressive – 65% work and 58% study, which shows very strong professional development for the group. 78% of those who work are engaged in activities that are related to computer technologies and programming.

Figure 48: 18+ TAS alumni status

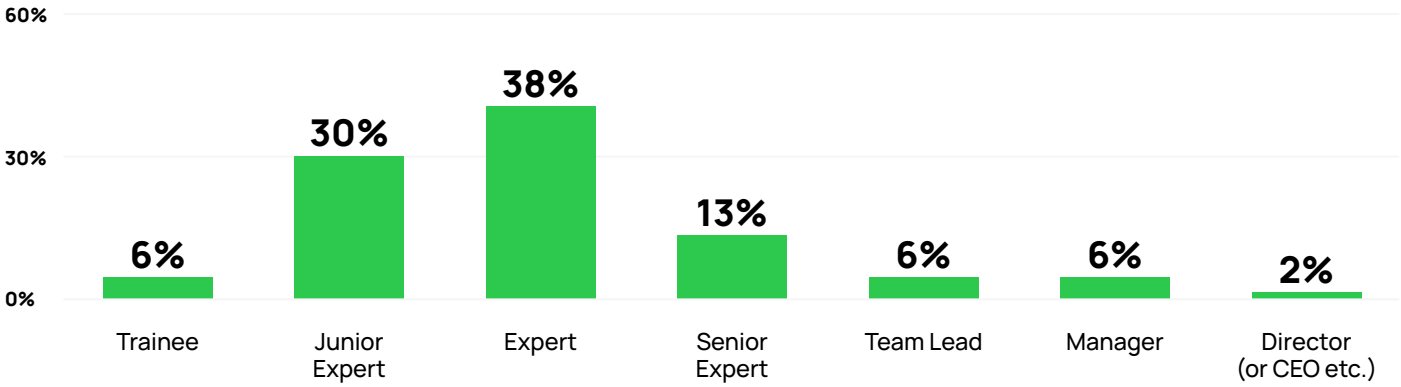
(Base a: 18+TAS alumni who worked, N=69, Employed or in maternity leave, Base B:, N=53)

A. **What is the job you do?**

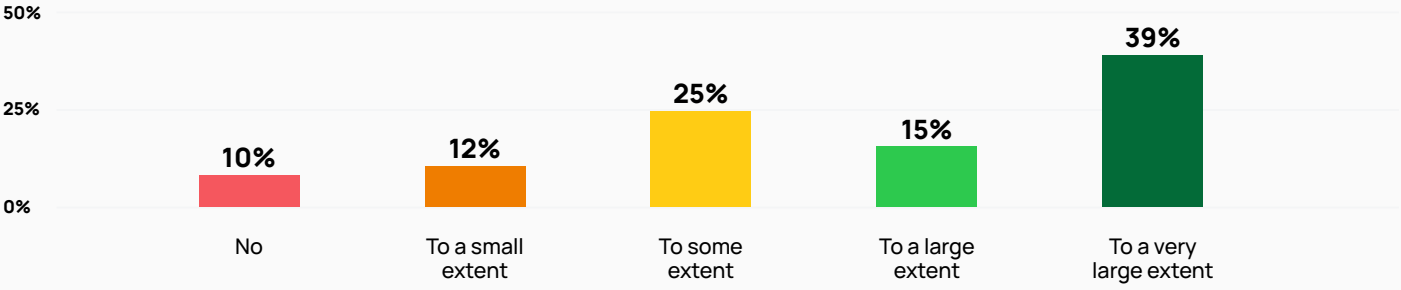


[8] NSI, Unemployed and unemployment rates of population aged 15 years and over for the first quarter of 2021 https://bit.ly/3iBkvkS
[9] https://rsvu.mon.bg/rsvu4/#/

B. **What is your current position?**



C. **Do you think that your participation in Telerik Academy School helped the successful start of your career in the field of information technology and programming?**



Source: Survey among TAS students and alumni

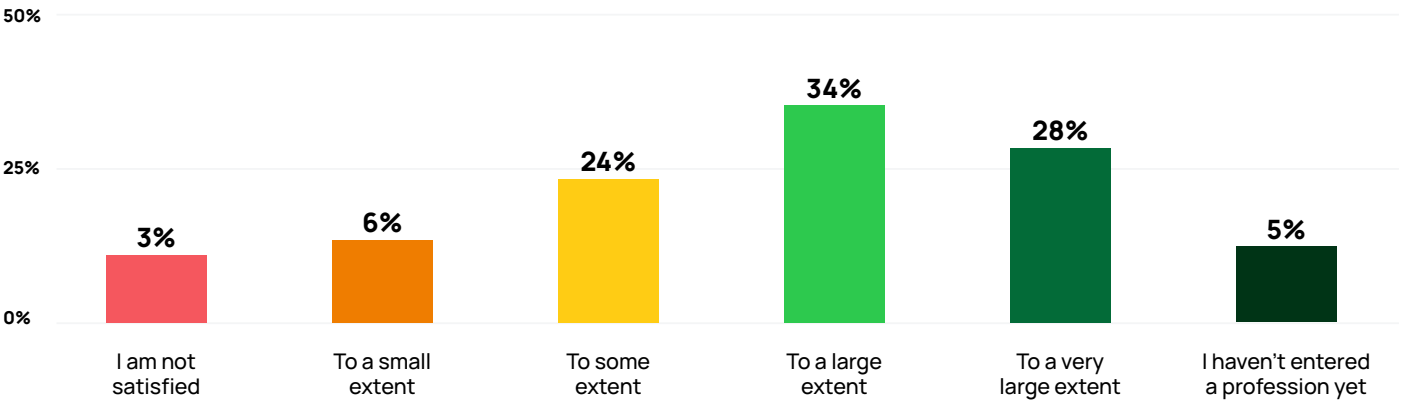
The majority of 18+ TAS alumni are employed on an expert position. The other third are junior experts. This is understandable as this groups just enter the labor market and also because their skills suggest expert work. A few reached senior positions or are in the role of team leader, manager or director. The latter are mainly the elder alumni.

The level of satisfaction from their profession as well as from remuneration is high. The majority of 18+ TAS alumni rate them as satisfactory to large or very large extent.

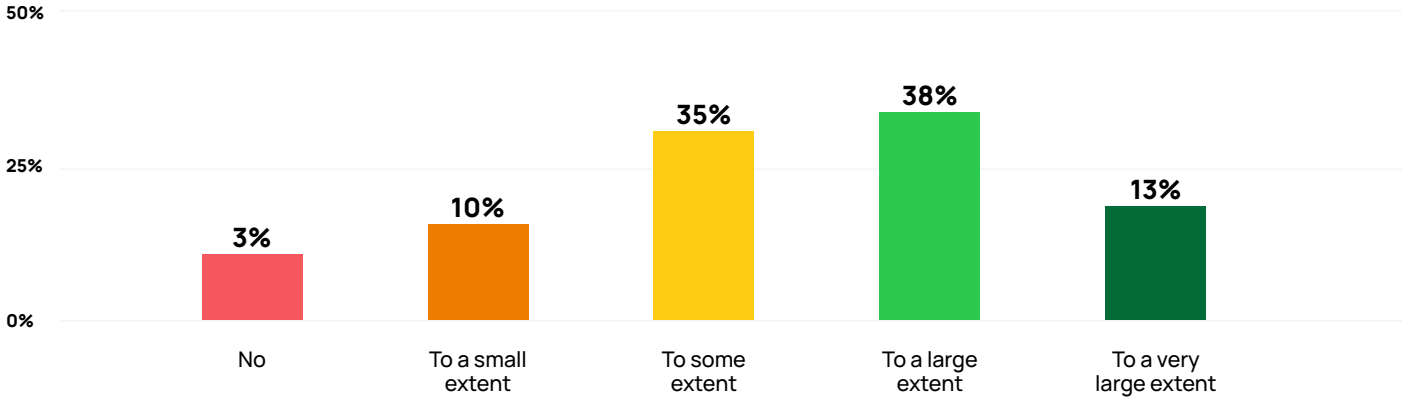
Figure 49: Job satisfaction

(Base: 18+TAS alumni who worked, N=69)

A. **Are you satisfied with your profession?**



B. **Are you satisfied with your salary?**

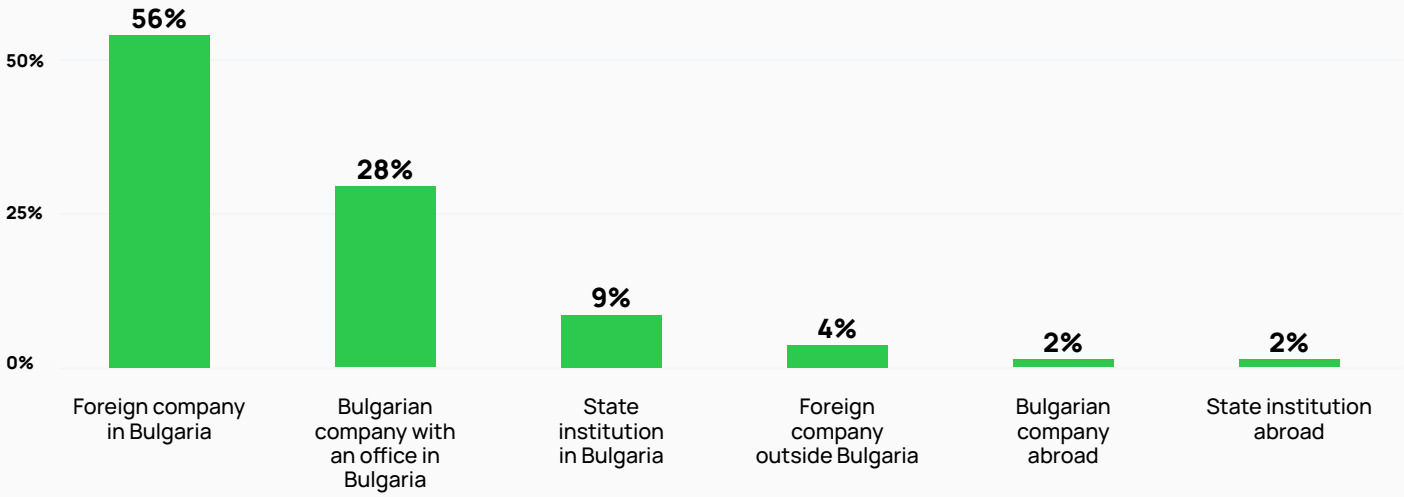


Source: Survey among TAS students and alumni

Figure 50: Work place of 18+ TAS alumni who are in employment

(Base: Employed or in maternity leave, N=53)

Where do you work?



Source: Survey among TAS students and alumni

The majority of 18+ TAS alumni were hired by foreign companies which are based in Bulgaria (56%). This is mainly because the structure of the market is predominated by foreign entities who have opened divisions in Bulgaria. Around 7.5% work for companies who are based abroad and so they live abroad.

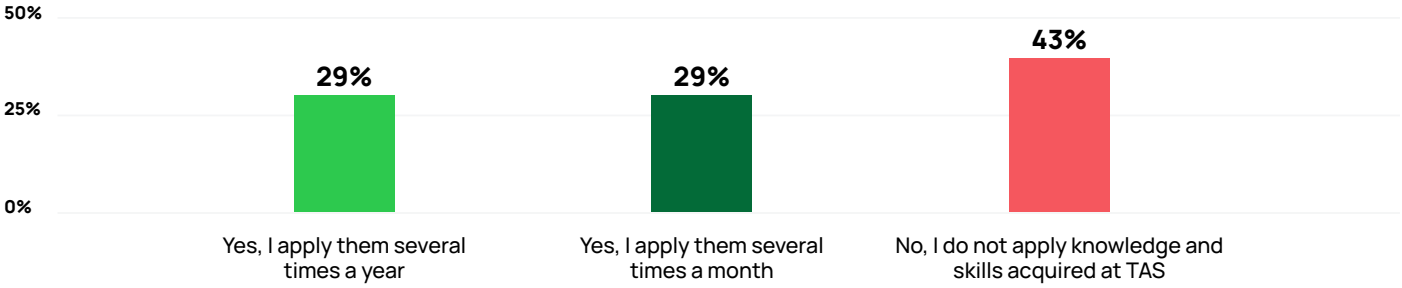
The types of positions are varied, but we can summarize the most frequent occupations: web application developer, desktop applications developer, front-end developer, web designer, teacher, mobile application developer, system administrator, and entrepreneur.

More than a half of those who work on a position that is not related to computers and technologies use the skills learned in TAS program for their work. This demonstrate that the program develops skills for 21 century which are applicable for wide range of jobs and activities.

Figure 51: Application of skills developed in TAS in work

(For those who work in fields not related to the programming, N=14)

Although your current job is not directly related to the courses you have completed at the Telerik Academy School, do you apply knowledge and skills acquired during your training at the Telerik Academy School in your work?



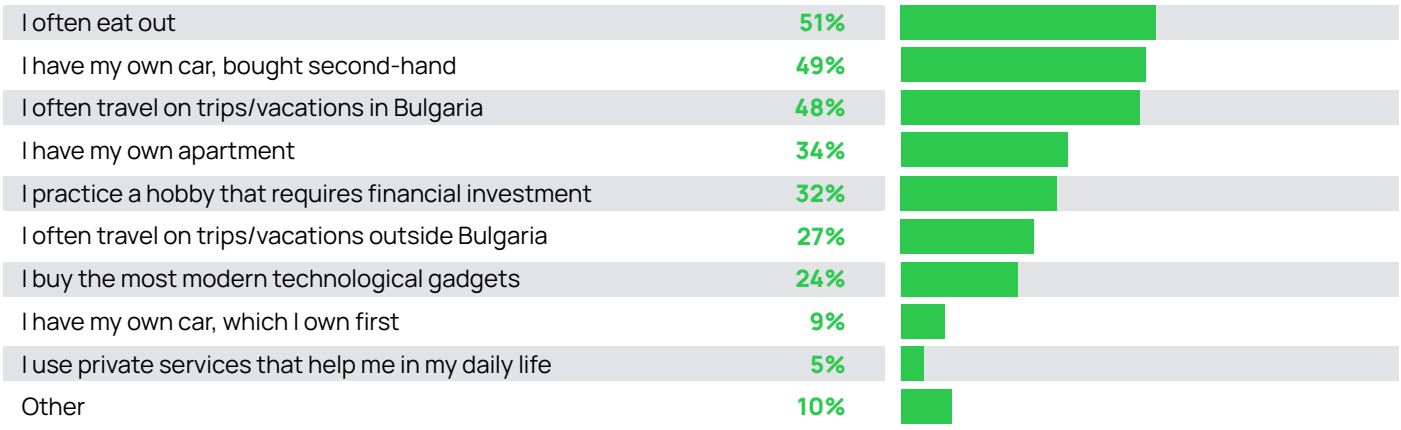
Source: Survey among TAS students and alumni

4.3.3.6. The well-being of the 18+ TAS alumni

The standard of living of 18+TAS alumni is high according to the survey. More than a half of those who have graduated from secondary education often have meals outside of their home. A similar percentage owns a second-hand car and takes trips/vacations abroad. One third of TAS students have their own apartment, practice a hobby that would require financial investment, and often travel abroad. This is indicator that the social and economic status of the group is higher than those of other young people with the same age and education level.

Figure 52: Well-being of alumni

(Base: 18+ TAS alumni, N=123)



Source: Survey among TAS students and alumni

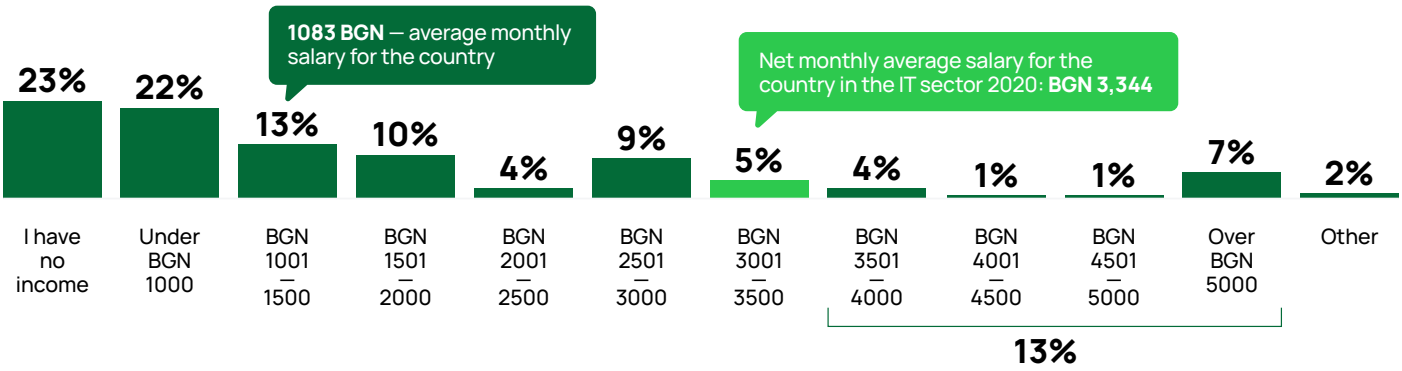
As the group of 18+TAS alumni are diverse group in terms of their educational and employment status we can observe that the income is spread between different intervals. The most successful one are 13% of 18+ TAS alumni already receive net monthly salary that is higher than the net monthly average salary for IT sector in the country. Another 14% receive monthly salary between 2500 and 3500 BGN and 14% - between 1500 and 2500 BGN. At the same time as some 18+TAS

alumni are in education or in the very beginning of their career or are not full time employed, there are people with lower income or without income (one in every five TAS students).

Figure 53: Net monthly salary of TAS 18+ alumni compared to net monthly average salary for the IT sector in the country in 2020[10]

(Base: 18+ TAS alumni, N=123)

What is your net (after taxes) monthly income?



Source: Survey among TAS students and alumni

[10] Annual status report of the software sector in Bulgaria. Remuneration. Page 8.

4.3.3.8. Case studies

Ivana

Hard Work and Placement in the Academy Network

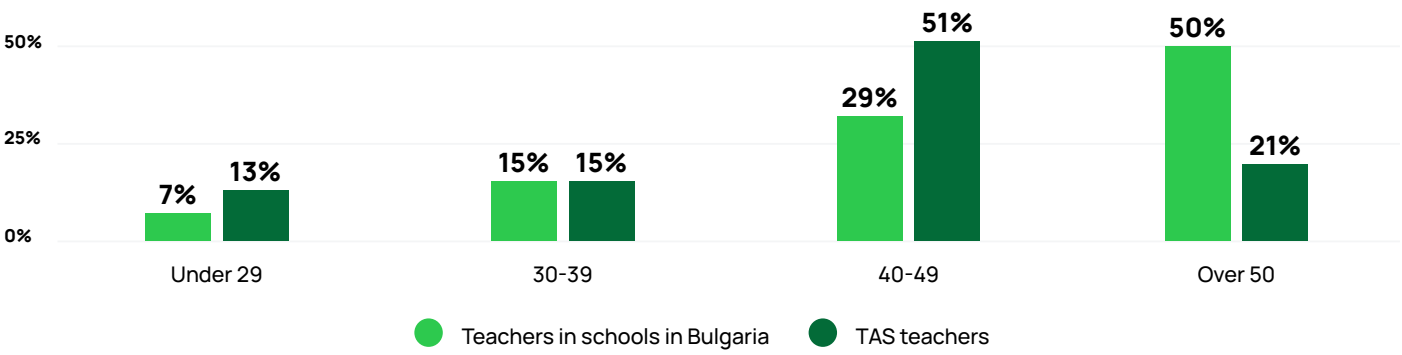
A game development course was Ivana's first experience with the Academy in 9th grade. She reports that it was "incredibly exciting" to think she could create a game that her mother and father could play. She traveled from her hometown to Sofia for the Academy and eventually moved there so she could manage the time in courses and hours of follow-up homework. The hard work, sleepless nights, and personal time resulted in high achievement. Ivana recalls that the project work was so interesting and the teamwork with fellow students made friends out of strangers. She was offered jobs from several companies in the Telerik network. Now, at 21, Ivana studies computer science at the Faculty of Mathematics and Informatics at Sofia University; the knowledge acquired within the Telerik Academy School has been extremely helpful in her studies.

4.4. PROGRAM IMPACT ON TEACHERS

4.4.1. Selection and preparation of teachers for participation in the TAS programs

The largest proportion of teachers who are part of the Telerik Academy School are professionals with extensive work experience: 35% of the respondents have been teaching for between 20 and 25 years, and 21% have even more experience. Teachers with experience between 16 and 20 years constitute 19%. Despite this strong presence of more experienced specialists, there are also younger teachers with between 11 and 15 years (10%), 6 to 10 years (4%), and up to 5 years (10%).

Figure 54: Comparison between the age of the teachers in Bulgaria and TAS teachers



Source: Survey among TAS teachers

Comparison between the age of the teachers in Bulgaria[11] and TAS teachers shows that TAS teachers are younger.

According to the statistical distribution, most of the respondents have joined the program in the last three years. Nearly 75% were involved for the first time in the work of the Academy in the period from 2018 to 2020.

The inclusion of teachers in the field of information sciences in the program is provided through several main channels. The Academy itself manages to successfully connect with many of the teachers.

During the interviews, the respondents emphasized that the Academy enjoys a good reputation and they were familiar with its' work before they were officially invited to work as teachers.

In some cases, especially at the beginning of the Academy, the recruitment did not take place in a systematic way, but on the basis of personal acquaintances and recommendations from representatives of the Academy. Some of the selected staff were graduates of the program in a previous period and received an invitation to participate in the work, but this time as teachers.

The Academy is seen as an organization offering flexible conditions and innovative teaching

[11] https://bit.ly/3q4ljCB

methodologies, which encourage respondents to apply as teachers. In the smaller settlements the awareness of the activity of the Academy among the teachers of informatics and mathematics is also high. The main reason for this is the undeniable success of the students who have completed courses in it, who take first places in various competitions and Olympiads.

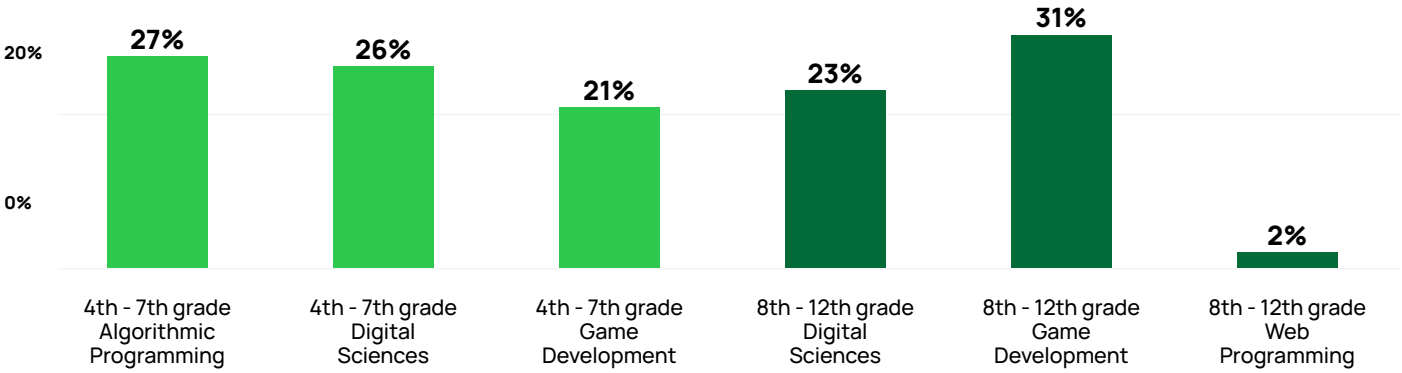
Teachers' goals are aligned with the goals of the program and believe that opening local Telerik Academy Schools is useful and necessary for the communities.

The effect of the program on the professional development and skills of teachers is measured by the extent to which teachers themselves believe that they have improved their teaching methods. They have identified the most valuable pieces of knowledge and skills they have acquired or improved. A crucial part of the analysis is the identification of the goals that teachers set for conducting training courses and whether they encounter difficulties in the learning process.

The study covers teachers who lead courses for children from 4th to 7th grade and from 8th to 12th grade.

Figure 55: What courses have you taught in TAS?

(Base: Teachers N=63)



Source: Survey among TAS teachers

Teachers consider their participation in the Telerik Academy School as beneficial both for their contribution to the development of children in the IT field and for the development of their own skills as teachers. Most of the respondents reported that the Academy has helped them form a number of skills related to teaching methods and techniques, as well as to update their existing knowledge. The Academy achieves very high levels of satisfaction with training and support provided to teachers.

Those who went through teacher training at the Telerik Academy School in 2019 recognized the positive effect of it to a very large extent. About 78% were extremely satisfied with the training. Teachers report that the training definitely provided an opportunity to learn new skills. The average score teachers give for the degree to which they agree with the statement that they have developed new skills as a result of the training is 9.10 on a scale from 1 to 10. This shows very high levels of impact of the program on the teaching staff. During a survey for the academic period from 2017 to 2018, 93% of the surveyed teachers stated that the influence of TAS on their teaching quality is very positive.

According to the data obtained from a study conducted between 2019 and 2020, teachers in informatics and information technology, who have work experience in the profession between

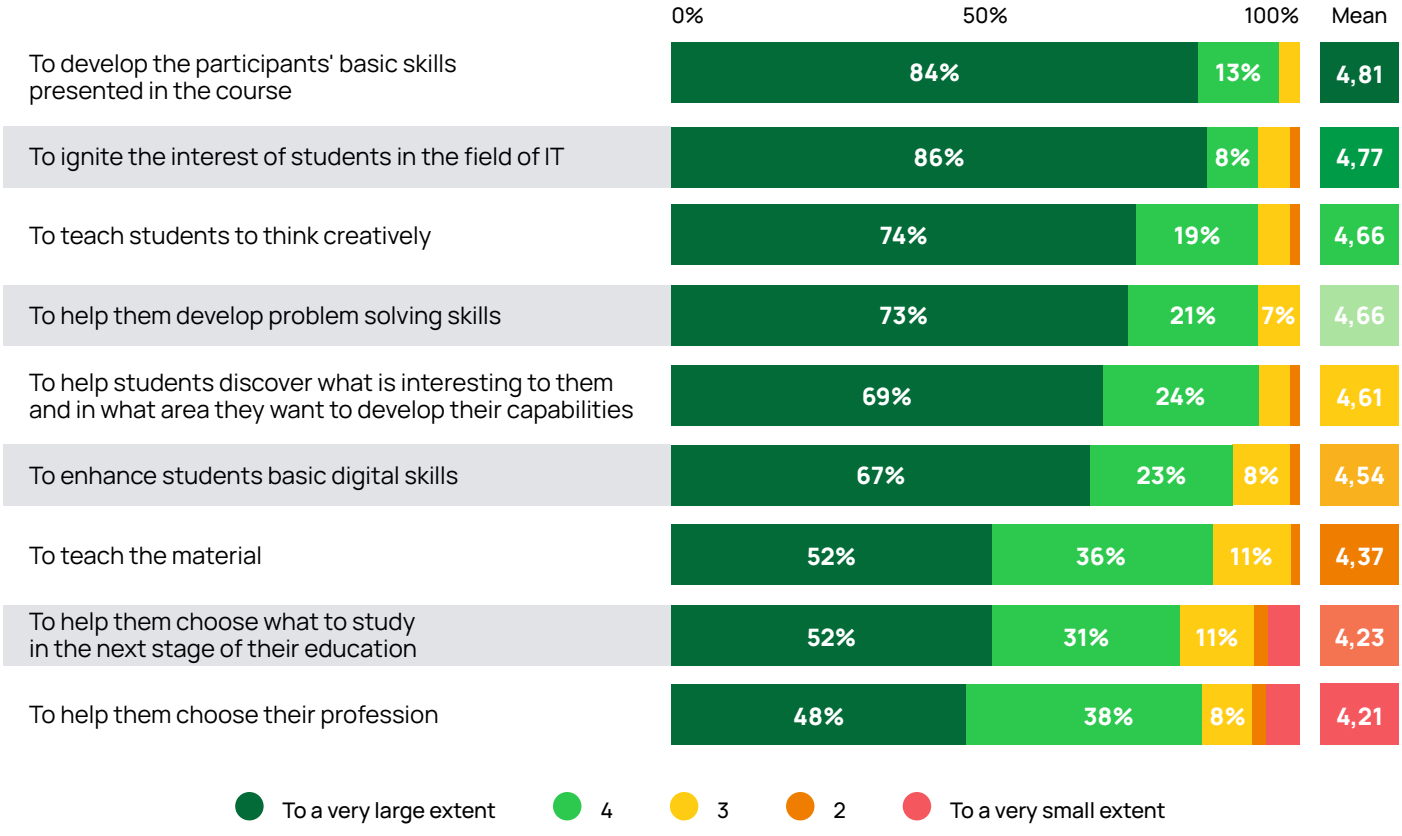
5 and 10 years have benefited the most from the training. Teachers with less than five years' experience also show high satisfaction with the new knowledge and skills they have acquired. This could be attributed to the shorter teaching experience among these groups. The less experienced teachers in the Academy, those with less than 5 years of experience as teachers, were often students in the program and have mastered some of the teaching approaches during their own training as students. However, more often than others, they need support in the application of specific methods of working with children and older students. The high levels of satisfaction with the trainings at the Academy are apparent in the high percentage of teachers who would recommend the training they have experienced: 86% of the respondents said that they would definitely recommend the training to a friend.

The most valuable knowledge and skills that teachers have developed during their training are related to the different child-centered teaching approaches. The approaches involve a child-friendly pace of teaching, practical methods and the way to create a free environment that encourages children's creativity.

There is a strong perception among teachers that their teaching skills have improved as a result of the program. Just over 90% of respondents tend to agree that the program has contributed to improving and complementing the teaching methods they work with.

Figure 56: What are the main goals you set for the trainings at TAS?

(Base: Teachers N=63)



Source: Survey among TAS teachers

The main goals set by the respondents during their courses are to develop the basic skills of the course to students and to generally ignite children's interest in information technology. Teachers are asked to assess the extent to which they agree with the statements regarding the goals

they set for the training. The above statements stand out with an average score of 4.8 on a scale from 1 to 5, where 1 is "To a very small extent" and 5 "To a very large extent". Teachers who teach courses for children from 4th to 7th grade agree to a higher extent with those goals. The tendency for stronger recognition of the goals among this group of teachers is maintained in relation to the other listed goals. Objectives related to the education of creative thinking and problem-solving skills were assessed by teachers with a score of 4.7. They are followed by helping children discover their interests (4.6), improving their digital skills (4.5) and transmitting the material (4.4). The lowest average grades are given for the orientation of children in education (4.2) and their careers (4.2). However, the average grades exceed 3, which means that more than half of the teachers set these goals as well.

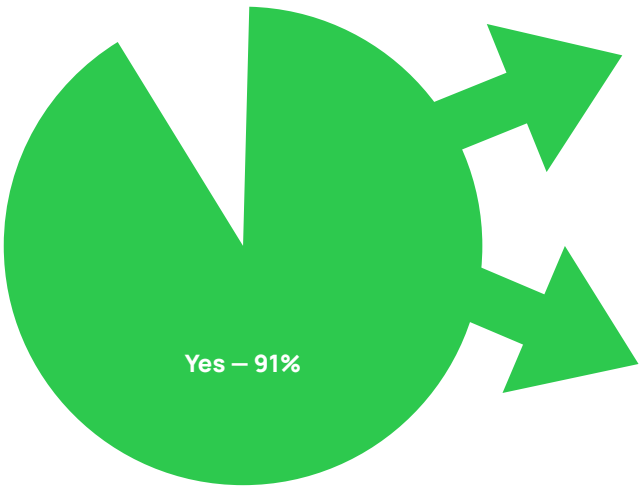
4.4.2. LEARNING OUTCOMES AND APPLICATION OF SKILLS ACQUIRED THROUGH THE TAS PROGRAM IN A BROADER EDUCATIONAL CONTEXT

Telerik Academy School manages to have a strong influence both on improving the skills of children interested in information technology and on improving the skills of teachers. According to the data obtained, the impact of the program on the teaching approaches of the surveyed teachers is strong.

Figure 57: Application of skills acquired through the TAS program in a broader educational context

(Base: Teachers N=63)

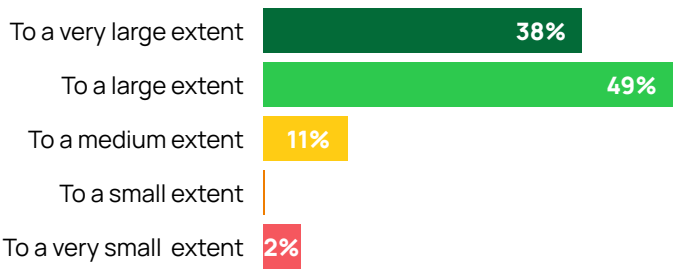
In the process of participating in the TAS, did you improve your teaching methods by improving methods you already knew and/or by learning new methods?



Among respondents who answered "Yes":

Do you apply them outside the program?
(within the teaching in your School/University)

To what extent do you think that the teaching methods that you have improved/learned during your work at TAS are effective in your teaching at school/university?



Source: Survey among TAS teachers

A total of 91% of the Academy teachers indicated that they improved their teaching methods by improving already known or new approaches. 94% of them applied what they learned outside

the Academy, and 87% assessed the acquired and mastered methods as effective. According to the selected data, 38% of teachers applied them to a "very large extent" and 49% "to a large extent".

Teachers who believe that they have improved their teaching methods, point out that the main goals they set during their courses are to ignite students' interest in information technology and to develop the basic skills included in the course. The highest share within this group of teachers agreed that managing to develop a child's logical thinking is the first goal. Due to the program, they also increase their confidence in working with computer/internet and learn more about the work of software professionals.

> **"I was personally impressed, and I try to implement game elements in the process of work. As a teacher in Mathematics, which is a relatively dry subject, I rarely have the opportunity and time for such game elements, while here the children are very impressed by these elements in the process of training. This is something that I have not used in my work so far and which I find very useful."**

Both the quantitative and qualitative research show that the respondents used the gamification approach in their work outside the Academy more often than other methods. This method is considered as extremely useful for motivating students' interest and retention for every age group. And it is applied relatively easily outside the program. Teachers interviewed praised the effectiveness of this approach, often believing that it had helped them create more entertaining lessons, even with lessons that are more theoretical and could easily bore students. The most frequently specific activities mentioned during the interviews are related to mind maps and memorization through associations. The modules offered at the Academy: "Accelerated learning" and "Digital literacy" are also often used outside the Academy.

> **"Some of the things that are in the program would be useful for students, such as fast learning, memorizing numbers with associations, mind maps, association with colors..."**

Most of the respondents indicated that they have improved their teaching skills by mastering an approach that includes setting tasks that provoke students' thinking. This approach involves setting a task that is difficult to solve with existing knowledge and skills or requires the discovery of a specific technical knowledge. The approach does not exclude the participation of teachers, but relies more on discussions until the right solution is found by students themselves. During interviewing, teachers shared that they often relied on the development of students' Internet search skills. This is defined as a key ability that is especially valuable for the IT field.

The next skills that teachers have improved are related to project-based learning. Assigning individual and group projects is considered extremely useful for students by TAS teachers. According to the interviewed teachers, this type of work provides a good measure of each child's

progress and forms skills for preparing their own product and ability to work in a team.

Some of the teachers also addressed the online learning necessitated by the Covid-19 pandemic. The transition to distance learning did not hinder the work of teachers, some of them even shared that they have improved their own skills to work in an online environment and have achieved better results with some students. However, there is a small share of teachers who have had a problem with discipline and students' attention retention.

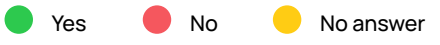
> **"The methodology itself I managed to apply later in 8th and 9th grade, even in specialized training… Something that is not studied at university… they do not teach you how to do exactly these things, and working with TAS gave me that. In the different age groups to be able to sift the spirit, the team, how the material is assimilated and to be able to better understand the children when they return feedback."**

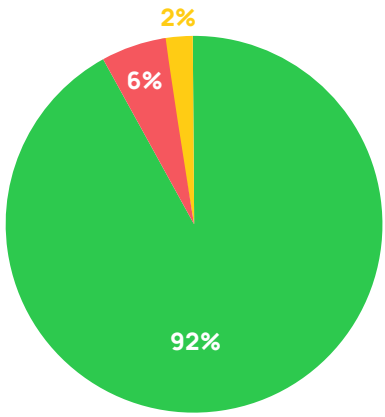
During the interviews, the teachers clearly highlighted the advantages of the Academy and its differences with the rest of the educational system, covering students from 4th to 12th grade. The TAS teaching approaches specifically aimed at retaining the interest of children and the ability of the approaches to be adapted to different groups of children and adults was highly valued. Teachers pointed out that the inertia of the established educational system, which follows a precisely defined, unchangeable operational plan, is less effective.

Figure 58: Application of teaching methods used TAS program in a broader educational context

(Base: Teachers N=63)

Do you apply teaching methods used in TAS outside of the program?
(within the teaching in your school/university)





Source: Survey among TAS teachers

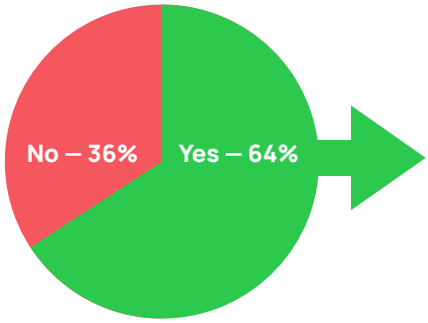
The percentage of teachers who did not use the teaching methods taught in the Academy was 6%. During the interviews, teachers didn't provide a reason for not using the techniques.

Over 64% of teachers used elements of the content of the Telerik Academy School program in their teaching outside the Academy. The elements used were considered effective in these contexts. Teachers who have failed to apply elements of the curriculum in their teaching outside the Academy most often cite the discrepancy in the curriculum with the curriculum they teach outside the Academy as the reason.

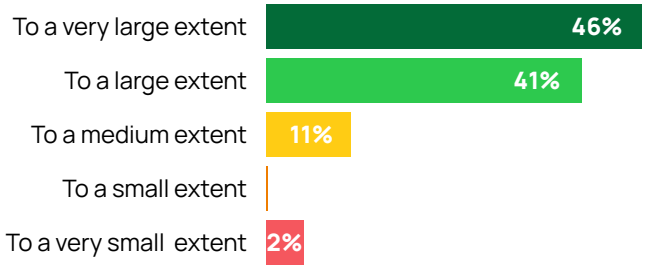
Figure 59: Application of skills acquired through the TAS program in a broader educational context

(Base: Teachers N=63)

Do you use elements of the content of the TAS program in your teaching outside of school?
(within your teaching at school/university)



To what extent do you think that the elements of the content of the TAS program which you use are effective in your teaching at school/university?



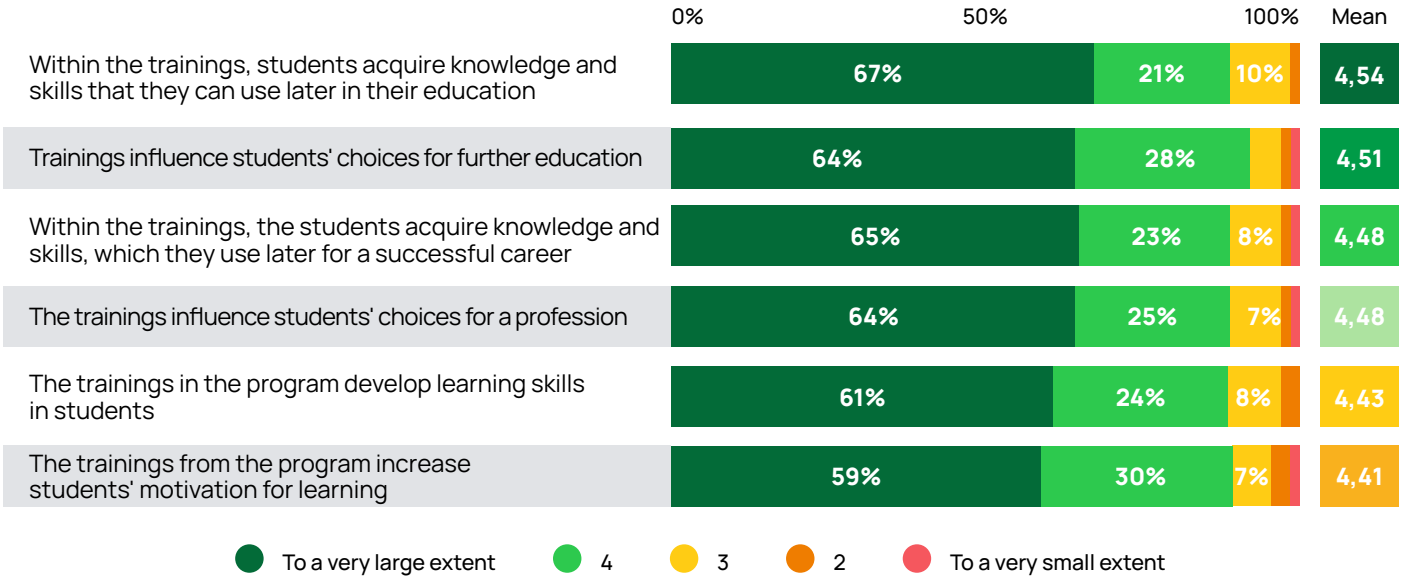
Source: Survey among TAS teachers

The results of the Academy for students as reported by teachers are manifested in many different aspects. In addition to improving specific IT skills, training could have a significant impact on children's overall motivation, commitment, and future development plans. Teachers should assess the extent to which students acquire specific knowledge and skills as a result of the program, as well as what are the most valuable qualities for full participation in the labor market.

Figure 60: Program outcomes according to the teachers

(Base: Teachers N=63)

To what extent do you agree with each of the following statements regarding the training at TAS?



Source: Survey among TAS teachers

The effectiveness of the courses for students in the program is highly appreciated by the teachers. According to the respondents, the impact of the program on the knowledge, skills, and motivation of the participants in the program was very strong. Cumulative proportions of over 88% supported the claims that training in the program creates learning skills in students, increases their motivation, and offers knowledge that serves as a basis for their next level of education. The same share of teachers also supported the claims that the trainings provide for a successful

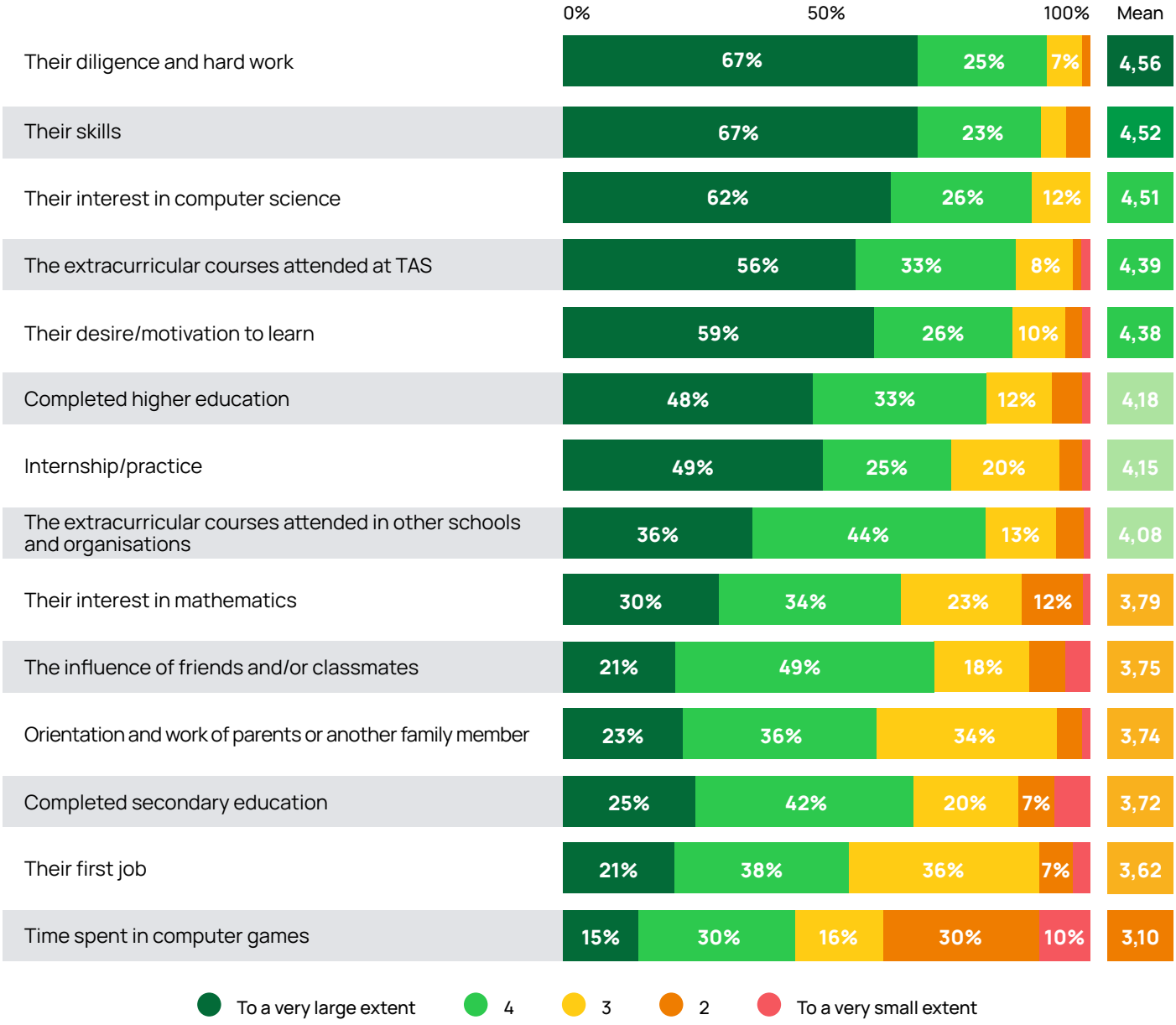
start in careers and in general for their choice in a professional field. The largest share of teachers reported that the trainings can influence students' choices for further education (92%). Teachers of children from 4th to 7th grade recognized the effects of the program to a higher degree, with the leaders of the "Digital sciences" course being more convinced than others.

Teachers were asked to identify which skills of children contribute to their future successful realization in the labor market. The answers showed strong unanimity, with diligence and skills being the most important, with average scores of 4.565 and 4.52 out of 5.00. Both statements are strongly supported by the teachers in the course "Algorithmic Programming" for children from 4th to 7th grade. 78% of the teachers, who consider diligence as the main factor for successful realization believe that the trainings under the program create motivation for students to learn.

Figure 61: Factors for career success of TAS students according to teachers

(Base: Teachers N=63)

Which of the following do you think help participants to succeed?



Source: Survey among TAS teachers

The interest in computers (4.51) and the attendance of extracurricular courses at the Telerik Academy School (4.39) were also assessed as extremely important for the eventual profession-

al development of children. This means that teachers recognize the Academy as an important factor in providing professional opportunities.

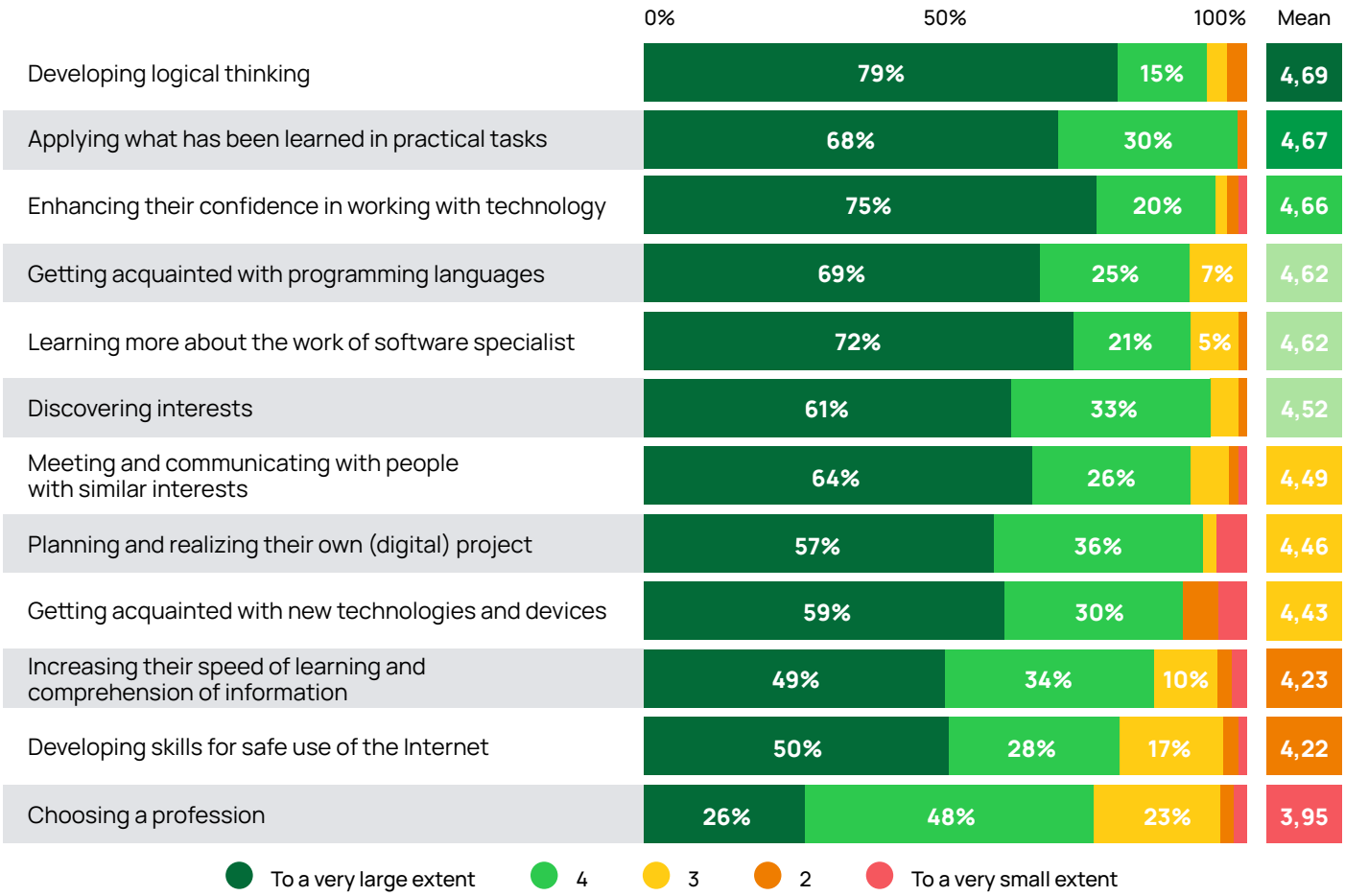
Completing higher education (4.18), internships (4.15), and attending extracurricular courses in other schools (4.08) were also considered important for the professional development of young people. Although teachers strongly supported students' participation in extracurricular courses, those who mentioned attending Telerik Academy School as a factor to help students succeed were 8% more than those who mentioned other schools and Academies.

> **"Teach children to make games, not to play for hours. That's my motto."**

The interest in mathematics was assessed as important for the eventual success of children, with an average score of 3.79. Respondents rated similarly on average the influence of friends and classmates (3.75), the orientation and work of parents (3.74), completed education (3.72) and the first job (3.62). Time spent in front of computers is rarely considered key in eventually finding a job, but again almost half of the respondents consider it important.

Teachers were asked: "Which of the following skills/knowledge do you think students manage to achieve as a result of participation in Telerik Academy School?"

Figure 62: Skills acquired by TAS students according to teachers
(Base: Teachers N=63)

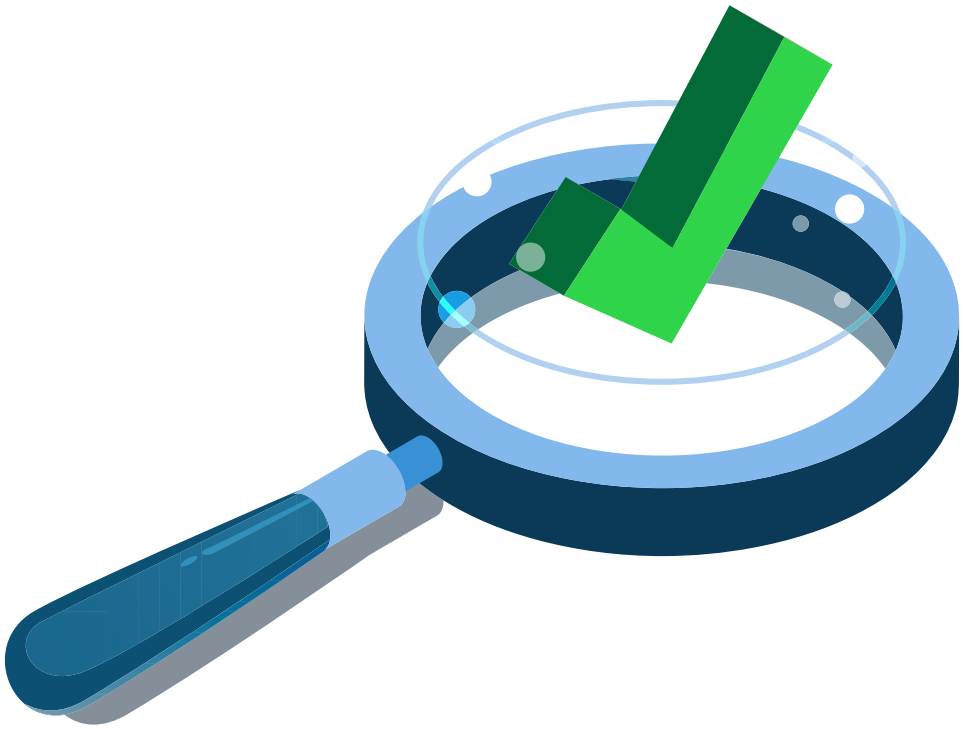


Source: Survey among TAS teachers

The data shows that, according to the teachers, the Academy helps develop a number of skills and provides an opportunity for orientation in the field of information technologies. All the listed statements were rated with an average score higher than 3, which means that they were supported by more than half of the respondents. Examining the cumulative shares of agreement/disagreement, almost all of these statements are supported by over 90% of teachers. 89% believe that the Academy provides an opportunity to learn about new technologies and devices, and 84% that it helps children increase their speed of learning. Last but not least, are the development of skills for safe use of the Internet (78%) and the orientation to a certain profession (74%), but again the share of those who support the statements is very high.

During the interviews, most of the teachers stated that the students of the Telerik Academy School achieved **high results in various competitions and Olympiads related to information technology and programming.** The opinions of the teachers were uniform around the statement that the **Academy creates a community of students with higher qualities and skills in programming**. Other effects of the program related to providing opportunities for development in the IT sector to children from smaller settlements were also pointed out. According to the teachers, the program creates a basis for staff development, which can benefit local businesses and at the same time helps to offer training on modern and innovative topics for smaller cities.

The statistical distribution shows that the teachers who teach courses for children from 4th to 7th grade supported the statements more strongly. This trend persists with respect to all assessments made by teachers in the course of the study, and it could be argued that teachers working with younger children in the Academy are more aware of the effects of the program and more clearly set basic goals in their teaching methodology. Similar to the data from students the results among teachers show that the effects are greater for junior students. On the other hand, during interviews, teachers of older students often said that their main goal was to introduce students to the basics of programming and to ignite their interest in the field.



4.4.3. Case studies

Dimitar

From Academy Student to Teacher

A lecturer at the Telerik Academy School for two years, Dimitar was enrolled as a 10th grader in the program for university students, studying C++ and JavaScript. After 11th grade, he worked as a program developer in xQuadro and began his higher education at the Faculty of Mathematics and Informatics at Sofia University. Now, he has been teaching for five years, including courses at the Academy. He models his teaching style on those he experienced at the Academy, building an informal, friendly environment in his teaching so the children feel comfortable and free to communicate. Dimitar strives to illustrate concepts by giving simple visualizations of the material, which would be harder to explain in words or pictures alone. In his teaching, Dimitar strives to lay the foundations of programming and to ignite in children an interest, just as his Academy teachers ignited it in him.

Ivan

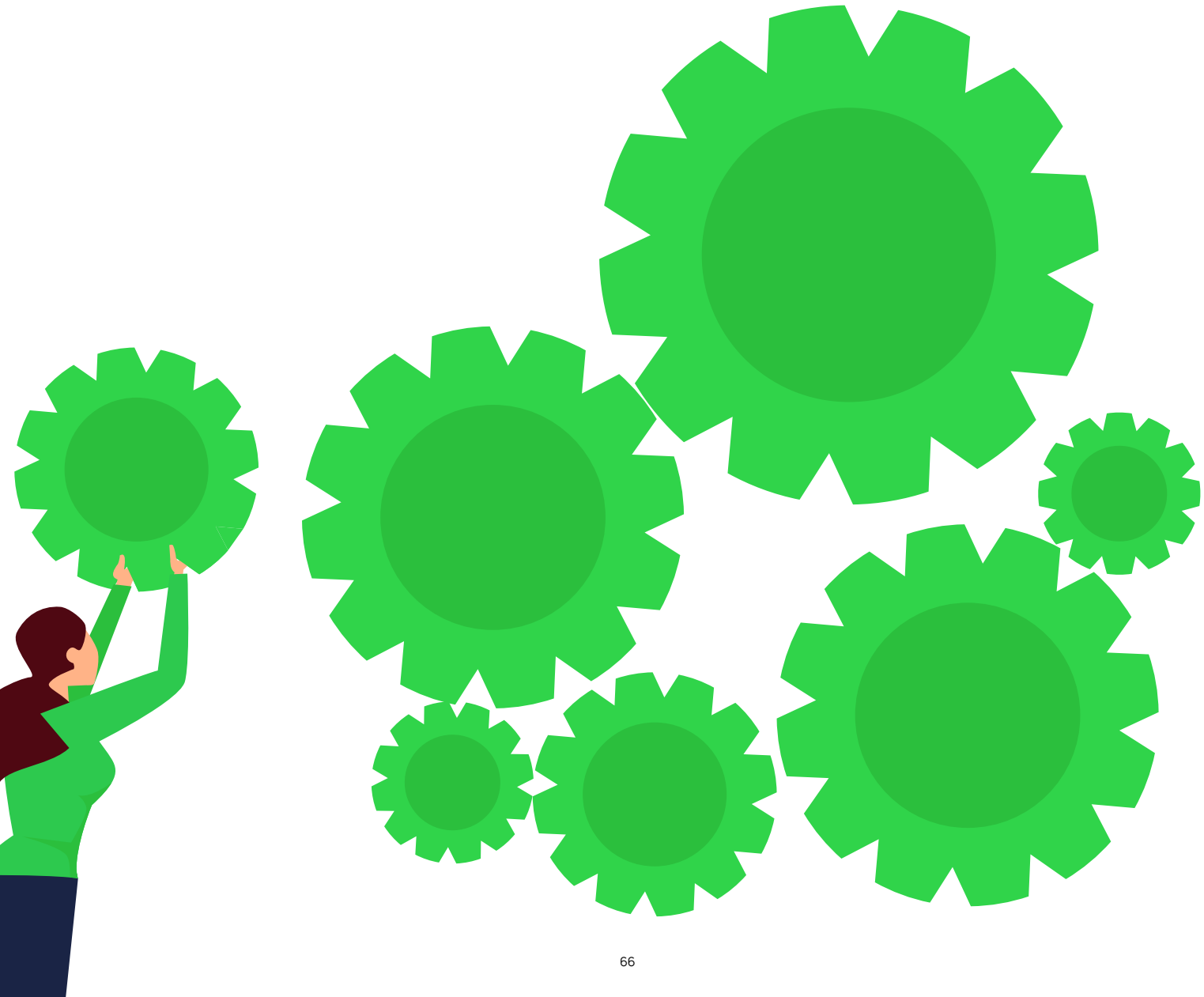
Teaches Students to be Independent Learners

Ivan showed his interest in teaching early – in 7th grade helping his teachers with junior students. A Telerik alumnus, he has been teaching algorithmic programming and game development in Academy camps for three years. Ivan gives his students resources for accessing information on their own and offers them reading materials. He believes that one of the most important skills that students in the 21st century should have is how to search for information on the Internet and apply it. He asserts that all Academy students can become fully capable Junior level program developers at an early age if they study conscientiously. Ivan is currently pursuing a master's degree in Artificial Intelligence at Sofia University, and will start working for a trading company in London in the autumn. He plans to return to teaching in the future.

Tsvetana

Leader Who Teaches Prize-Winning Students

Tsvetana has a 10-year history at the Telerik Academy School. She started teaching Algorithmic programming at the Academy in 2011 and has been a leader in establishing this course in other cities. She also teaches Informatics, Information Technology, and the modular course training in the professional classes “System Programmer” in the mathematical high school "Kiril Popov” in the city of Plovdiv. When Telerik Academy School started the Game development, she took over the training of students between 8th and 12th grade in Plovdiv. She has commented on the high quality and great value of the Academy training for students, adding that the courses are free, making them available to many who could not afford this education. Tsvetana is among the most successful leaders of the high school Competitive Informatics teams. Her students have won more than 60 medals and prizes.



4.5. COMPARISON BETWEEN TEACHERS' OPINION AND STUDENTS' SELF-ASSESSMENT

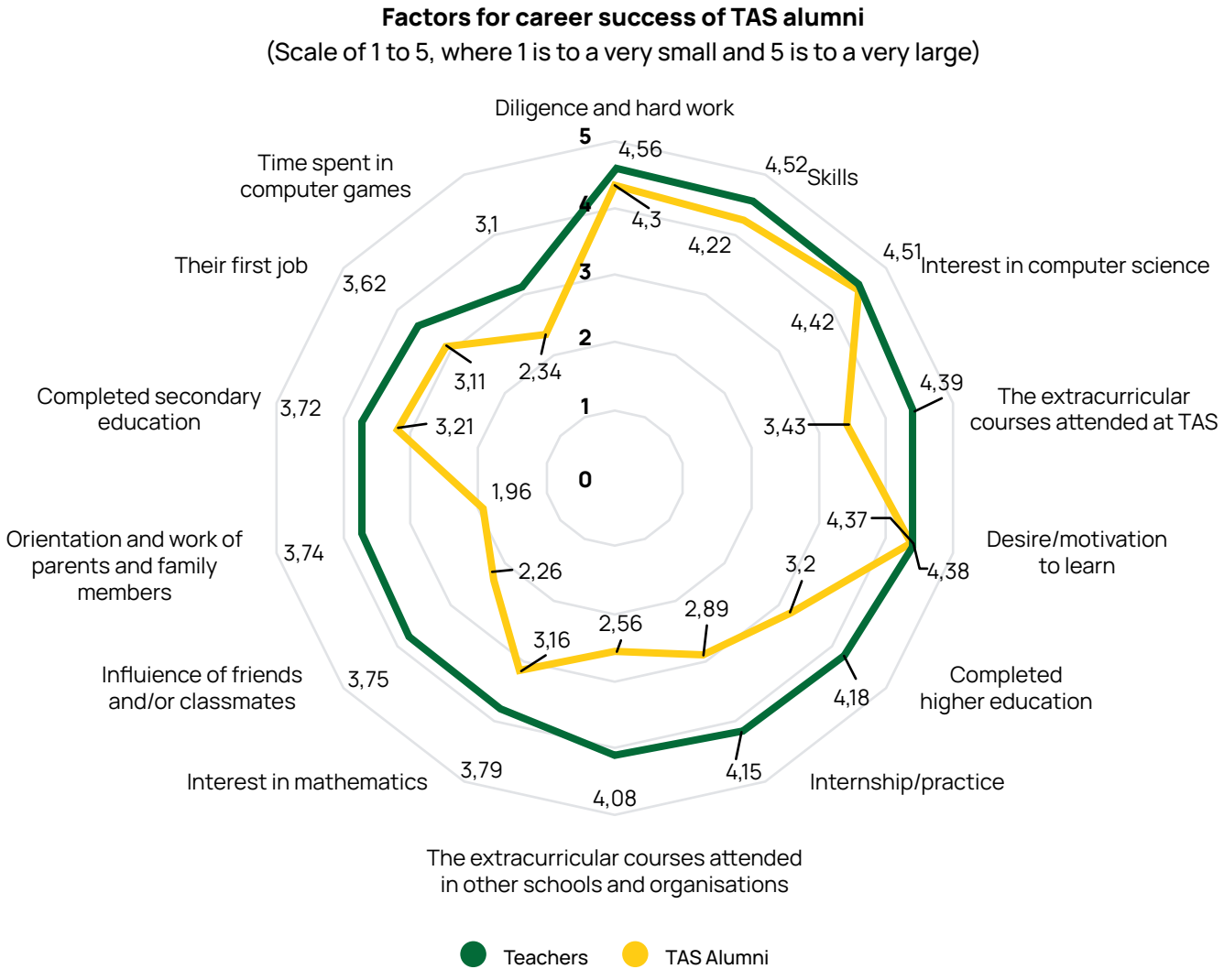
Factors for career success of TAS students

The comparison between teachers` opinion and TAS alumni`s self-assessment shows a relatively similar picture. For both teachers and TAS alumni, diligence and interest in computer science are in the top three most important factors for career success. For teachers, skills are also part of the top three factors, while TAS alumni think that their desire and motivation to learn is the most important factor.

As a whole, teachers give higher assessment for all factors for career development compared to TAS alumni. The factors with the biggest difference between the two groups are Orientation and work of parents or another family member (1,78), the extracurricular courses attended in other schools and organizations (1,52), and the influence of friends and/ or classmates (1,49). Desire/ motivation to learn is the factor where TAS alumni and teachers have similar score.

Figure 63: Factors for career success of TAS alumni - comparison between teachers and TAS alumni

(Base: Teachers N=63, 18+ TAS alumni, who completed 12th grade and work in the field related to computer technologies, N=54)



Source: Survey among TAS teachers and survey among TAS alumni

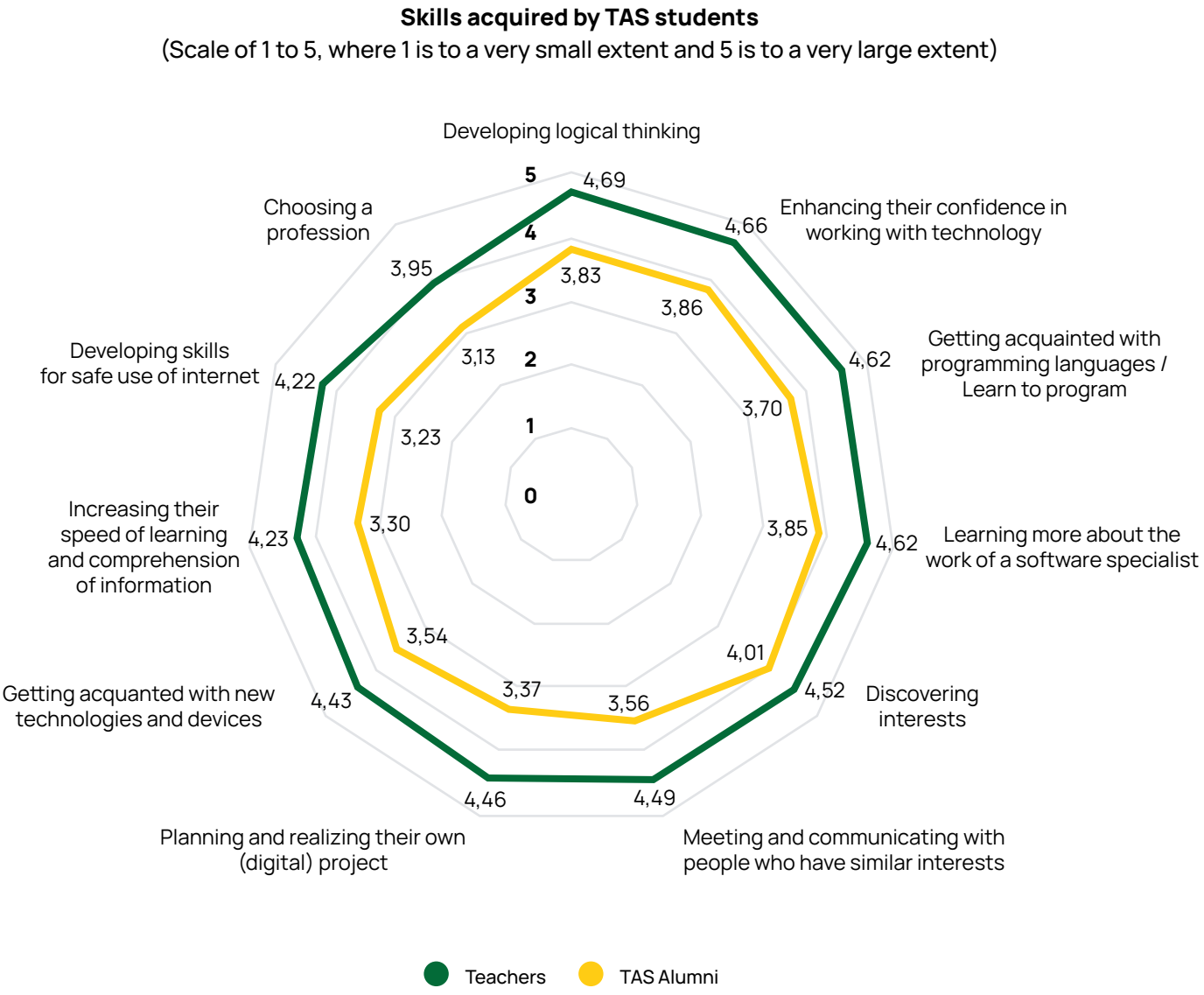
Skills acquired by TAS students

When it comes to the skills acquired by participation in the program, there are some differences between the teachers` opinion and students` self-reporting. Both groups, state that increase of the confidence when working with a computer is one of the top three benefits of participating in the Academy. However, while teachers think that as a result of their participation in the training students develop their logical thinking and learned to program, TAS alumni put in their top three acquainted skills – discovering interests and learning more about the work of software specialist.

Here again, teachers as a whole tend to give more positive assessments compared to TAS alumni. The factors with the biggest difference between the two groups are planning and realizing their own (digital) project (1,09), developing skills for safe use of the Internet (0,99), meeting and communicating with people who have similar interests (0,93) and increasing their speed of learning and comprehension of information (0,93).

Figure 64: Skills acquired by TAS students – comparison between teachers and TAS alumni

(Base: Teachers: 63, grade 4-7 students, N=146, grade 8-12 students, N=151, 18+ TAS alumni, N=123)



Source: Survey among TAS teachers and survey among TAS alumni

4.6. STRENGTHS AND WEAKNESSES OF THE TAS PROGRAMS

4.6.1. Teachers

Strengths

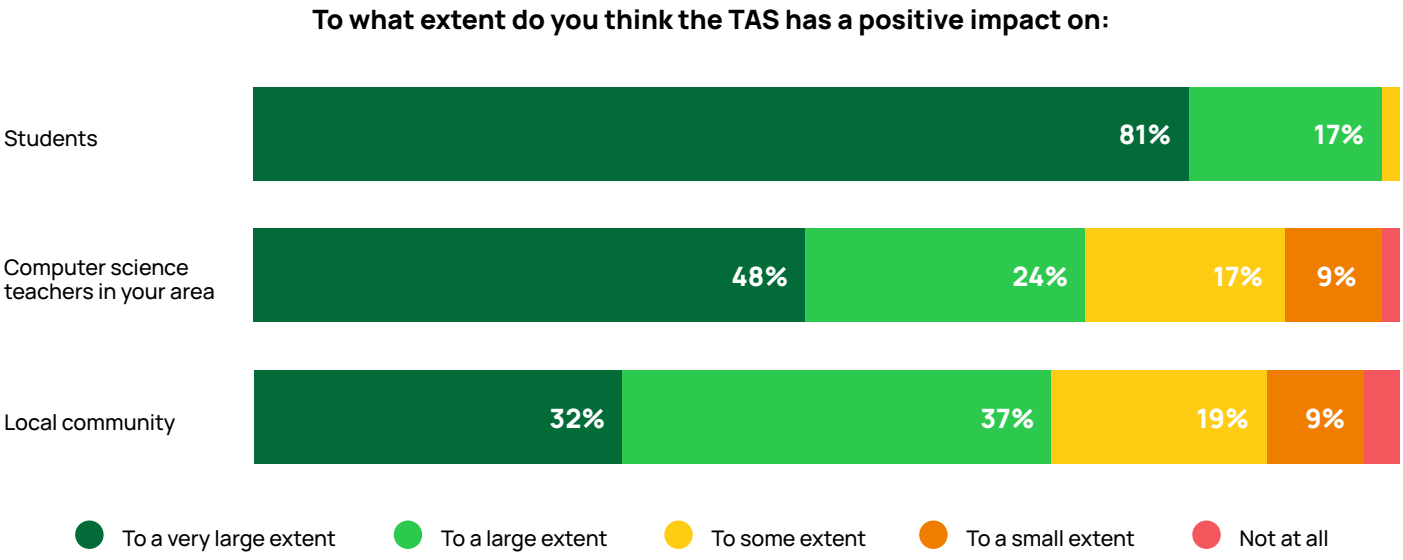
The overall evaluation of the Telerik Academy School by the teachers was excellent. Teachers clearly recognized the positive impact of the courses offered on students. Just over 80% believed that the positive effect of the program on students was very large, and 17% defined it as large. Attitudes towards the influence on computer science teachers and the local community were also positive. A cumulative share of 72% supported the claim that the program has had a great or very positive impact on the local teachers who were part of the program. Attitudes towards the positive impact on the local community were similar.

> **The meetings and gatherings organized by the Telerik Academy School are always pleasant, always useful, always constructive and always done almost to perfection.**

Teachers pointed out the strengths of the Academy in improving the knowledge and opportunities of students, creating conditions for development in the IT sector for students from smaller settlements and offering opportunities for early learning. In small towns there are rarely opportunities for training in the field of information technology, and there is often a financial barrier for children wishing to develop their skills in this direction.

Figure 65: Impact of TAS program on different levels according to teachers

(Base: N=63)



Source: Survey among TAS teachers

The Academy successfully combats these factors by offering free training at a local level. The strength of improving the teaching methodology by introducing different approaches, aiming to

present the necessary information in an interesting and effective way, is identified as a strength. Providing flexibility in the work process is also highlighted as a strength of the Academy, as it allows teachers to adapt lessons to the specifics of the group they work with. According to the teachers, the Academy successfully motivates the students and provokes their further interest in information technologies, as it happens in a friendly environment, through well-adapted approaches.

> **"The strengths of the program are that it motivates children to learn digital science in a way that is enjoyable for them, not mandatory, but desirable, and turns our classes into fun, not boring material to take. "**

During the interviews, the positive effect of the program at **a local level** was repeatedly emphasized. As the courses are free, each child has the opportunity to get acquainted with the field and develop their abilities. This neutralizes the lack of access for students due to financial reasons, while allowing for the development of children from smaller settlements. Although children living in smaller cities have difficulty finding an IT internship or job, they often manage to reach their potential in various competitions and Olympiads.

The main positive effect of the program is the **early education of children**. The Academy offers more advanced courses covering children from 4th to 7th grade, while this happens at a later stage of education within the state educational system. Teachers appreciate this opportunity, as it allows children to orient themselves earlier in the field and creates a basis for successful performance in Olympiads and competitions.

Weaknesses

In both qualitative and quantitative research, **teachers rarely identify weaknesses in the program**. The given recommendations for the overall organization, topics and conducting of the trainings of the Telerik Academy School are related to the creation of manuals for lessons and topics from Digital Sciences and Game Development for the grade 8 to 12 students. Suggestions are also given for the Academy to prepare students and teachers for the courses. This includes preparing presentations for new teachers and introducing children to the courses and their specifics.

For a small number of teachers, the different level of children in the groups was also a problem, although most of them shared that with the appropriate methods this problem was quickly overcome.

Some disadvantages and advantages of online teaching and learning are mentioned during the interviews. Lack of personal contact with students has sometimes led to problems with discipline and attention retention. However, teachers share that some of the shyer students were able to express themselves better during distance learning.

Teachers rarely report difficulties in their work at the TAS. The share of respondents who share that they experienced difficulties was just under 10% (9.7%). During the interviews, high marks were also given in terms of working with the Academy. All participants shared the opinion that when facing a problem or difficulty they have always received timely and adequate assis-

tance. The speed with which they received support was also appreciated. The main difficulties faced by the teachers were related to the children's performance and the probability of dropping out of TAS trainings. It is clear from the interviews that students dropping out is most often associated with a lack of sufficient interest in IT technologies or a lack of motivation among parents. Distance learning has also created barriers for some children, but it is often shared that this form of learning has been more beneficial for students who have been inactive in the in-person form of studying. Between 2017 and 2018, the main problem that the teachers had was with the equipment in the location where the courses are held (the school) (30%). This problem was mainly experienced by teachers in the courses "Digital Sciences" and "Game Development". However, it should be noted that the difficulties are mainly related to technical problems.

4.6.2. Parents

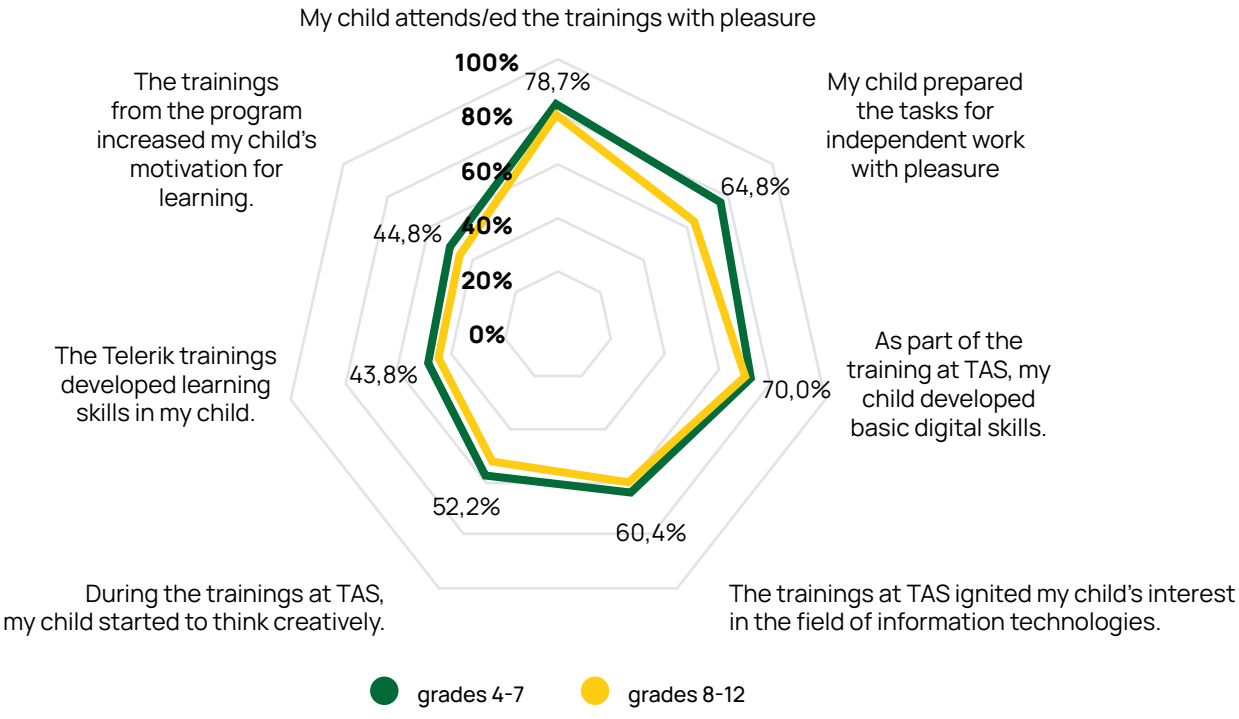
Strengths

The parents see the TAS program as important factor for their children to help them strengthen and realize their interests in programming and technology. For parents of grade 8-12 students, the TAS program is also important to help students decide if they want to continue their higher education in the field of programming and technology. The assessments of parents also gave evidence that the majority of students participated with pleasure in TAS trainings, demonstrated high motivation for learning, and did their homework readily. The skills development was also highly appreciated by parents. The program ignited in children interest in the field of information technologies.

Figure 66: Parents assessment of skills developed by TAS

(Base: Parents 4-7 grade, N=254, Parents 8-12 grade, N=235)

To what extent do you agree with each of the following statements?
(Scale of 1 to 5, where 1 is to a very small extent and 5 is to a very large extent)



Source: Survey among parents of TAS students and alumni

Weaknesses

Parents indicated the following **several weaknesses** in the way the trainings were conducted and the communication with the stakeholders:

- Improve the mechanisms for giving feedback to parents of junior students. Some parents do not have the necessary knowledge and cannot assess the student's progress.

- Provide information to parents about future courses (e.g. by sending emails to parents).

- Do not offer courses on different topics at the same time, because students who want to attend both courses do not have the physical ability to attend them.

- Look for homogeneity in the level of students, as students who are not at a similar level with the majority of the group are demotivated.

- Find a balance in terms of teaching speed - faster speed also demotivates some students. This is also very important in the context of another role that the program plays - to help children understand whether the programming is interesting for them. At a higher speed of teaching or when it is impossible to present the subject in a more accessible form, it is possible for some students to give up, not because they have no interest or qualities to become programmers, but because the entrance to programming has not been optimally provided. And it is a challenge to find this balance and tools to ensure with confidence that students who drop out really do not have the attitude and qualities to become programmers, and not because of the high speed of teaching, inappropriate group (group with too high level) or difficult individual tasks, etc.

- Availability of materials and feedback on homework and their check in the group. According to some parents, despite the stated intentions and work plan - teaching materials to be uploaded to the system, homework to be checked regularly, in some cases this practice is neglected, and the feedback on the implementation of tasks for independent work stops. This is a problem for students' progress, especially for younger ones, as they cannot assess whether they have done well or not.

- Loss of motivation during distance learning. Although many parents are satisfied with the organization of the learning process from distance, some parents say that during this period the motivation of their children has decreased, they are behind the learning process and cannot catch up.

- In the context of different levels and the need to teach in "two speeds" due to the inability to open groups for different levels and ages, some parents suggest the introduction of assistant teachers. This practice is used in many of the courses of TAS and is assessed as successful by both teachers and alumni who have taken on the role of assistant teacher. Moreover, this approach also helps the assistant to develop their skills further and rethink the learning material and programing. The challenge would be to provide assistants for all courses throughout the country or to find suitable students from the course to take on this role.

4.6.3. Students

Strengths

The program contributes in many areas in skills formation, career orientation and personal development of trainees. It strengthens their desire to continue in higher education in the field of programming and technology.

The program is especially valuable in that for 4-7 group the program provides the basic skills needed for programming and development in the field of computer technology.

Students share that they have fun while learning, appreciate the opportunity to communicate with other peers who have similar interests and skills they have acquired in the field of programming.

Weaknesses

At the same time, providing a variety of groups according to the levels of students or providing training at different levels is a significant challenge for the program, which is shared by students. The complexity of the study material, as well as the speed of teaching is set as a weakness by some students. Many students are looking for opportunities to upgrade, but do not always know which courses are right for them and in what combination it is appropriate to take them. It would be good if teachers take some time to present the courses (and those that they do not lead personally, but are led by their colleagues).

4.7. LESSONS LEARNED, CONCLUSIONS AND RECOMMENDATIONS

The TAS program is an example of a successful investment in human capital, which contributes not only to the individual development of participants, but also to the development of the local economic environment in small towns and regions. It also provides support for the sector with the highest added value in Bulgaria—IT. The coherent theory of change, together with appropriate resources (suitable teachers, effective trainings for them, and appropriate learning environments) and the quality of the courses for students give very positive results for all key target groups - students and teachers. Positive opinions were also reported by parents.

One of the biggest achievements of the program in the past three years is its outreach to smaller towns in the country where opportunities for developing the IT knowledge and skills of children are limited or even missing, or the financial barrier for doing it is high for the parents. TAS successfully combats these factors by offering free training at local level, thus creating the conditions for students in smaller settlements to learn and develop skills necessary for their future careers. This geographic expansion of the program should continue.

It is important to continue working with both, junior and senior students, as the training seems to develop different knowledge and skills in them, while solidifying the interest in IT in both groups. According to the teachers, the Academy successfully motivates students and encourages their further interests in information technologies in a friendly environment and using well-adapted approaches.

Another gap that TAS fills in is the early IT education of children. The Academy offers more advanced courses for juniors, while this happens at a later stage of education within the state educational system and with a limited scope. This helps the kids to gain knowledge and skills applicable in the future, regardless of the chosen professional track.

The participation in TAS ignite students in programing. The program contributes to the skills formation of students 4-12 grade and prepare them for future study and work in the field of programing and computer technologies.

The participation in TAS also contributed for evolving students' interest in continuing tertiary education and helped them realized or strengthen their desire to study higher education in the field of programing.

Beside the excellent results of the program several challenges have been identified during the evaluation:

- The homogeneity of groups
- Speed of the courses
- Complexity of material
- Feedback on homework
- Too intensive homework
- Choice of right level of difficulty of homework
- Communication with parents with feedback on the students' performance
- Communication with parents regarding next courses.

Many of these are disputable and there is no one answer how the program can improve. Below are the views of different target groups for the further development of the program and challenges that should search for solutions:

Role of TAS for teachers and teaching practices

- The introductory steps in the program play an important role in attracting teachers to the cause of the Academy. The trainings and meetings for exchange of experience have a significant impact on the subsequent attitudes and the approaches used by the teachers in their work.

- The most effective approaches included in the program are related to teaching methods "child-oriented" - game approach, adapted pace of teaching, practical methods, creating a free environment, encouraging children's creativity.

- The tasks that provoke the thinking and creativity of the children, without placing an explicit focus on the achieved results, manage to form a desire to learn, improve the self-esteem of the students and work successfully to keep their interest.

- The optional nature of the program and the lack of assessment are extremely important for the smooth and successful formation of a desire to learn, high self-esteem and improvement of the general value system of children. Lack of evaluation removes the desire for progress in the context of higher grades and replaces it with a desire for personal development and growth based on available own capabilities.

- The application of the methods from the program in the standard educational system forms in the teachers a stronger confidence and a feeling of satisfaction from their work. This increases their productivity and dedication, both in terms of their obligations to the Academy and beyond.

- Creating a community of students with high success in programming is of significant benefit to local communities. In this way the horizon of opportunities for participation in regional competitions between different districts of the country is expanded, the professional capacity in the field is increased and opportunities for positions with higher paid work are created.

- The most common reasons for the impossibility to apply the methodologies of the Academy is the **discrepancy between the curriculum and the content of the schools and those in the Academy**. In order to ensure the process of applying the methodologies of the program in the standard educational system, it is necessary to take into account the specific features of the curriculum of the particular school.

- Teachers emphasize **diligence and skills** as key qualities for successful realization on the labor market. This means that there should be an explicit focus on creating specific skills, such as searching the Internet, solving problems without the necessary knowledge, logical thinking and practicality, which will build the necessary flexibility in children to create them as self-confident individuals and desire to work.

- Teachers believe that it is necessary to create **special related manuals** for lessons and topics in Digital Science and Game Development 8-12 grade. Suggestions are also given for prior support of students and teachers. This includes preparing presentations for new teachers and introducing children to the courses and their specifics.

- The effectiveness of different approaches related to putting the child at the center of the work is often pointed out. For this reason, the availability of **soft skills in teachers** stands out as particularly important. Special training sessions could be offered to overcome already established problems at work - lack of interest in children, lack of interest from parents, differences in the age of children in different groups, problems with discipline, challenges of distance learning, etc.

TAS role for students

- Early IT education of children (4th grade) is extremely important as it provides an opportunity to develop skills in students at an earlier stage, which subsequently creates a very good basis for development in the sector.

- The development of **leadership skills in children** would have a positive effect on local communities, as it would ensure that professional and human capital remains in the settlement and at the same time will provide a basis for the development of the field in smaller settlements. Students with well-developed leadership skills would have a greater interest in starting their own business.

- One of the reasons for students dropping out of the program is lack of motivation among parents. This gives grounds for directing measures for their involvement and acquaintance

with the work on the program. Information materials related to the achievements of the graduates of the Academy could be prepared to show the effects of the program.

- As the Academy plays an important role in the choice of further education or career, the program could offer support specifically aimed in this direction.
- Students find smaller study groups to be more efficient and that the teacher could pay more attention to each student in that group. This applies mostly to group in-person training in Sofia, rather than the smaller in-person groups in other parts of the country.
- Continue working with junior (4th – 7th grade) and older (8th – 12th grade) students since the courses seem to develop different knowledge and skills in them. The Academy seems to develop and solidify the interest in informational technologies in both groups of students. That is vital for the future career development of students, once they graduate.
- Continue with the "Entry" course that has little to do with programming itself, since students find this course important for their entry into the world of programming. They find it useful.
- Although students do not report on a larger scale developing more technical skills like programming and creating a website and apps, they find that attending TAS has helped them a lot with their more advanced trainings later on in their development as informational technology specialist. TAS should continue with their current curriculum for 4 to 7 and 8 to 12 grade students.
- TAS could try to popularize their courses within students without any specific technical profile – students in high schools that have little to no exposure to informational technologies. Data shows that students within those high schools have interest in the courses and might be a pool of new students for Telerik Academy School. There might be an even bigger impact on the development of technical skills like programming, creating a web-site or apps within those students.
- Students of Telerik Academy School share that they would like to financially contribute to the Academy, once they are able to, so fundraising within this groups is an option for TAS.

In some cases, students from the youngest age group (4-7 grade) face difficulties to understand the material because it is too complicate and they are losing motivation. The challenge here is to what extent this becomes natural selection process of those who will continue in the programing or is negative factor for dropping out of students who in other circumstances can become good program developer.

V. APPENDIXES

COMPARISON BETWEEN SAMPLE AND GENERAL POPULATION

Number of courses attended per unique student	TAS database	Survey
One	65,6	68,9
Two	15,8	18,8
Three	6,0	6,4
Four	2,8	2,0
Five and more	9,8	3,9

Courses attended (base total number of attendees/unique individuals)	TAS database	Survey
[4-7 grade] Algorithmic programming	35,4	31,8
[4-7 grade] Digital sciences	8,3	8,9
[4-7 grade] Preparation for National Olympiad in IT	0,2	1,6
[4-7 grade] Game development	18,5	39,4
[8-12 grade] Algorithmic programming	6,7	5,5
[8-12 grade] Database	2,3	3,7
[8-12 grade] Digital sciences	5,5	6,6
[8-12 grade] Mobile apps	1,2	2,1
[8-12 grade] Preparation for National Olympiad in IT	0,4	2,6
[8-12 grade] Applied projects	0,4	2,1
[8-12 grade] Java programming	4,6	3,9
[8-12 grade] JavaScript programming	5,5	7,3
[8-12 grade] NET programming	4,2	4,7
[8-12 grade] Game development	7,9	16,3
[8-12 grade] Web programming	18,3	13,1

Year of participation	TAS database	Survey
2011-2012	5,1%	4,1%
2012-2013	14,1%	3,9%
2013-2014	23,2%	7,5%
2014-2015	8,4%	9,4%
2015-2016	11,2%	11,0%
2016-2017	7,2%	10,5%
2017-2018	7,7%	13,6%
2018-2019	9,2%	17,4%
2019-2020	14,0%	22,6%

Type of settlement	Which grade group do you belong to?			TAS data base	
	grades 4-7	grades 8-12	I have completed 12th grade	2018-2020	2011-2017
Capital	46,8%	72,0%	72,8%	37,7%	91,0%
Regional city	42,6%	16,7%	16,5%	53,6%	8,6%
City	12,8%	12,9%	12,6%	8,7%	0,4%

TAS Program/Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Total
[4-7 grade] Algorithmic programming	533	337	1217	182	514	407	548	589	460	374	**5161**
[4-7 grade] Digital sciences			245				114	127	307	265	**1058**
[4-7 grade] Preparation for National Olympiad in IT					91						**91**
[4-7 grade] Game development				311	301	300	356	481	560	847	**3156**
[8-12 grade] Algorithmic programming		890	554	369	300						**2113**
[8-12 grade] Database		284		186	140	172	900				**1682**
[8-12 grade] Digital sciences							116	116	248	201	**681**
[8-12 grade] Mobile apps				230	119	109					**458**
[8-12 grade] Preparation for National Olympiad in IT		81	59	40							**180**
[8-12 grade] Applied projects			69	60	109						**238**
[8-12 grade] Java programming					1171		2835				**4006**
[8-12 grade] JavaScript programming			926			547					**1473**
[8-12 grade] NET programming		740		682							**1422**
[8-12 grade] Game development				177			22	194	271	438	**1102**
[8-12 grade] Web programming		1107	2008	330	403	1357	922		67	138	**6332**
GRAND TOTAL	**533**	**3439**	**5078**	**2567**	**3148**	**2892**	**5813**	**1507**	**1913**	**2263**	**29153**

Source: TAS database

CASE STUDIES IN DETAILS

A.T. (19 years old)

A. is an example of a person who has developed along with the development of the Academy itself. He has gone through almost all the trainings ever offered by the Academy.

Already in the 3rd grade he started attending computer science courses at Sofia School of Mathematics, led by Yavor Nikiforov. Then, in an effort to make progress as quickly as possible, during the winter holidays, Alex read the entire 9th grade computer science textbook. The young man's striving for knowledge is constant and he starts attending the course for fifth-graders when he is still in the 3rd grade.

At the moment when Yavor Nikiforov was invited to teach at the Telerik Academy School, he attracted some of his most prominent students tzo help him, including Alex. The task of the assistants is to help students who have difficulty with the material. Alex conscientiously and devotedly takes on the role of assistant lecturer and helps anyone in need. He says his participation as an assistant teacher at TAS, helped him most to develop his skills and knowledge.

Telerik Academy School also proposes training appropriate for his level and the level of other more advanced students. During the trainings, each of the students is charged with the task to prepare and present several topics to the group.

A. attended many courses in Telerik Academy School: KIDs Academy, School Academy (with Java and game development), Algo Academy and Software Academy (2 modules - C # and JavaScript), taking all exams with honors. He states that the greatest degree he has received in the Academy is the knowledge of algorithms using C++, knowledge in competitive programming, but also developed skills for learning, communication skills, teamwork.

In his spare time, he has always sought to develop further by using Telerik Academy's student materials for his self-study.

A. graduated from the Sofia Mathematical High School only a few days ago, and can now boast an enviable CV in the field. He started his first job at the age of 16 at Codix, where he remained until the beginning of 12th grade. He was then recruited by a British startup, and is currently a software engineer at VMWare. He is currently a student at Technical University-Sofia, majoring in Industrial Engineering (in English). He also runs his own Startup project with classmates.

B. V.

B. started attending the courses of the Telerik Academy School when she was in 8th grade. Attends Java and TypeScript courses.

B. shares that she has learned a lot of new and useful things that have laid the foundations of programming for her. The intensity of the trainings and the level that each participant had to cover at the end was a serious challenge.

> **"Personally for me when I was that age, things were moving too fast because I didn't come from a class that had such a focus - I did it out of self-interest… "**

B. evaluate the high level, sets by the Academy, as a strength of the program. This provoked her to work hard and make extra efforts.

> **"With Telerik Academy School, I built my basic knowledge of programming. The topics were quite interesting. It's just that for me everything was moving very fast, because I didn't have this basic knowledge beforehand. I mainly focused on understanding some basic concepts that I didn't have at this stage. I was trying to build what a high school math student would have as knowledge. Definitely the more complex topics we covered towards the end of the Academy came to me too much and I did not have the ability to deal with them. But that's exactly what prompted me to keep racing and learning new things in my spare time."**

The additional efforts she made during the training gradually introduced her to many topics in greater depth. The trainings gave her clear understanding of the opportunities for development in the area and understanding what is interesting for her.

> **"I would say that I am pleased with how far I have come and I am grateful to Telerik Academy School for being able to direct me to what I want to do."**
>
> **"After the Academy, I knew what kind of programming I wanted to do. I knew which language I wanted to pursue. It was the Academy that helped me lay the foundations in these directions. The Academy was a mean to the next step on the ladder."**

Today B. is pursuing a Bachelor's degree in Computer Science at one of the best universities in the UK. She is currently completing her year in industry/placement year as a Software Developer at IBM.

I. H. (21 years old)

I. started attending the Telerik Academy School when she was in 9th grade. She was studying in a game development course. She remembers with a smile:

> **"Grade 9-10th imagining that you would make a game, then show it to your mother and father and let them play against each other was an incredibly exciting experience."**

The trainings are conducted in three days of the month and for each of these courses I. had to travel from his hometown - Lovech, to the capital and stayed there. This physical distance, which she has to cover every time, does not stop her. In the 12th grade I. again enrolled for training at TAS. She took the decision to study in part-time education at school and moved to Sofia.

> **"I moved to Sofia with the idea to study at Telerik Academy, because it was 4 hours a day of training and if you want to learn the material, you need at least another 4 hours of work at home."**

I. actually enrolls not in one, but in two trainings in the Telerik Academy School. She attended the trainings for digital skills at Telerik Academy School and the professional program of Telerik Academy in parallel.

> **"In general, I went downstairs to be on first floor for one training and went upstairs immediately afterwards to continue with the lectures on the other "**

Hard work, sleepless nights and personal time devoted to high results are not a burden for her. On the contrary, she shares as a fond memory of a working meeting with colleagues from the course, which lasts for hours even on Christmas Eve:

> **"We were three people in the first team project we had to do. We didn't know each other. I wrote to the other two boys. It was very interesting then. There was some very good symbiosis between us as a team. We were so interested in doing the task we had been given that it fell exactly in December then on the night of Christmas. I remember falling asleep on a laptop at 3:00 o'clock AM, while discussing how we will do the project. With complete strangers! We have spoken exactly two times. But they also stayed at 3 o'clock. And by the way, I still see these people and even one of them became my best man."**

I. shares that she saw enrollment in the professional program of the Academy as a springboard to start working. That's what happened. Less than a month after completing the program, work began. And she has the opportunity to choose between several jobs offered to her by companies from the partner network of the Academy. She chose the place that she believed will contribute the most to her development.

To date, I. already has two years of experience in the field. Years ago she was invited to return to the Academy as a mentor in the professional program. I. studies computer science at the Faculty of Mathematics and Informatics at Sofia University and shares that the knowledge acquired within Telerik Academy School and Telerik Academy is extremely helpful for her studies at the university. She managed to exempt of many of the exams and others pass easily thanks to the skills she already has.

D. T.

D. T. has been a lecturer at the Telerik Academy School for two years. He teaches the game development course. He himself is a graduate of the Telerik Academy School. He first joined Kids

Academy in 2012. Then he attended courses and algorithmic programming in C++ and games development. At that age he started helping Yavor Nikiforov in game development trainings. He was answering questions and helping other students who had technical difficulties. He remembers that at the age of 16 he became interested in teaching, going to school and helping other students, and gave his first independent lesson when he was 17 years old.

He says that trainings of his teacher Yavor Nikiforov have always been in a highly informal style, which counts as a positive side and he is trying to apply this same style in his own manner of teaching.

In 10th grade, he enrolled in the Telerik Academy program for university students, studying C # and JavaScript.

At the end of 11th grade Dimitar started working as a program developer in xQuadro, where he worked for two years. In the meantime, he began his higher education at the Faculty of Mathematics and Informatics at Sofia University. He currently has about five years of teaching experience. He teaches in some of the summer schools of programming, organized by Yavor Nikiforov, also teaches algorithmic programming for 6th grade in Sofia School of Mathematics, and within the Telerik Academy School he teaches development of computer games.

D. T. strives to build an informal, friendly environment in his teaching. He wants the children to feel comfortable and free to communicate.

> **"I try to make the trainings informal and the environment pleasant for the children. I try to make them feel like they're in front of the computer with friends and programming, not like they're at school and everyone has to keep quiet.“**

It strives to offer children a variety of activities and to build friendly relationships with them. In some breaks he is playing football or volleyball with the students or he offers them different activities to distract them temporarily from the learning process and to give them opportunity to relax.

> **"I imagine that the students see me as their friend and the programmer who is there to help them with the problems they face. The friendly environment, I think, has also encouraged shyer children to communicate and ask questions freely. The goal is not teacher to look scary and the whole training to look scary."**

He appreciates the activities that make children feel that they are an active participant in the learning process:

> **"I try to make children feel as if they also participate in the teaching and learning, and not as if the only task is for me to tell them what to do and for them to do it"**

He strives often to illustrate concepts that presents to the students, giving simple visualizations of already developed codes. This he believes helps children to better understand the material, which will be harder to explain in words or pictures alone.

The strength of the game development course, according to him, is precisely the seriously set visual element:

> **"I would say that perhaps the more fundamental programming knowledge is in the programs of algorithmic programming, but the programmes of game development are much more rewarding for the children, because the result is much more "attractive" and they see the result on their screen."**

Personally, he says that teaching helps him to better understand some concepts in programming and makes him a much better programmer.

> **"Despite the things I teach are easy, they are fundamental, and I would say that if I hadn't taught, I would have had a worse understanding of them."**

In his teaching, D. T. strives to lay the foundations of programming and to ignite in children an interest in this activity, just as his teachers ignited it in himself:

> **"I try to give children a foundation for the most basic things in the field of programming and computer graphics. The other thing I think is more important is that they "catch fire". To make it interesting for them. To start doing it with pleasure. In the beginning there may be some difficulties, the children do not understand why this happens, to see it as a kind of magic, I try to show them that it is not complicated, it is not scary and that a child can do it."**

I. D.

I. D. has been teaching for almost ten years. He started when he was in 7th grade. He then was helping the teachers by teaching the junior groups. After graduating from school, he joined the camp organized by Yavor Nikiforov, and shortly afterwards in 2016, he joined the camps organized by the Telerik Academy School. He has been teaching there for three years. He teaches algorithmic programming and game development. He himself is an alumni of the Telerik Academy School.

He is currently pursuing a Master's degree in Artificial Intelligence at Sofia University, and will start working for a trading company in London in the autumn. He says he would certainly return to teaching students in the future.

As a teacher, his main goal is to convey to students the desire to prepare themselves further:

> **"There are quite detailed resources in this area online as well. If they have the desire, they can develop themselves. So that's the key. "**

Almost always, when teaching, he gives resources for students to access information they can view and offers them materials they can read further. One of the most important skills that students in the 21st century should develop is searching for information on the Internet. Therefore, he strives to use every opportunity that is given to students to exercise this skill in a controlled way.

> **"Usually, when a child asks me how something can happen and it's a question he can easily answer on his own with the search engine, I tell him that I won't answer it and I'll just let him try to find the answer and if then he will fail, I will help him."**

He finds working with young people extremely inspiring and satisfying.

> **"It's almost always interesting people who want to do interesting things, and it's always exciting when a student of mine shows me that he's done something cool that I know I've helped him do in some way. In general, perhaps most of all, I take for granted the satisfaction of teaching students to develop."**

Goals and objectives that follow in his teaching are well defined depending on the training. In the algorithmic programing - to prepare competitors in programming in the form that is conducted. In game development - to teach children the skills applicable in programming, with which they can easily find a job as program developers. He claims that all students of Telerik Academy School, who study long enough and conscientiously, become fully capable of Junior level program developers at a very early age. Students who are trained in algorithmic programming, in turn, become good competitors in national competitions. Most of the leading places in competitions in the country are of students of the Telerik Academy School. This gives a strong advantage in future job search. Large technology companies such as Google and Facebook, for example, value the strong performance of such programming competitions as part of their job portfolios.

I. D. states that he wants to be a teacher who knows how to inspire his students.

T. D.

T. D. is senior teacher in Informatics and information technology. She also leads modular training of students in the professional classes "System Programmer" at the Mathematical High School "Acad. Kiril Popov "in the city of Plovdiv. She started teaching there in 2007. She is among the most successful leaders of the Competitive informatics team of the high school. Her students have won more than 60 medals and prizes. She has defended all professional qualification de-

grees / from fifth to first /, and in 2018 she defended a dissertation on "Basic learning activities in preparing students up to 5th grade to participate in competitions in informatics and information technology" and acquired a PhD. In 2019 she received the "Teacher of the Year" award and was awarded the badge of honor of the city of Plovdiv. In 2021 she again received the award "Teacher of the Year" from the Union of Bulgarian Teachers in the field of "Educational work, extracurricular activities" and won the grand statuette and the honorary award "Neofit Rilski".

T. D. is also a teacher with a 10-year history at the Telerik Academy School. She started teaching Algorithmic programming at the Academy in 2011. She has been one of the first teachers to respond to the idea of establishing Algorithmic Programming trainings for Telerik Academy School in different cities. The aim is to support teachers for additional training of students for competitions. For her experience as a leader of the Competitive informatics team she shares:

> **"To make a competitor is not very easy and it is not about the number of hours, it comes to innumerable sleepless nights and work, and standing in front of the computer, staring at the code, which you have to break down to the smallest detail."**

When Telerik Academy School started the Game development, she took over the training of students between 8th and 12th grade in Plovdiv. She receives training from the Academy on the specifics of the course topic. Since last year she has been also teaching the Web programming course at the Telerik Academy School. She is enjoying a great interest in the courses and good reviews from the side of the students:

> **"They see me in the hallway: "We will now enroll and the next course! "Those who have enrolled Games development, look forward to enroll Web programming. And those who have completed Web programming are thrilled to go into Game development … I really like these courses. Even after completing those two, because they are one level, they ask: "Is there another one?"**

One of the biggest positives of the program, that she mentions, is that the trainings are free and give a chance to children who cannot afford to pay such courses.

> **"Quality teachers provide quality education to all children and that's great! It's a cause, which you can't imagine how happy it makes whole families."**

Mrs. D. is extremely committed to her profession and likes, and is motivated by working with students and working environment, which together have created:

> **"If I tell you with what joy, with what sparks in the eyes the children come. Because we also play games, we make friends, there is a moment of… just to become as one, as a team. These courses last as a good emotion. It's great!"**

Within the course on Algorithmic programming T. D. strives to set the basics of programming for children, doing it in an interesting and accessible way. Additional goal that she sets, is to develop logical thinking of students.

> **"Our goal is not to make competitors, but to develop the logical thinking of these children and teach them a new programming language and give them the basics of informatics."**

Very often in their teaching she includes games, so that students " can feel the thinking of the computer".

> **"Sometimes I explain one and the same thing in three ways, and when it doesn't happen in the third way, we start acting it out. Very often I include games -simulation to be able to feel the thinking of a computer ... For example, when we played sorting, we all laughed so much! Because I deliberately let one-part watch and the other play it, so that they can be seen from both sides - when they are inside the game and when they are outside of it. "**

T. D. speaks with great love and positive emotions for Telerik Academy School and the team. She shares that she has the opportunity to see and apply many new teaching methods offered by the Telerik Academy School. The materials developed to help teachers are also extremely useful to her. The freedom that the team gives teachers to determine certain aspects of their teaching, depending on the level of the group, makes her calm and satisfied with the learning process.

> **"I have the opportunity to watch the videos that are prepared by the Academy, and I do it because I want to adjust my watch, to see their style. They are young girls and boys who teach in a very interesting and different way for me… There are things I watch with admiration. For example, these games that I include, I learned from them about these games. They even provoked me to create new ones. I learn from them and I like that."**
>
> **"I also really like that I have freedom. They give you a sample program template, but you are free to add, to accelerate, to decrease depending on the group."**

"Every year they surprise me with new ideas. They are great and every time I have something to learn from them. Now 2021 marks 10 years. I want to tell you that it is such a pleasure to work with them.

I even cannot imagine not working with them!"

OPINIONS OF STUDENTS (Source: in-depth interviews)

"The most interesting thing that impressed me was that when she offered us to sign up, the lady appeared with a T-shirt with a ninja on it. I decided that I must have such a T-shirt. I really wanted to have such a T-shirt and decided to sign up. Yes, that's it. And then it turned out that I really liked it, and I didn't need to look for anything different."

"In the fifth and sixth grades, the beginning, the basis of programming, C ++, was given and now, according to one's views and needs, a person - having this basis, can easily transfer it to other languages."

"The good thing is that you don't start something in C ++, and then leave it to learn another language, and just accumulate a lot, a lot, a lot of basic knowledge about different languages, but act in one direction and having something complete, we can easily shape it the way we want."

"I continue to apply the learned knowledge not only as a competitor, but also as an author of tasks."

"It's an opportunity that in fifth and sixth grade you have something else to do besides school, which seems to give you extra room for expression. That was one of the most valuable things for me that TAS gave me then."

"Certainly, participating in the TAS helped me in my further education."

"Telerik Academy School provided knowledge that is taught in the ninth grade, for example, or in the tenth, in Informatics classes. It gave us the opportunity to take them at 5-6 grade because we really needed them. And already in the classes it was more of an upgrade and when the teacher sees that you have this knowledge, he/she will give you other tasks so that you can develop, and not stand and watch what others are doing."

"The Telerik Academy School gives a great start and now when you want to deepen something, you can work alone, because you have the necessary knowledge so that you can develop with the help of other teachers."

"The Telerik Academy School has set the direction and by setting this direction, it is normal if a person manages and does not give up over the years, not everyone can stand it. Especially when in the ninth grade and schooling becomes more intensive. But if you follow this path to the end and give your best, this end - and it is not the end, it is a sequel, it is quite logical."

"I really liked the way they teach because I'm from a family of teachers and I know it. It was very interesting, because the teaching itself, the way, the style, how they make us a community - which I liked, because then there was a quarantine... How we were united and really after that we remained friends."

"One of the most important things they taught us is to know how to find what we need. Because there is really everything son the Internet, but knowing how to find exactly what you need is much more complicated. And don't be afraid to try on your own, to try, to do."

"Motivated people go to such a place - those who want to do this thing, and the environment is completely different. Because everyone wants to, and if you don't like it, you just stop going."

"It definitely helped me to be more confident in this area, to know that I like it. I already know that I like it and that I want to develop in this field."

"I don't know how confident I am about teaching. Yes, I was taught by boys who are two years older and I totally know it's okay. But yes, I would definitely go back to teaching and teaching what I know, and stimulating, and showing something new that interests them, and learning something new, because I know we all learn something new from students. All teachers."

"The topics were interesting. The knowledge I gained gave the initial impetus, which began my " career " in Competitive informatics competitions."

"The classes laid the foundation for my participation in competitions in Competitive informatics. I learned the most commonly used data structures in Informatics, as well as the standard operations on them. I use the skills learned during the training every day, and I plan to use them in my professional realization."

"Even after the end of my participation in the program, I continued to develop in Competitive informatics, preparing myself."

"My participation in the Academy significantly influenced my choice to continue working professionally in computer science. "

"I don't write off at all as an option to one day have to do some of the things I learned at the Academy. Or to help someone close to me. In general, that's why I graduated from the Academy."

"The Academy was something peripheral to me that I might need one day, but not something I want in my daily life."

"Because I was not satisfied with what we learned in school, I sought external information. With the exception of the Internet, I wanted it to be something that they explain."

"What we learned in school until the 12th grade, we passed in TAS in the first month, in the first three days in reality, when the classes were."

"After TAS, I went on an internship in an IT company and I wondered if this was my thing, after this internship. But in this internship I certainly applied what I had learned in the Academy, because it was literally after that. It was the next summer."

"The goal of Telerik Academy School, in my opinion, is not to give you knowledge and skills, the goal is to ignite you, and you have to develop yourself. With the skills you get there, I don't think they're that good. They ignite people, children at least. When you go there is fun. Then the course ends, but I have the Internet - and you keep learning and deepening."

OPINIONS FROM OPEN-ENDED QUESTIONS IN QUANTITATIVE SURVEY

"I want to share again the positive emotions and impressions that the Telerik Academy School left in me. Thanks to the good organization of the team and the professionalism of the teacher - Doncho Minkov, I can confidently confirm that my participation helped me develop in the field of programming, introduced me to interesting technologies and gave me the impetus to continue programming. During the program I participated in, I was looking forward to the three days of the month in which to travel from Haskovo to Sofia to participate in the themes and tasks Doncho Minkov gave us. I am grateful that in our country there are organizations with good and competent teachers like him and I am convinced that they significantly contribute to the technological progress of our nation. Telerik Academy School ignites the interest in programming in high school and gives more a close look at the whole technology stack and the different skills and knowledge we need. It gives a good idea of what to continue to learn and deepen as topics and skills after graduating from the Academy.

I am grateful that I joined the initiative "Web applications with Java and Spring MVC "- 2017/2018, led by Doncho Minkov!

With wishes for many more inspired students to continue to develop in the field, thanks to you! :) "

"I first started going to the Academy ~ 8 years ago and it really helped me a lot to understand that I want to deal with technology. Yavor Nikiforov is an amazing teacher and I would say that he is one of the most influential figures who brought me to the situation I am in now. I loved programming with him."

"I want to thank you for teaching me the logical thinking one need to become a programmer."

"When I attended the Telerik Academy School, I was still not aware with myself and how I wanted to develop. And normally, at the age of 15-16, who knows what he wants ..."

"Training in TAS would be quite useful for anyone who is attracted to computer science, mathematics and technology in general. It helped me personally to realize that this type of activity is not to my taste and abilities, but I was still extremely happy with the way of teaching and learning environment."

"Your entrance level is too high. There are people with qualities who cannot start training because a foundation is required that humanitarian education does not provide."

"TAS gave me the basics of programming. At the moment, because of this, I am far ahead in my school and I know what I want to study and work."

"I'm satisfied. The children are changing. But I will never forget the time when he attended school. He was happy, ambitious, unsatisfied with what he had achieved [striving for more]. And he struggled with his childish strength. And he ran away from the last class in general school to attend Telerik Academy School. Thank you all!" (parent)

COMPARATIVE DATA BETWEEN GROUPS ON KEY INDICATORS

Which of the following things did you manage to achieve as a result of your attendance/participation in Telerik Academy School?

(Base: 4-7 grade students, N=146; Base: 8-12grade students, N=151; Base: 18+ TAS alumni, N=123)

Source: Survey among TAS students and alumni

Share of participant by TAS courses in each school year	Before 2016-17	2017-18	2018-19	2019-20	2020-21
[4-7 grade] Game development	5%	6%	32%	29%	37%
[4-7 grade] Algorithmic programming	18%	9%	39%	24%	17%
[4-7 grade] Digital sciences	1%	2%	8%	16%	12%
[4-7 grade] Preparation for National Olympiad in IT	1%				
[8-12 grade] Game development	1%		13%	14%	19%
[8-12 grade] Digital sciences		2%	8%	13%	9%
[8-12 grade] Web programming	29%	16%		4%	6%
[8-12 grade] Java programming	7%	49%			
[8-12 grade] Database	4%	15%			
[8-12 grade] Algorithmic programming	12%				
[8-12 grade] JavaScript programming	8%				
[8-12 grade] NET programming	8%				
[8-12 grade] Mobile apps	3%				
[8-12 grade] Preparation for National Olympiad in IT	1%				
[8-12 grade] Applied projects	1%				

Source: TAS database