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# SCHOOL OF THE FUTURE PROGRAM IMPACT ASSESSMENT



AMERICA FOR BULGARIA  
FOUNDATION  
Фондация Америка за България



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The purpose of this report is to assess the impact of support provided by the America for Bulgaria Foundation (ABF) to Bulgarian schools. The support consists primarily in investment in new educational technology including the required environment for the use of the technology. In the following sections we use the term *technology* in this broad sense meaning all related aspects of change initiated in order to provide conditions for the use of new equipment and education tools.

This assessment was commissioned by ABF and implemented by a team of the Open Society Institute and Admin Soft Ltd.

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The report benefited from the support of the team of ABF including Ivanka Tzankova, Natalia Miteva, Ivo Bossev and Stanislava Staneva.

The field work in the schools supported by ABF and in more than 200 other schools was carried out in November 2015. The report was finalized in March 2016.

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# Executive Summary

## Purpose of the Evaluation

The *purpose of this evaluation* was to appraise the **immediate and long-term impact** of 46 projects supported by America for Bulgaria Foundation (ABF) for improving the educational outcomes at Bulgarian schools through modernizing the learning environment and promoting the use of new educational technologies and practices. The study assessed the impact of these interventions on students and teachers, as well as the overall impact on the school and the community.

## Evaluation Methodology

The evaluation of the School of the Future projects used a variety of research tools and approaches, starting with extensive desk research and going through a combination of different qualitative and quantitative instruments. Thousands of students, teachers, and representatives of the school management and community participated in and contributed to the study. The two tables below summarize the different instruments and illustrate the magnitude of the samples.

### Quantitative Methods

Method	Type of Stakeholders	Number
On-line Survey	Students in comparison schools	37,916
	Students in ABF schools	14,534
	Teachers in comparison schools	5,048
	Teachers in ABF schools	1,346
	Management in comparison schools	354
	Management in ABF schools	77
Anonymized results of external evaluation – 2010 – 7th grade	Students in ABF and comparison schools	60,684
Anonymized results of external evaluation – 2015 – 12th grade	Students in ABF and comparison schools	54,507

## Qualitative Methods

Method	Type of Stakeholders	Number
In-depth Interviews	ABF schools – principals	22
	ABF schools – project coordinator	22
	ABF schools – parents	25
Focus Groups	ABF schools – students	266
	ABF schools – teachers	175
Semi-structured interviews	ABF Program Management	2

The main evaluation approach is based on a comparative analysis of schools supported by ABF and comparison groups of schools and a retrospective study of the students' standardized results at national tests before and after project implementation. To analyze the change, the added value model was used.

The added value model was developed in the last decade specifically to assess educational programs. The concept focuses on the progress of the same students over time<sup>1</sup> and allows to assess the contribution of each school to student performance. This is a complicated method regularly used by international organizations such as the OECD and the World Bank. In Bulgaria, an added-value evaluation of the whole school system based on standardized national examinations was initiated by the World Bank and a report is expected to be published soon. This evaluation uses the same methodology and adds a statistical analysis of the difference in scores of schools supported by ABF and schools included in the comparison groups.

## Summary of the findings

### Impact on the Students

The Information and Communication Technologies (ICT) are **better integrated in the learning process** in ABF-supported than in comparison schools: 35% of the students use ICT equipment almost every day or several times a week, 5% higher than their peers in all comparison groups. The most often used technologies are multimedia and interactive boards. A quarter of the

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<sup>1</sup> Gray, J., Goldstein, H. and Sally Thomas "Of Trends and Trajectories: searching for patterns in school improvement," *British Educational Research Journal* (29, no 1), 2003, pp. 83-88.

students use Internet-based tutorials and lessons. Almost 2/3 of the students use the equipment supplied under the ABF supported projects at least twice a week.

The increased usage of new technologies for learning has contributed to a better performance at national standardized tests and competitions at school, regional and national level.

The results of the national standardized tests confirm that the ABF-supported schools have more added value in **Bulgarian language and natural sciences** (using the combined scores in physics, chemistry and biology) exams than comparable schools. Though the ABF program does not have any special tools to influence Bulgarian language teaching, this exam is the only mandatory one and as such, it is representative of the overall achievements of the students in the school. From this perspective, the exam in Bulgarian language can be considered a good measure of the whole effect of the ABF program. The significantly better results of ABF-supported schools reflect the changes that have occurred in improving the quality of teaching and learning.

In **foreign languages**, schools supported by ABF and the comparison groups had a similar level of success in 2010. At the matriculation exams in 2015, students in ABF-supported schools did much better than their peers in other schools. Recognizing the influence of many other factors, still a valid conclusion is that ABF program has contributed to the improved foreign language results of the students.

There is no any added value in **mathematics** and further analysis shows that this is due mainly to the fact that the students at ABF selected schools were already very good in mathematics before the program started.

The study of the **cognitive skills** has found that students at ABF-supported schools outperform their peers in comparable school in the strong memory test and in practical numeracy, i.e. reading and interpretation of charts, tables, schedules and numeric information presented in pictures and words. We explain the good results of the memory test by the better skills of the students to quickly grasp and process information delivered on a screen. So, good results in a strong memory test of the students in ABF-supported schools is also a sign that their IT skills have improved. Besides, students at ABF schools have demonstrated ability to link theoretic knowledge to the solution of practical problems, something that continues to be one of the deficits of the Bulgarian school education

The study of the **non-cognitive skills** has measured important personal traits, including the so called "big five"<sup>2</sup>, but also decision making, grit, and having a growth or fixed mindset. These characteristics are known to influence performance at school but also on the labor market. There is statistically significant positive difference in the personal characteristics of the students in ABF-supported schools. The most important one is in the lower level of hostile bias. This

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<sup>2</sup> The big five personality characteristics include Extraversion, Conscientiousness, Openness to experience, Emotional stability (opposite of Neuroticism), and Agreeableness

means that they have a more positive perception of others. They are also a bit more emotionally unstable, which is actually a common characteristic of better performing students with high ambition. The other factors revealing substantial positive difference are decision making, conscientiousness, grit, achievement striving, and openness to experience.

### Impact on the Teachers

Approximately 40% of teachers say that as a result of the ABF program **positive changes** have occurred in their schools in: personal use of new technologies; introducing extracurricular and out of school activities and forms; presentation of teaching material and organization of the classroom work; the approaches to student assessment and assignment of homework tasks and individual preparation of students.

ABF projects have improved the access to state-of-the-art computers with Internet connection in the supported schools. As a result, 75% of the teachers have **access to the new technologies** against 68% in comparison schools. Despite the accessibility of the new technologies in general, almost 67% of the teachers at ABF-supported schools have not been able to use an interactive whiteboard. Estimated 45% of the teachers use the premises and equipment funded by ABF at least twice a week, which is a great result, having in mind the nature of the majority of the projects – language, science, and IT labs – which predefines the pool of teachers to use them.

Students at all surveyed schools share about **low use of new technologies** by the teaching staff. 41% of the students at ABF-supported schools reveal that teachers do not use ICT equipment often in class. This percentage is higher (48%) with the big comparison group.

As part of the ABF projects, many teachers were trained to work with new technologies and thus has contributed to the **development of teaching capacity** in the field of information technology. As a result, the majority of the managerial staff at ABF-supported schools (87%) are satisfied with the qualification of the teachers in informatics and believe they help the learning process against less than 75% in comparison schools.

### Impact on the School

Both, teachers and students in ABF-supported schools express a **stronger sense of belonging** to the school than in the comparison groups. Not surprisingly the ABF schools are positioned better to attract more students and the average number of students they have is about two times higher than in the schools from the comparison groups.

The **satisfaction** of the students at ABF-supported schools is way above the average for the country and reaches 53%. In 2012 PISA survey less than ¼ of the students in OECD countries expressed very strong satisfaction from their schools while in Bulgaria 1/3 did so. ABF schools are doing much better, so no doubt the School of the Future projects have contributed to this.

One of the reasons for the stronger sense of belonging to and satisfaction with the school described above is the fact that ABF program beneficiaries significantly overpass the comparison groups in terms of the overall **quality of the learning environment**, technical facilities and equipment. The ABF program has the biggest impact on the refurbishing of the schools with interactive boards, tablets, microscopes, laptops and multimedia projectors – these assets increased by 20% to 57% in the different schools as a result of project implementation.

With the ICT equipment provided by the School of the Future program, over 55% of the school managers at ABF-supported schools believe that the available computers are up-to-date and support the educational process.

Approximately half of the students in all schools believe that their school provides access to a state-of-the-art computer with internet whenever they need. However, the school of the future program allowed the ABF-supported schools to overtake the schools in comparison groups in terms of ITC equipment per student.

The ABF requirement to always strive for the best quality has started changing the attitude of the management of the supported schools to value the importance of doing things in the best possible way and to make choices based on quality and potential for sustainability. Making a funding contribution a requirement for the schools has developed their **ability to fundraise** and to better work with the community. The principals of the ABF-supported schools have reported that the average amount raised by a school after the project completion has went up from BGN 23,000 in the first year to BGN 62,000 in the 4<sup>th</sup> – an amount comparable to the average of BGN 68,000 contributed by a school during project implementation.

Another important change inspired by the program is the **spill-over effect on the school** itself. Parents in the ABF schools value the program achievements, but along with this they have started requesting measures to make all classrooms look the same as the renovated teaching spaces. A big number of the principals have reported continuous effort for improving the learning environment at the entire school following the high quality standards of the ABF program. Many of them claim that the entire school meets the contemporary requirements for supportive learning environment.

### **Broader Impact**

ABF program has produced some **spill-over effects of the modernization of the learning environment beyond the supported schools**. When headmasters and teachers from other schools learned about program achievements, they began looking for ways to replicate the examples of their peers.

The likely channels through which the project became known to other schools were professional networks of teachers, communication between school headmasters and by word of mouth within the parent and student communities.

Investment in modernizing the learning environment has also generated some potential for bottom-up pressure for systemic change in education coming from teachers and parents who demanded increased access to new technologies in schools and better educational outcomes. The project created a resurgence of parenting communities for fundraising and searching options for further improvement of school environment.

## Conclusions

The most lasting effect of the program's investment can be expected in terms of the **overall school organizational development** (team interaction, school climate and practices) and teaching strategies and pedagogical approaches. They underpin sustainable change and create a school environment that is able to produce consistently high-quality results for many cohorts of students. It makes sense for the ABF program to continue monitoring the process of change in schools.

The program is **highly relevant** to the needs in Bulgarian education. Computers, other technical tools, and the run-down classrooms are equally important deficiencies. The need of technological renewal and modernization of the learning environment is positioned among the top three challenges identified by the school principals. Improving the learning environment was a main component of the ABF supported projects to which over 50% of the funding was allocated. ICT and furniture used almost 30% of the money.

Despite the fact that ABF interventions cover small part of the school, the effects are strong enough to become visible at school level by influencing significantly the **overall student performance** and initiating also some significant school wide changes which are likely to evolve.

Contrary to popular assumptions that student results come at the end, the evaluation of the School of the Future program demonstrates that it is possible to improve performance and specific cognitive skills of a cohort of students within a relatively short period of 3-5 years. Improvement in **non-cognitive skills** appears to come harder, while making the impact sustainable and **changing irreversibly the whole learning environment** and school communities seems to be the hardest of all.

Most of the ABF-supported schools belong to the category of town schools with bigger number of students and often considered "elite". However, some smaller schools outside big cities were also reached by the ABF program, though with much smaller funding. **Those schools responded well to the incentives of the program** and it apparently contributed significantly to their technological upgrade. Given the identified potential of the smaller and less funded schools to be creative and the bigger proven needs of their school communities compared to big urban schools, it seems promising to invest there if there is no risk of closure due to demographic or other reasons.

## Recommendations

**Popularize the results** of the current evaluation and engage experts, educationalists, teachers and school principals in a discussion about the challenges of technological innovation in Bulgarian schools. This can be done through a series of events, some involving the expert community and others opening to the general interested public.

This evaluation demonstrated that program results can be captured by using external standardized tests already at a quite early stage. This kind of assessment can be done at a very acceptable cost. The use of further instruments like tests for skills and general purpose questionnaires provides even more useful detail about the impact and functioning of education programs. ABF joins forces with Bulgarian NGOs to advocate for broader use of evaluation in publicly funded education programs in Bulgaria.

ABF support was largely dependent on the initiative and entrepreneurial drive of the school leadership as well as on the existing capacity for change and development. In the subsequent cycles of the program it makes sense to explore further opportunities to **broaden the selection criteria and diversity** of schools selected in the program.

We therefore recommend expanding the scope of the program to include different types of schools. Results of the evaluation show that such a diversification of the ABF portfolio can increase “the bang for the buck” invested in Bulgarian education. The program can benefit from partnership with other organizations.

One of the strands of support for schools mentioned by teachers and headmasters is the provision of **more information on concepts of modern education and the organization of school processes**. Examples and experiences of school improvements and good teaching and learning practices are welcomed by program participants as well.

The impact of investment in technology can be increased by **stepping up training activities**. There is a need to enhance teachers’ competence to use new technology and new methods of teaching. We therefore recommend to allocate more funds for training in the new rounds of the program or encourage schools and teachers to look for other opportunities to do so. Schools do not encourage enough research and experimentation by teachers. The potential of teachers to innovate needs to be unleashed because the purchase of equipment and technology does not guarantee a real change in the process of teaching and learning. One possible way to tap into the teachers’ energy is to provide them with a space where they could share their practice stemming from the ABF program. We recommend creating a biannual or quarterly newsletter where teachers could publish articles, lessons, vignettes describing specific practices; share approaches, methodologies, and other materials.

The concept of **innovative schools** which was developed for the first time in the new school education law can be very useful for the schools within the ABF program. It gives opportunities to innovate by changing more radically the school curriculum and adopting unconventional methods of teaching and learning. These opportunities need to be explored and eventually used by the ABF program. School management of supported schools can be encouraged to think how to prepare proposals for innovations and acquire the status of an innovative school. The ABF investment can be very supportive as it creates a suitable track record of previous innovation and valuable technological assets to build on.

We recommend **maintaining the contact** with schools already supported by ABF. This can be done by supporting the building of a network of schools which experiment with technological innovation and by involving previous and current program beneficiaries in events and informal communication for discussing school improvement through technological innovation.

Finally, **comprehensive investments, more equitable distribution of benefits and enhanced capacity building** would definitely increase the program's outcomes significantly and would further boost its potential to impact the overall technology driven transformation of the educational system.

## 1. Program background

A major challenge in Bulgaria's education today is that technology is not integrated in the teaching and learning process, even in schools where equipment is available. To help the country bring its education to the 21<sup>st</sup> century, ABF has been supporting the meaningful use of technology in the classroom and the introduction of new educational tools and practices.

In five years, 2009 – 2014, ABF supported 45 schools in 29 towns and villages to improve the educational process by modernizing classroom settings and introducing new classroom technologies. Over BGN 5.5 million were invested by ABF in 46 projects, additionally supported by BGN 2.5 million, contributed by the schools.

The objective of the projects for modernizing the learning environment was two-fold:

- Address a need of the majority Bulgarian schools to modernize teaching and learning in the classroom by introducing new technologies and practices;
- Complement the very theoretical education with more practical work and exercises, particularly in the sciences.

These projects also aimed to advance the school curriculum by introducing new educational tools such as web-based instruction, multi-media and other interactive teaching techniques. While the variety of implemented projects was big, the funded activities can be summarized in several categories – creating specialized:

- IT centers;
- Foreign languages centers;
- Science Centers;
- Interdisciplinary Centers (combination of language, IT, and science labs, as well as multipurpose auditoriums in some cases).

## 2. Evaluation purpose, objectives and scope

The *purpose of this evaluation* is to appraise the **immediate results and long-term impact** of the ABF projects for improving the educational outcomes at Bulgarian schools through modernizing the learning environment and promoting the use of new educational technologies and practices at the supported schools. The study assesses the impact of these interventions on students, teachers, and the overall impact on the school and the community (if relevant) with a focus on:

- Student performance and the effect of ABF program on their standardized test scores as well as on cognitive and non-cognitive skills;
- Changes in the way learning takes place in supported schools;
- Effect on school leadership and the development of school communities;
- Attitudinal and behavioral components of the generated changes such as discipline, school attendance, the sense of ownership and sense of belonging to the school;
- Specific effects on subgroups of targeted schools.

In addition, the evaluation analyzes the relevance of ABF program to the needs of the Bulgarian school education and the potential for its replication and formulates lessons learned that can be relevant to national programs for modernizing the schools.

### 3. Evaluation methodology

To carry out the evaluation the evaluators' team has designed packages of qualitative and quantitative instruments. The combination of different research tools ensures methodological triangulation to enhance the validity of data. The two tables below summarize the different research instruments and their scope.

TABLE 1: SUMMARY OF THE QUANTITATIVE METHODS USED

Method	Type of Stakeholders	Number
On-line Survey	Students in comparison schools	37,916
	Students in ABF schools	14,534
	Teachers in comparison schools	5,048
	Teachers in ABF schools	1,346
	Management in comparison schools	354
	Management in ABF schools	77
Anonymized results of external evaluation – 2010 – 7th grade	Students in ABF and comparison schools	60,684
Anonymized results of external evaluation – 2015 – 12th grade	Students in ABF and comparison schools	54,507

TABLE 2: SUMMARY OF THE QUALITATIVE METHODS USED

Method	Type of Stakeholders	Number
In-depth Interviews	ABF schools – principals	22
	ABF schools – project coordinator	22
	ABF schools – parents	25
Focus Groups	ABF schools – students	266
	ABF schools – teachers	175
Semi-structured interviews	ABF Program Management	2

The main evaluation approach is based on a **comparative analysis** of schools supported by ABF and comparison groups of schools and a **retrospective study** of the students' standardized results at national tests before and after project implementation.

**Comparison Groups:** The assessment of the school improvement program focuses on the main effects measured through the progress of students. In order to say that the program has a positive effect it is necessary to prove that students in ABF-supported schools have improved faster than their peers in similar schools not included in the program.

This assessment was commissioned long after the implementation of the program had started. This means that carrying out a true randomized experiment was not possible. Instead, a matching procedure was used based on a set of criteria to pair each school in the sample with at least one similar school not from the sample. For simplicity, the units not supported by ABF and selected through such a procedure are called a *comparison group*<sup>3</sup>. Matching criteria include variables such as the size and location of the school as well as socio-economic characteristics of the settlement or community where the school is located. As a result we have come up with the four comparison groups described in Table 3.

TABLE 3. TYPE SCHOOLS IN THE MAIN AND COMPARISON GROUPS

Type of schools in the ABF supported and comparison groups	Definition	# of schools
ABF Schools (ABF supported)	Schools funded by the ABF program	45
Empirical peers	Schools which were short-listed for the second round of the ABF bid, but did not make it to the finals.	17
Small group of matched schools	Peer schools which are as close as possible to the ABF supported on a set of indicators.	35

<sup>3</sup> The term control group is often reserved for true randomized experiments so strictly speaking what we will get are quasi control groups, i.e. units identified as similar to the ones that got the treatment *after the intervention has already taken place*. Such groups are usually called in the research literature comparison groups.

<b>Big group of matched schools</b>	The big group of matched schools builds on the small group of matched schools with the second and third closest schools added.	108
<b>Randomly selected group of schools</b>	Randomly selected schools from the whole list of primary and secondary schools (VET schools included).	116

**Assessment of Students' Performance:** We measure the improvement in students' performance from three different aspects:

- The academic achievements as documented at the national standardized tests after 7<sup>th</sup> and 12<sup>th</sup> grades;
- Cognitive skills measured by a special module in a students' questionnaire; and
- Non-cognitive skills also measured through a set of items in a questionnaire for students.

**Academic Achievement:** The idea of the evaluation is to track the performance of the same students in successive external examinations in order to see if students from ABF-supported schools have made more progress. Having in mind that the focus of the ABF program was on the last years of the lower and the upper secondary level of school education, we have concentrated the analysis on the students' progress between the external examination after grade 7 in 2010 and after grade 12 in 2015. We have used the scores in Bulgarian language, mathematics, foreign languages and natural sciences from standardized national exams. The **added value model** was applied to track the *additional effects* from each school on the students' results at the matriculation exams in 2015 beyond the result which can be predicted from the results on the external examination in 2010<sup>4</sup>.

**Cognitive Skills:** We have adapted the STEP (Skills to Employability and Productivity) questionnaire developed by the World Bank<sup>5</sup>. The cognitive module of the special questionnaire contains 30 questions, which test the memory skills of the students, their ability to use written language (semantics), and their competences in reading and interpretation of data represented by tables, pictures and graphs (practical numeracy and linguistic skills).

**Non-cognitive skills:** The module includes 36 questions on personality scales built on the Big Five personality traits (or factors)<sup>6</sup>: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (opposite to emotional stability). Beneath each of the five factors, a number of correlated and more specific primary factors are claimed that describe

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<sup>4</sup> See more on the added values model in Annex 1.

<sup>5</sup> The Skills Towards Employability and Productivity (STEP) program was designed by the World Bank to better understand the interplay between skills on the one hand and employability and productivity on the other. The STEP program developed survey instruments tailored to collect data on skills in low- and middle-income country contexts. Bulgaria was one of the surveyed countries and OSI collected the data for Bulgaria.

<sup>6</sup> Norman, 1963; for review see John and Srivastava, 1999.

human personality. This instrument allows us to measure and compare the personal traits of the students at ABF-supported and comparison schools and to analyze important attitudinal and behavioral dimension such as Self-control, Achievement striving, Grit, Hostile bias, and Decision making.

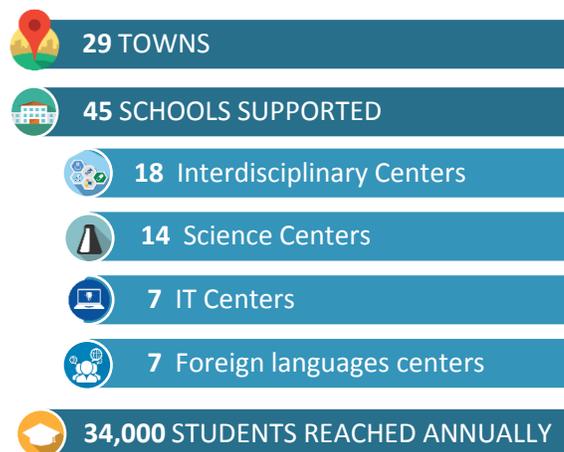
Annex 1 provides a detailed description of the methodology.

**Limitations of the Study:** The ABF program has evolved throughout the years. It started in 2009 with a heavy focus on language and math and science schools selected based on the strong leadership demonstrated by the principals and ambition to modernize the school environment by integrating the ICT in the learning process and introducing new teaching methods and practices. The very individualized approach in selecting the participants was later replaced by introducing a call for proposals, which aimed at streamlining the selection process. Further, the pool of schools was expanded to cover primary, K-12 schools, as well as small-size schools in economically disadvantaged areas. While initial investments prioritized the improvement of the learning environment, learning by doing, and the integration of ICT in the learning process, later projects have started addressing the deficiencies of teachers' competences in using the new technologies. What has remained unchanged is the variety of projects that the schools could suggest based on their specific needs.

Given this diversity of program interventions, it is very difficult even for the most sophisticated methodology to capture the impact of the program in all of its dimensions and find adequate schools for the purpose of the comparison. This has resulted in some softer conclusions that should not be treated as marginal program impact rather a limitation of any methodology that applies the same research tools to interventions that have been constantly changing in the past five years.

## 4. Main outputs of the program

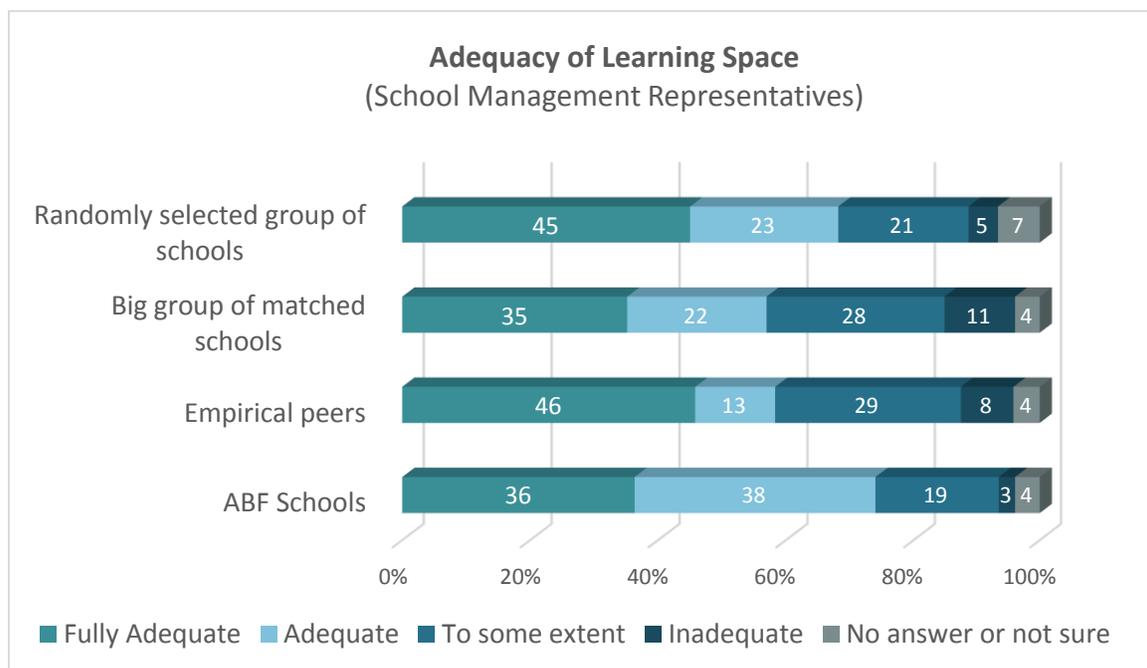
The infographic below summarizes the main outputs of ABF School of the Future Program:



The initial ABF investments in schools were demand driven but also aiming at achieving tangible results in a relatively short period of time. While these projects were not governed by a clear theory of change, they have somehow followed the proven theory about the five important factors that change the school educational system<sup>7</sup>: leadership, pedagogy (new teaching methods and practices), capacity building (educated and trained teachers), technology, and architecture. Studies of the Finnish and other successful educational reforms have proved the key importance of the learning environment (architecture and technology) for the improved achievements of the students. These studies have also found that the fastest effects can be achieved in the spaces and technologies. For this reason it is recommended to start with changing the physical environment, which in turn reflects in pedagogical change. Addressing the identified needs in the country, the ABF program has directed more than half of the resources for renewal of teaching spaces, thus contributing to the improvement of this important factor.

This investment has resulted in substantial improvements in the ABF-supported schools as proved by the assessment of their leadership about the adequacy of the learning space. The evaluation has found out that twice as many school leaders at these schools have reported fully adequate or adequate classroom environment that supports the learning process compared to the comparison groups.

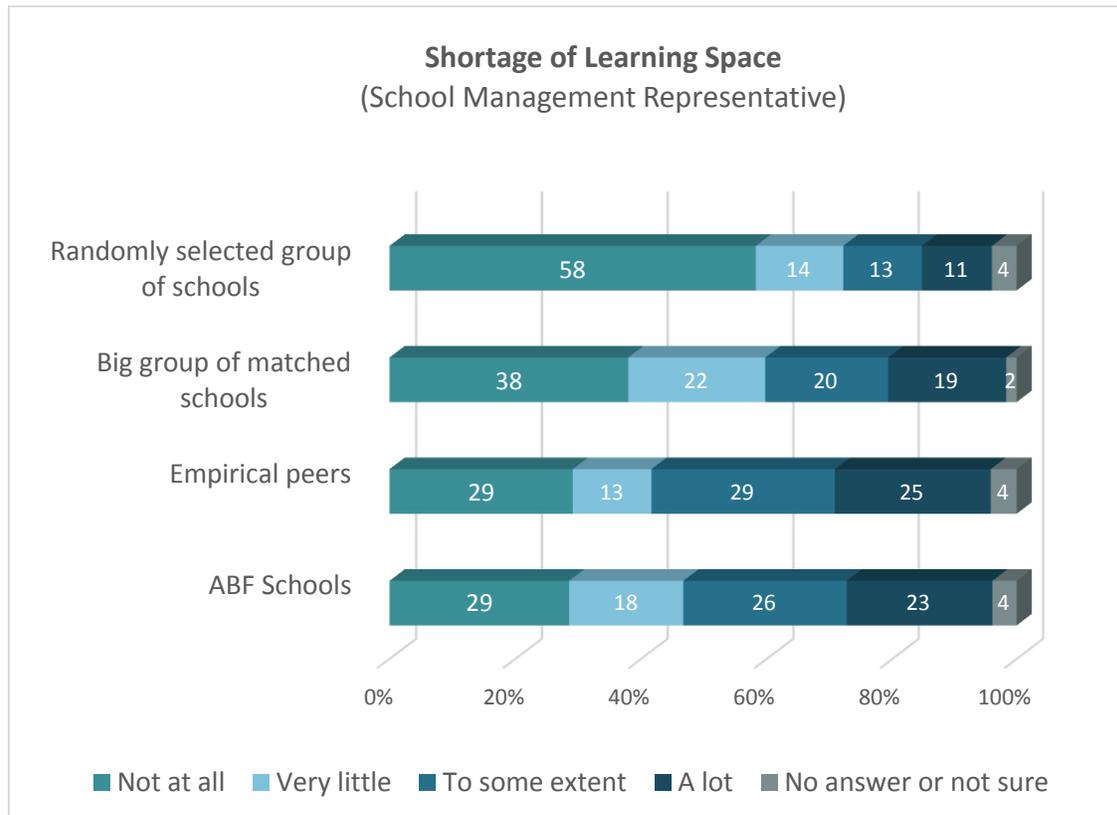
**FIGURE 1. ADEQUACY OF LEARNING SPACE ACCORDING TO SCHOOL MANAGEMENT**



<sup>7</sup> How to Create the School of the Future – Revolutionary thinking and design from Finland, Pai Mattila and Pasi Silander 2105, University of Oulu

The importance of the ABF investment in the learning environment is further supported by the finding that about half of the school leaders acknowledge **serious problems related to the shortage of classrooms** at both, ABF-supported schools and those in the comparison group of empirical peers. Although the ABF program has encouraged the creative use of the learning spaces, it cannot compensate for the huge needs in many of the schools.

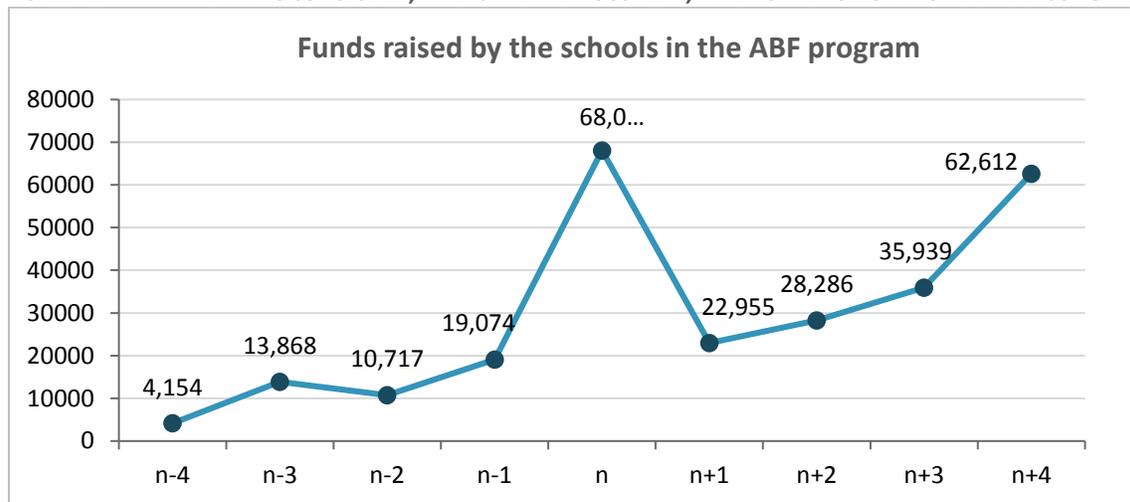
FIGURE 2. SHORTAGE OF LEARNING SPACE ACCORDING TO SCHOOL MANAGEMENT



In addition, the field observation reports have shown that ABF investments have covered a **small part of the participating school**. These areas differ substantially from other classrooms, hallways and learning spaces that still remain non-refurbished due to the lack of funding. Undoubtedly, the project has generated expectations that renewal would extend to the whole school. There are two possible scenarios as to how this situation may evolve. The drive for improvement could lead to the finding of additional sources of funding to bring an overall change or the impact will remain limited to the scope of the ABF intervention.

The ABF program has strongly encouraged philanthropy as a major tool for funding of future initiatives. **The evaluation has found that the ABF-supported schools tend to have stable increase in the raised funds.** This trend had started before ABF funding was awarded and the linear growth has continued with some evidence of acceleration on the 4<sup>th</sup> year after completion of the ABF project. In general this means that we cannot observe a direct link between the amount of funding attracted and the ABF intervention.

**FIGURE 3. FUNDS RAISED BY THE ABF-SUPPORTED SCHOOLS ON AVERAGE IN BGN. 'N' IS THE YEAR WHEN THE AGREEMENT WITH ABF WAS CONCLUDED, 'N-1' IS THE PREVIOUS YEAR, 'N+1' IS THE FOLLOWING YEAR AND SO FORTH.**



For most of the schools the ABF funding has been the biggest investment in them within a period of up to 9 years. After completion of the ABF project, some schools have managed to sustain a similar level of external funding. In general, the highest levels of external funding come as a result of successful applications with other institutional donors. We can assume that the successful experience with ABF has contributed to improving the organizational capacity of some of the schools in developing consistent and competitive funding ideas and attracting money.

ABF investment in technological improvements is estimated at approximately 30% of the total project cost. The BGN 1.6 million bought equipment that has drastically increased the availability of different contemporary educational tools by 20% to 57% in different schools.

**TABLE 4. SCHOOL ASSETS GROWTH AS A RESULT OF ABF PROGRAM IMPLEMENTATION**

Tablets	57%
Interactive boards	49%
Microscopes	37%
Lap-tops	30%
Multi-media Projectors	20%
Desktop Computers with internet connection	16%
Desktop Computers	16%
Books received in the library in the last 12 months	10%
Printers	6%
Paid subscriptions for access to websites/libraries	3%
Books in the library – total	0,2%

The inventory lists submitted by school principals showed clear advantage of ABF schools in terms of technological development<sup>8</sup>. This achievement is even more important having in mind that ABF-supported schools were lagging behind the schools of the comparison groups in terms of equipment items per student. The project has allowed ABF schools to take a leading position on the same indicator. Although the program has contributed to the quantitative increase of any type of equipment, the most noticeable change is in the supply of **tablets, interactive boards, tablets, microscopes, laptops, and multimedia projectors**.

**Overall, the learning environment in ABF-supported schools is more supportive in terms of opportunities for technological and professional development.** The data in the following paragraphs substantiates this conclusion.

The ABF-supported schools provide access to state-of-the-art computers with Internet connection to three out of four teachers while in comparison schools the share of teachers with access to such equipment is 6-7 percentage points lower. The availability of and access to quality equipment has changed the attitude towards the role of technologies in the educational process. While close to 50% of the school managers in reference schools believe that low quality or outdated computers and limited access to good Internet connection hinder the educational process, less than 40% of their colleagues at ABF-supported schools share this concern.

The school principals' opinion is supported by the teachers. Teachers in **ABF-supported schools who believe that the shortage of computers and technical devices is not among the leading problems are about 2 times more** than those who still see this as a very serious problem. These two "camps" of teachers in the comparison groups are almost of equal size with just a small preponderance of those who believe they have enough computers and technical devices.

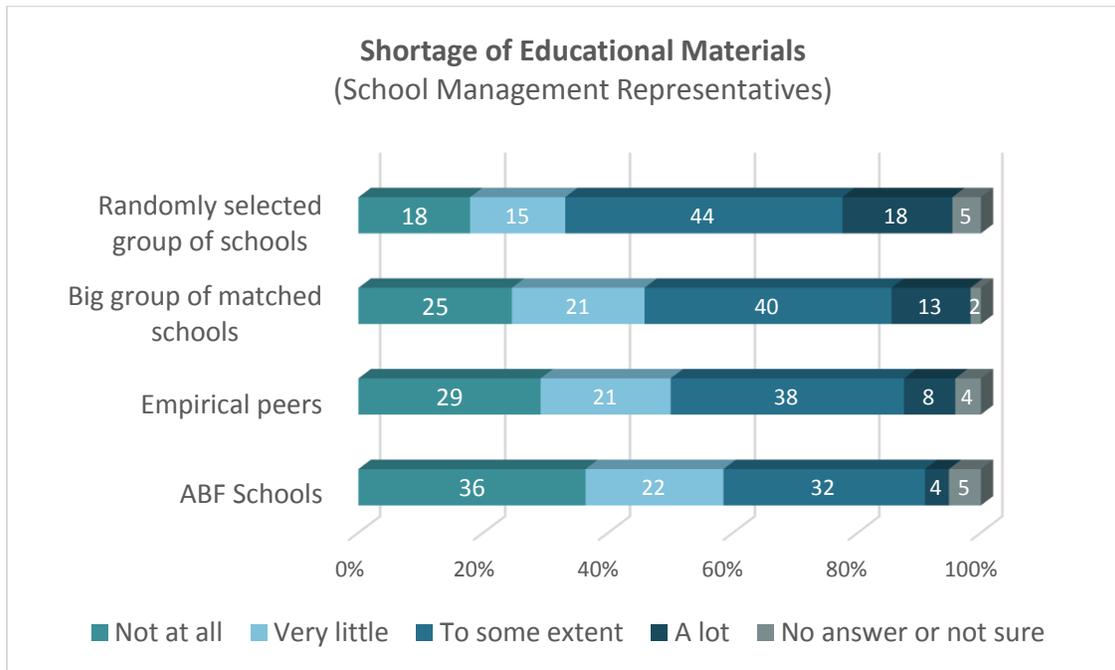
Contrary to the situation in the comparison schools, **ensuring an adequate Internet connection is no longer an impediment to the learning process in ABF-supported schools**. On this factor, ABF-supported schools demonstrate results, which are commensurate with the average score of the OECD schools assessed by the OECD PISA Survey in 2012.

**The insufficient or inadequate specialized educational software or library materials are defined as a serious barrier to the learning process by over 50% of the school management in the comparison schools** compared to around 40% in ABF-supported schools. Besides, 56% of the management in ABF-supported schools believe that they have enough educational materials to support them in the teaching, see Fig. 4.

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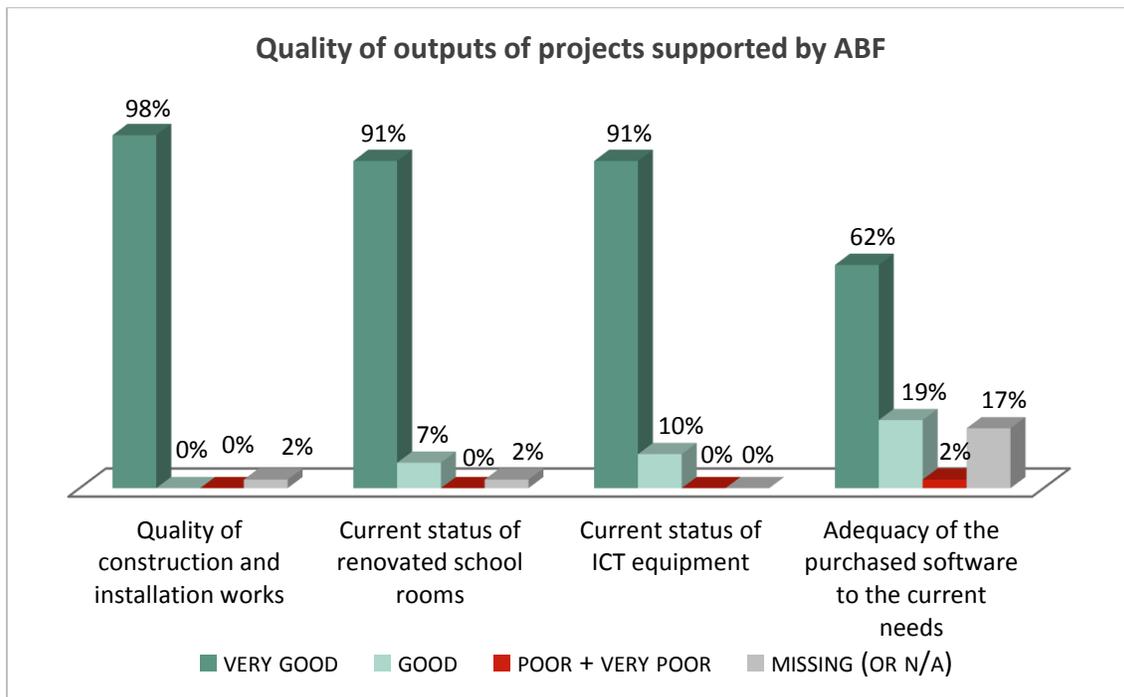
<sup>8</sup> More detailed comparative data is available in Annex 5 "School assets".

FIGURE 4. SHORTAGE OF EDUCATIONAL MATERIALS



ABF has put an emphasis on the quality of the implemented projects. This has required additional effort in convincing the beneficiaries to **invest in high quality materials**. We believe that this has worked out very well given the fact that the quality of outputs is ranked very high by almost all school principals and the purchased software is still adequate.

FIGURE 5. QUALITY OF OUTPUTS OF PROJECTS SUPPORTED BY ABF



## 5. Main Effects of the Program

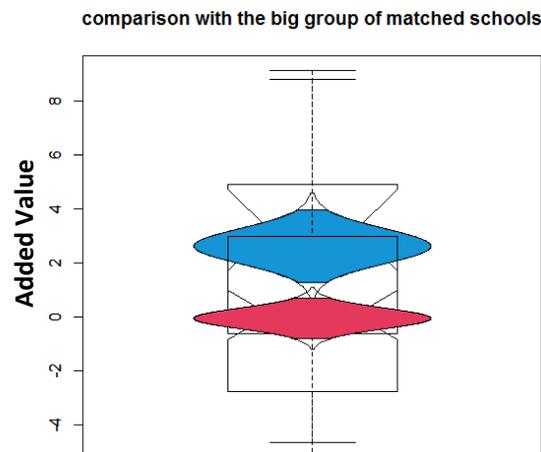
### 5.1. Students' Performance

#### 5.1.1. Performance on external examinations

**Bulgarian Language and Literature (BLL):** In BLL exams we found statistically significant difference in the added value between the schools supported by ABF and two of the comparison groups. See Figure 6, where the results of the ABF-supported schools are in blue and those of the comparison group - in red.

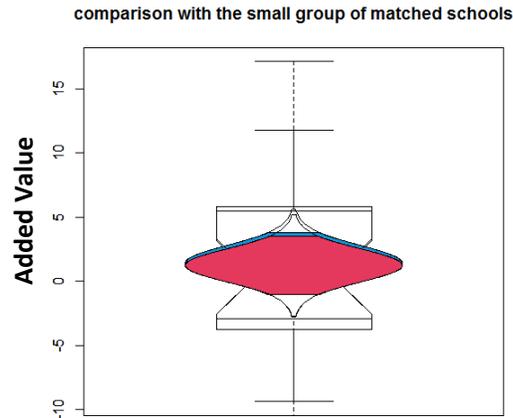
The scores used for the calculation of the added value come from a complex model and do not have any obvious intuitive meaning. In particular, they are not connected to the scale used for the assessment of the student performance. A score of 'zero' means that there is no added value. Negative numbers mean that the added value is negative, i.e. there is an actual loss of value or in other words, in schools with negative score students have performed worse than predicted based on their previous results. Such schools have a negative impact on student achievement. Positive numbers mean just the opposite - such schools have helped their students to perform better than predicted by their previous achievement. The chart below shows that there are no schools with zero or negative value added among the ABF-supported schools, while half of the comparison schools have negative or zero value added.

FIGURE 6. ADDED VALUE IN BLL COMPARISON WITH THE BIG GROUP OF MATCHED SCHOOLS, ALPHA = 0.05.



**Mathematics:** In mathematics we did not find any difference in the added value generated by the ABF-supported schools. Figure 7 shows the comparison with the small group of matched schools where the "blue" and the "red" overlap. The same pattern repeats with the other comparison groups.

FIGURE 7. COMPARISON OF ADDED VALUE IN MATHEMATICS WITH THE SMALL GROUP OF MATCHED SCHOOLS, ALPHA = 0.1

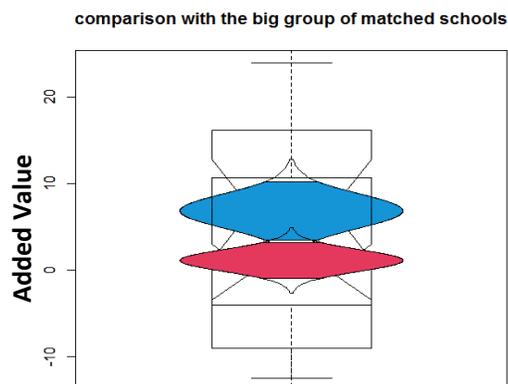


Most likely this is due mainly to the fact that students in ABF-supported schools were already very good in mathematics before the project started. We have to keep in mind that the standardized national tests are not designed to capture exceptional performance, as achieving outstanding results is not part of the mandatory agenda of public education. Therefore, such tests do not capture the development of talent beyond the requirements of the national curriculum, i.e. successful participation at national and international competitions.

The conclusion is that from the point of view of the official curriculum the ABF support has not had more added value in mathematics than similar schools, which did not participate in the program. With this set of schools it is unlikely that the ABF program will be able to have more added value in mathematics even if more time passes. The only way to achieve higher added value in mathematics is to support schools where students have deficits in their numerical skills.

**Natural Sciences:** The analysis shows more added value in students' performance in natural sciences in the schools supported by ABF compared to two of the three comparison groups. By performance in natural sciences we understand the combined scores from standardized external tests in physics, chemistry and biology. See Fig. 8.

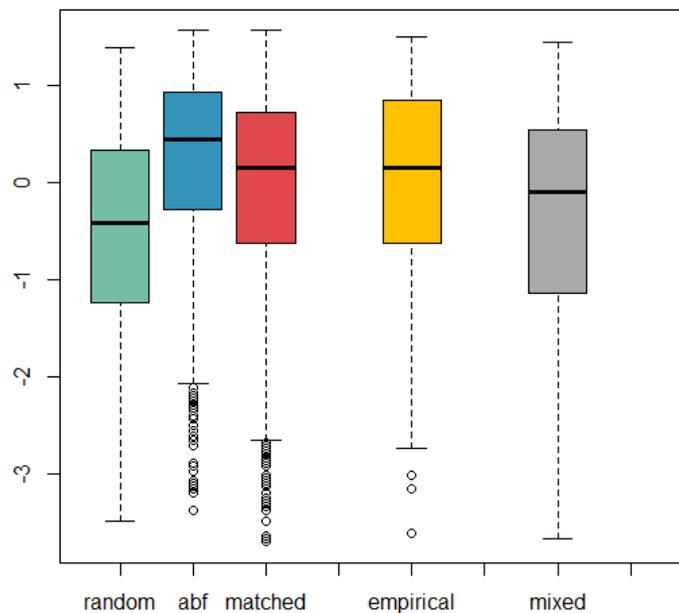
FIGURE 8. COMPARISON OF ADDED VALUE IN NATURAL SCIENCES WITH THE BIG GROUP OF MATCHED SCHOOLS, ALPHA = 0.1.



The expectation was that science centers would have contributed more to student achievement in the relevant subjects. Therefore, we compared the added value scores in natural sciences only of schools with science centers funded by ABF. The comparison was made with the small group of matched schools, which was the one without statistically significant difference in added value when compared with the overall added value in natural sciences of ABF-supported schools. Indeed, the average added value of this subset of schools supported by ABF was higher, but still not high enough in order to make a clear difference with the small group of matched schools. However, we can assume that the specific investment in science centers has had some positive impact on student performance in natural sciences.

**Foreign Languages:** In foreign languages there are not many students attending twice a foreign language examination. So it is not possible to apply an added value model. We can see, however, that schools supported by ABF had just slightly better results on the foreign language exams in 2010 and a markedly better result on the matriculation exams. For the purpose of this analysis we used the test scores from all examinations in foreign languages - English, Russian, German, French, Italian and Spanish. The distribution of standardized scores<sup>9</sup> in 2010 of ABF-supported and comparison schools almost overlaps meaning that they had a similar starting level. At the matriculation exams in 2015 (see Fig. 9) there is a clear difference between ABF and comparison schools, i.e. students in ABF-supported schools do much better than their peers in other schools.

**FIGURE 9. MATRICULATION EXAMS IN FOREIGN LANGUAGES IN 2015. "MIXED" IS A MIXTURE BETWEEN MATCHED SCHOOLS AND EMPIRICAL PEERS.**



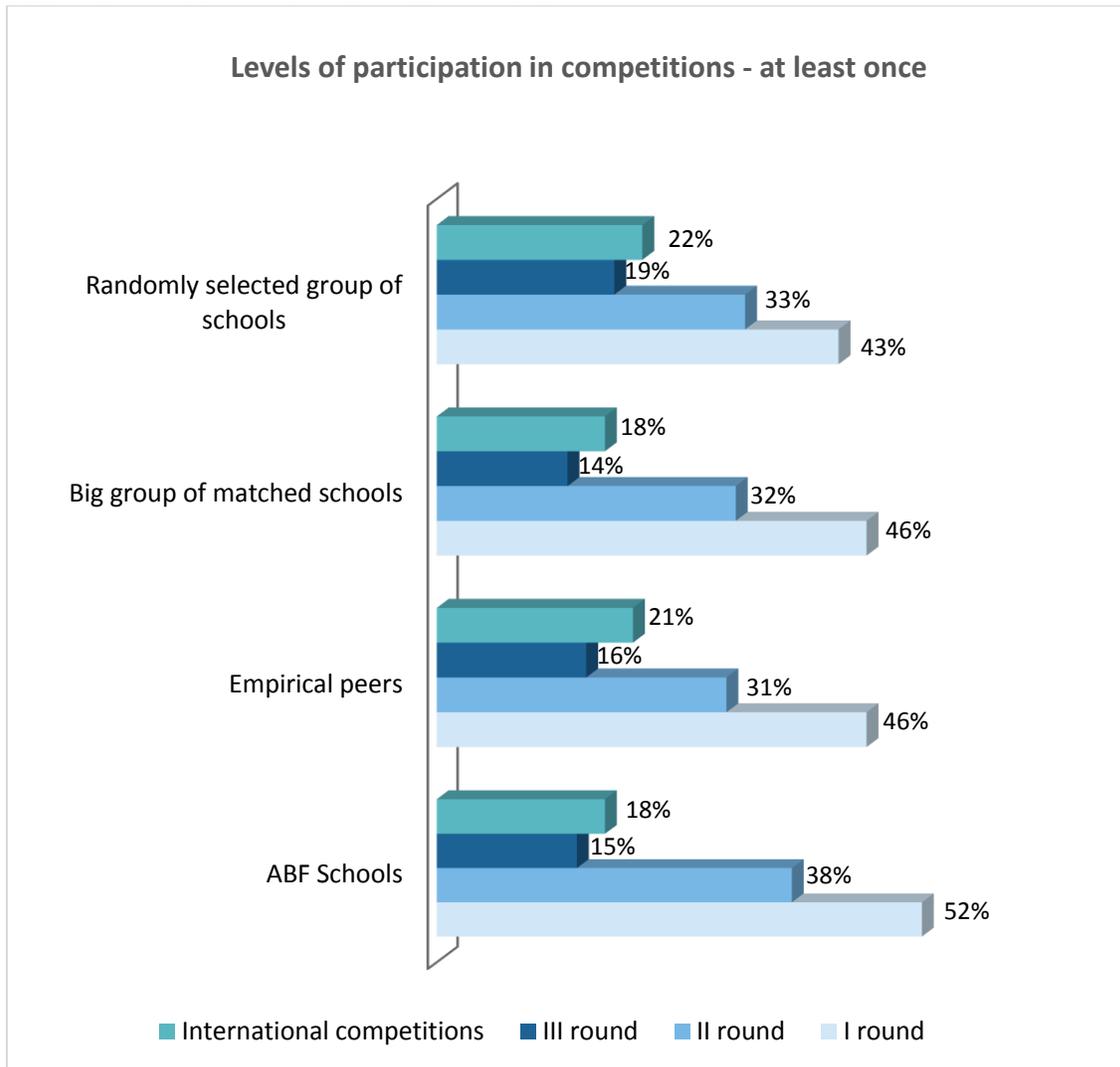
<sup>9</sup> Standardization of the test scores is necessary because when different examinations are compared there is no guarantee that they are of the same difficulty.

There is of course a possibility that the different results are due to the fact that different students appeared on the exams in 2010 and 2015, which we cannot fully reject. The exploratory analysis, however, shows that it is very likely that ABF interventions have had a positive impact on foreign language learning.

**Exceptional Student Performance**

Exceptional student performance cannot be measured by standardized tests, which by definition are designed to measure ordinary performance according to the requirements of the state curricula. To some extent we can judge about the exceptional student performance based on their participation at national or international competitions. Fig. 10 compares the number of students at ABF-supported schools who have participated at the four rounds of competitions to their peers at comparison schools. ABF-supported schools have been represented by more participants at municipal and regional levels, which is an indication of their overall better preparation in the respective subjects.

**FIGURE 10. LEVELS OF PARTICIPATION IN COMPETITIONS**



### 5.1.2. Cognitive skills

The cognitive skills were tested in several main categories: memory, semantics of words and expressions, semantics of sentences, and reading and interpretation of data.

**Schools supported by ABF have shown significantly better results in strong memory skills and in practical numeracy skills, such as reading and understanding graphs, tables, schedules and texts containing numeric information.** Positive difference in semantic skills was observed with only one of the comparison groups. We believe that the measurement of cognitive skills delivered through computer interface also captured some IT skills. This means that better performance in memory and numeracy showed by students in schools supported by ABF is due to some extent to their better skills in working with computers.

**Memory** deserves special attention as it differs from the other cognitive skills. It is considered the most in-born of all cognitive skills, which also means that it is the least malleable. So, one may legitimately ask how it is possible for a school modernization program to have influenced memory skills.

We believe that the explanation is in the way the memory test was conducted. The test was delivered in an electronic form, which means that numbers to be remembered appeared on the computer screen in a matter of seconds depending on the length of the sequence. Ability to “see” quickly and understand information appearing on a screen, which plays an important role in this test, is no doubt a key IT skill.

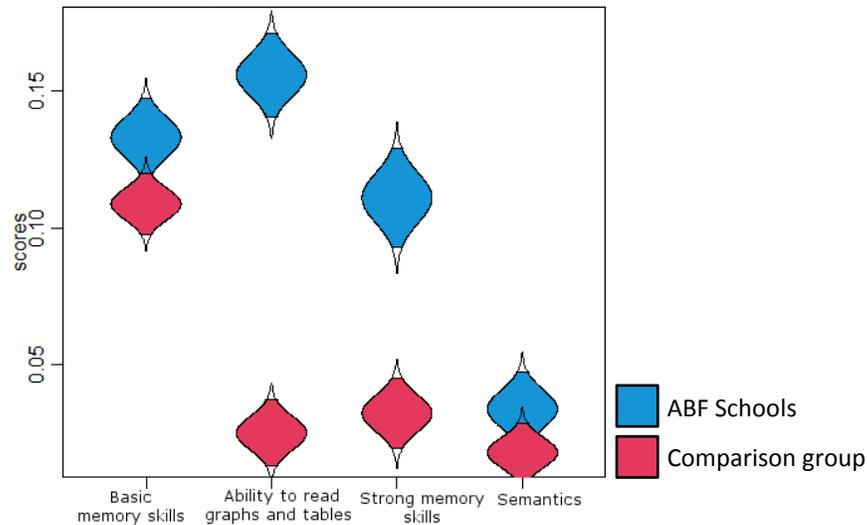
On **semantics**, the ABF schools perform better than the empirical peers but no better than the two groups of matched schools. As far as cognitive skills are concerned the empirical peers seem to be a bad match for the schools supported by ABF. The difference on certain indicators is so large that it is not plausible to attribute it solely to the support provided by ABF. This means that somehow the ABF staff was able to sense which schools are most likely to succeed. This does not exclude some contribution to the difference in results of the ABF support, but it cannot be disentangled from the difference between those schools which was apparently present before the ABF program started.

**Reading and Interpretation of data** is composed mostly of the ability to read graphs, tables and other numeric information but includes also some semantic skills though with lower weights. The schools supported by ABF perform better than all other groups. The difference is statistically significant. Apparently the use of IT and the participatory process of learning which evolved in some of the schools supported by ABF were conducive to the development of practical skills in the field of numeracy. Students at ABF schools have demonstrated ability to link theoretic knowledge to the solution of practical problems, something that continues to be one of the deficits of the Bulgarian school education.

Figure 11 summarizes the results from the assessment of cognitive skills on all four factors. We

show only the comparison with the large group of matched schools. The comparison with the small group of matched schools produces similar results, while empirical peers perform in general much worse.

FIGURE 11. SCORES ON ALL 4 FACTORS COMPARING ABF FUNDED SCHOOLS AND THE LARGE GROUP OF MATCHED SCHOOLS



### 5.1.3. Non-cognitive skills

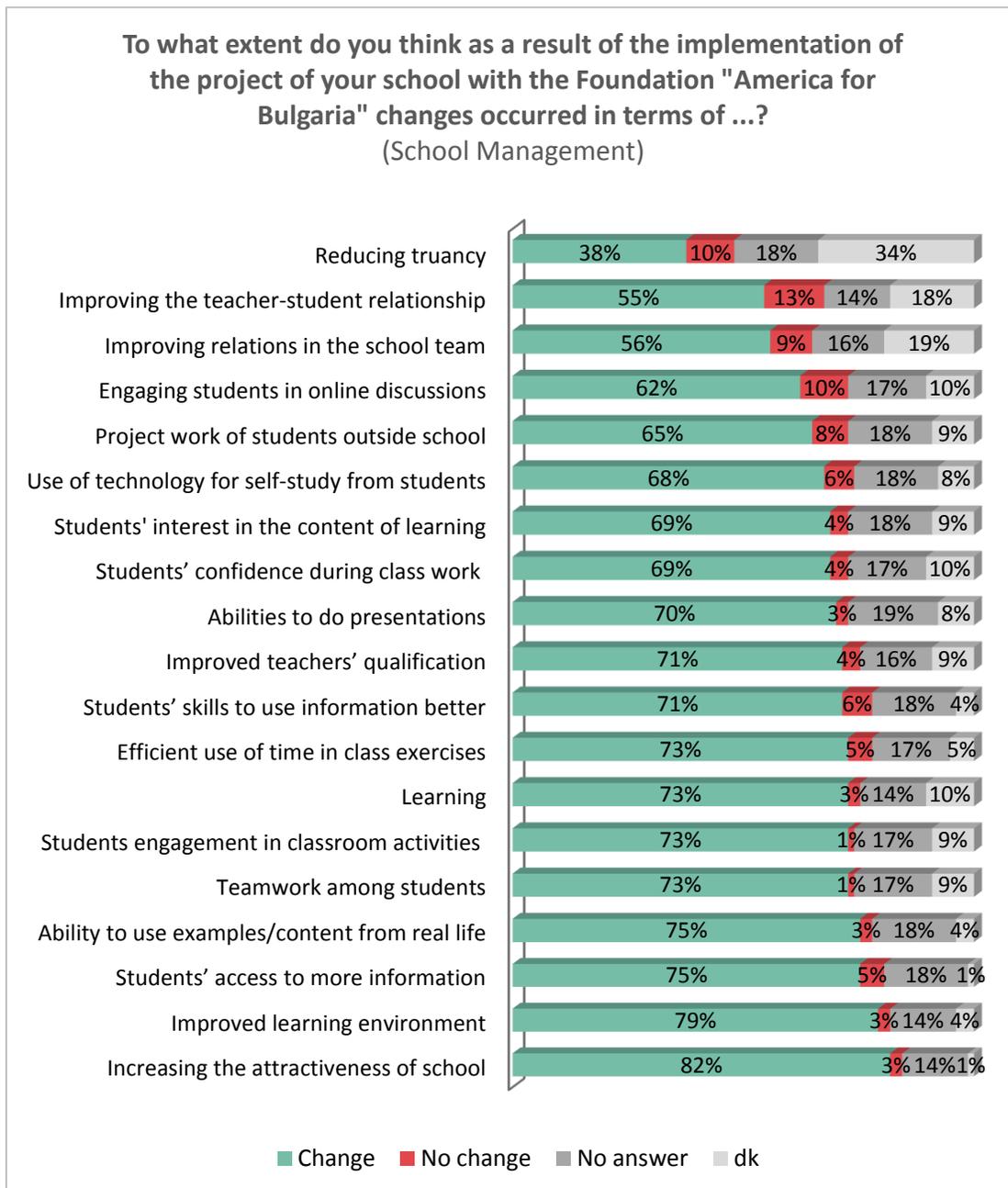
The test of the non-cognitive skills measures important personal traits, including the so called “big five”<sup>10</sup>- Extraversion, Conscientiousness, Openness to experience, Emotional stability (opposite of Neuroticism), and Agreeableness, but also decision making, grit and having a growth or fixed mindset. These characteristics are known to influence performance at school but also on the labor market and in a variety of social contexts. **There is statistically significant positive difference in the characteristics of the students in ABF-supported schools** compared to two of the comparison groups. The most important one is the **lower level of hostile bias**. This means that they are less likely to display hostile bias to others, i.e. they have a more positive perception of others. They are also a bit more emotionally unstable, which is actually a common characteristic of better performing students with higher ambition who experience pressure from their peers, teachers, and parents to sustain good performance. The other factors displaying substantial positive difference include **decision making, conscientiousness, grit, achievement striving and openness to experience**. The detailed analysis is presented in Annex 2.

<sup>10</sup> Norman, W, (1963). Toward an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. *Journal of Abnormal and Social Psychology*, 66. 574-583.; For review see John, Oliver P. and Sanjay Srivastava. (1999). "The Big Five Trait Taxonomy: History, Measurement and Theoretical Perspectives." in *Handbook of Personality: Theory and Research*, L. A. Pervin and O. P. John. New York: The Guilford Press. Chapter 4, pages 102-138.

## 5.2 Process of learning

According to the leaderships of the schools participating in the program the largest effects of the program are related to the **increased attractiveness of schools, improved learning environment, and students' access to more information** (see Fig. 12). However, the chart confirms that equally important is the impact on what happens in the classroom.

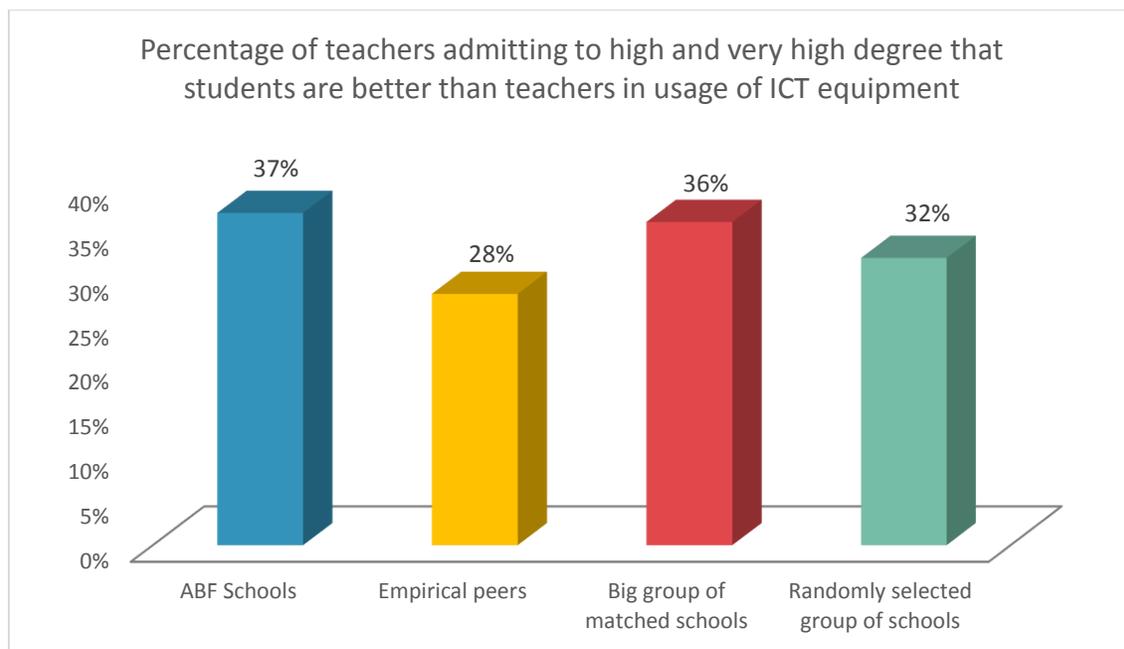
FIGURE 12. CHANGE AS A RESULT OF THE ABF PROGRAM ACCORDING TO SCHOOL MANAGEMENT



### 5.2.1. Teaching and learning

The analysis of Figure 12 shows that substantial changes have occurred in the classrooms related to the process of teaching and learning. Students are more engaged in the classroom, they are more interested in what they are learning, teamwork is a frequently used method of learning, practical examples and real life content are used more often for learning. We notice that students' confidence in class is also impacted by the project. One possible explanation is the use of the new technologies where the youngsters generally do much better than their teachers. Teachers in all schools confirm that they are lagging behind their students in handling the new technologies. Teachers also admit that the effects of introducing new technologies occur most rapidly through the quickly acquired skills of the students to work with them. Teachers in the ABF-supported schools are more inclined to acknowledge that they are not a match to their students when it comes to using new technologies.

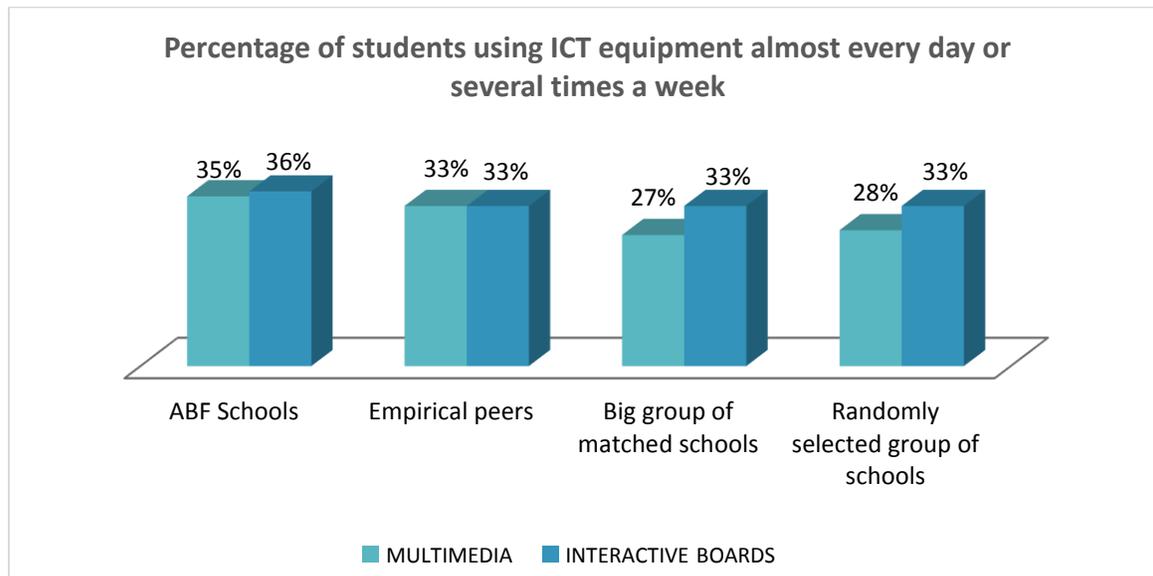
**FIGURE 13. PERCENTAGE OF TEACHERS ADMITTING TO HIGH AND VERY HIGH DEGREE THAT STUDENTS ARE BETTER THAN TEACHERS IN USAGE OF ICT EQUIPMENT**



We have to admit, though, that the impact of technology on students is very likely moderated in one way or another by the process of learning that takes place at school. Even if technology could somehow have direct impact on student performance we can be almost sure that this impact will not be stable and replicable if the way students and teachers interact does not change as well.

One of the main signs of the changing role of technology is the use it is put into. The study has revealed that all surveyed schools are dominated by students who do not use regularly multimedia, interactive boards or actually any type of ICT equipment at school. Regularly means almost every day or several times a week. However, there is a larger share of students in the ABF supported who often use this technology. See Fig. 14.

FIGURE 14. PERCENTAGE OF STUDENTS USING REGULARLY ICT EQUIPMENT



The share of regular users of Internet-based tutorials as well and lessons is similar in the ABF supported and the comparison groups: one student in four uses such tools.

Bringing technology to the classroom can have multiple consequences beyond mastering the use of technology itself. As was emphasized many times in discussions with students and teachers when working with new IT students have the opportunity to be in the role of experts and to help teachers when they cannot cope with the new technology. Such episodes model another type of **more democratic and more equal relationship** where the teacher is no longer an expert who knows everything that students need to learn. In the new circumstances the teacher and students together try to deal with challenges that require everyone's contribution of knowledge and skills. This educational scenario is actually inherently modern and creates the preconditions for **change in attitudes to learning itself as a process of "symmetry of ignorance/knowledge"**<sup>11</sup>.

New technologies are a necessary condition for shift to learning oriented towards practical skills and learning as fun, which is broadly considered deficit in the Bulgarian education system. Practical skills for using technology are valuable on their own. In small schools in rural areas a computer classroom is of great importance for pupils in view of the confidence they derive by using the new technologies. Early contact with technology can facilitate their adaptation to the environment in larger settlements, where many of them continue their secondary education.

<sup>11</sup> Developments in Design Methodology". Edited by N. Cross. Chichester: John Wiley & Sons Ltd, 1984, pp. 325-327.

Support for the use of technology at school is neither unconditional nor pervasive. Many teachers are convinced that the importance of new technologies should not be overestimated. Teachers used two types of arguments to show why the role of technology must be judged soberly and without euphoria. First, they pointed out that some traditional methods of communication and traditional learning techniques still had their place in school. On the other hand, they insisted that the change in the ways of teaching, working with students, and giving tasks for individual and group work was much more important than or at least as important as access to new technologies. Some students also tend to admit that **the key role for the learning process belongs to the teacher.**

Perhaps the lack of confidence and knowledge of new technologies contributes to the cautious attitude of the majority of teachers. Not surprisingly, many of the surveyed teachers emphasized the existence of significant challenges to learning related to new technologies. **According to some teachers computer technology could cause students losing autonomy, not developing analytical skills, and even being unable to express themselves in writing.** These teachers believe that in order to develop the above mentioned soft skills, the students need individual work and more school classes devoted to exercises and discussions.

As a matter of fact statements showing limitations of the power of new technology do not contradict the belief that nowadays technology is essential for learning. They just show that technology does not work if some prerequisites are not met. The most important one is the **ability of teachers to integrate technology into teaching.** Learning to use new technologies is assessed by teachers as one of the most important factors for achieving better results from the projects supported by ABF. However, the **training interventions under the projects were limited in number and insufficient to prepare the teachers.** Besides, hardly **every sixth of the teachers participated in trainings organized within the program.**

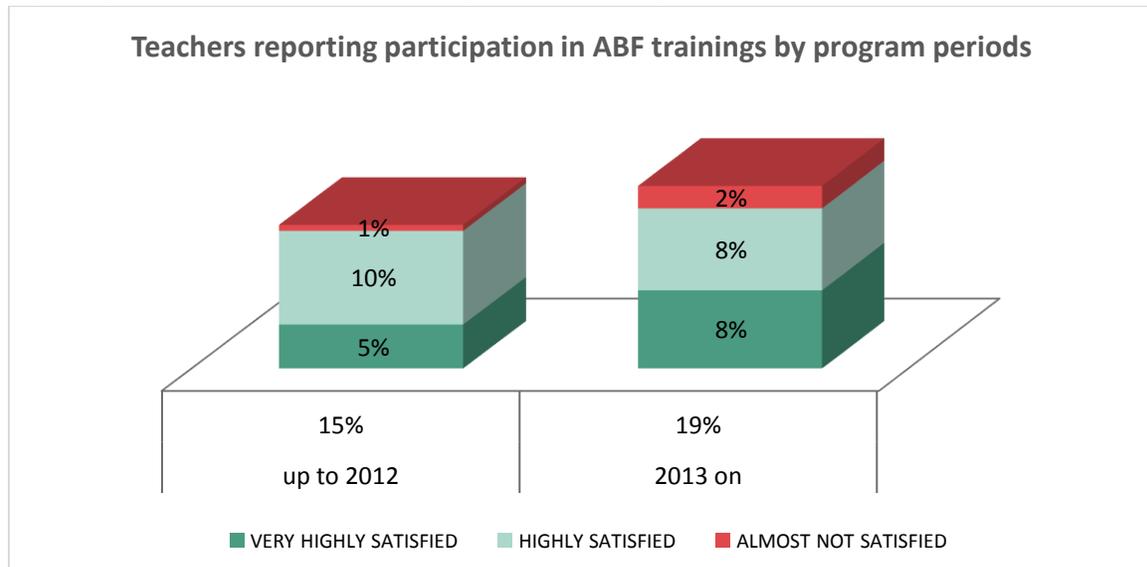
**Adaptation of teachers to new technologies was not trouble-free, even in the most successful schools.** It passes through many obstacles. One such obstacle is the resistance which is not necessarily retrograde; it can have sound grounds. Part of teachers have never succeeded in adapting their methods of teaching to new technologies. The cleavage line does not necessarily pass along the borders between different generations of teachers, although the age plays unquestionable role in the ability to adopt technological innovations. In the course of the study several examples were identified of how young teachers simply did not accept the new technology and refused to change in any way their teaching, which was traditional and very conservative. It was most probably learnt during the initial qualification at university.

About 41% of students in the ABF-supported schools share that teachers did not use often PC/laptop /tablet when presenting lessons. This proportion is different in the two comparison groups. In the larger comparison group it is higher (48%), but it is lower among the empirical peer schools (35%). Overall, the data indicates that **despite the established IT environment in**

**all schools there is a feeling among students of relatively low frequency of use of the new technologies by the teaching staff.**

Since 2012 the ABF has put special emphasis on teacher training. The results show a trend of gradual increase of the share of teachers participating in trainings organized under the ABF projects. The satisfaction from the trainings also tends to rise slightly and all in all growing number of trainings influence positively the outcomes related to the use of ICT in class room and pedagogical approaches.

**FIGURE 15. TEACHERS REPORTING PARTICIPATION IN ABF TRAININGS BY PROGRAM PERIODS**



With ABF support many teachers were trained to work with new technologies – computers, multimedia and interactive boards. **The ABF program seems to have contributed to mitigating the shortage of well-trained key teaching staff in schools and to the development of teaching capacity in the field of information technology.** The shortage of teachers in information technology is universal and equally valid for all schools. However, the difference in the qualification of the teachers in informatics in ABF-supported and comparison schools is significant. **Over ¼ of the managerial staff of comparison schools deems that the low qualification of teachers in Informatics hinders the learning process against only 13% of their colleagues in ABF-supported schools.**

Overall teachers shared their expectations for continuing training on the use of new technologies that should be very practical. Teachers are eager to learn how to effectively use information technology including how IT is used in other schools.

### **5.2.2. Access to the equipment supplied by ABF**

Some of the schools participating in the ABF program have created conditions for efficient use of the project outputs. According to the data provided by the school head masters of 42 schools

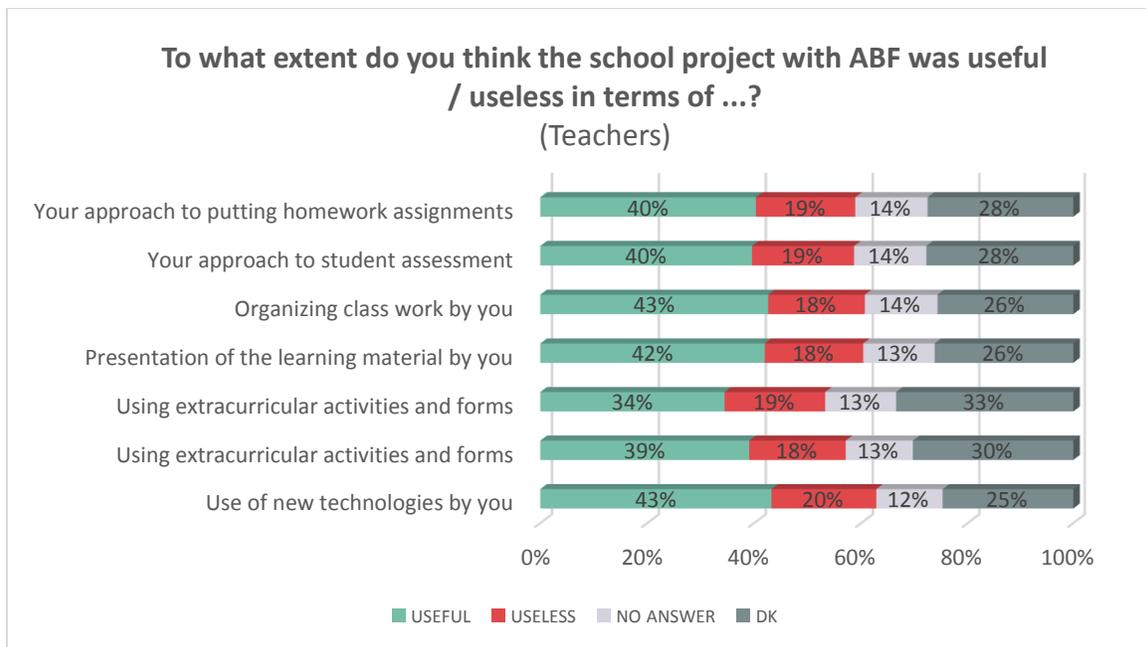
that took part in the ABF program the students using the equipment provided by ABF (at least twice a week) amount to 505 and the average number of teachers using it at least twice a week is around 26. In other words, almost 2/3 of students and 45% of teachers used the equipment and premises supplied by the ABF projects at least twice a week.

In many schools, however, demand for the products exceeds supply and not all students can benefit regularly from all project deliverables. In numerous cases, students and teachers reveal that access to premises and equipment is limited. This entails making tough decisions to choose the beneficiaries entitled to use the new assets, which is indicative of the limited resources generally available in schools and the risk of frustration resulting from arbitrary allocation.

Science teachers share a feeling of being "a thorn in the sides of their colleagues": "It looks as if the labs were made especially for us". (Interviews with teachers) This is due to the fact that the science laboratories contrast with other classrooms.

**Approximately 40% of teachers say that as a result of the ABF program positive changes have occurred in their schools** in: personal use of new technologies; introducing extracurricular and out of school activities and forms; presentation of teaching material and organization of the classroom work; the approaches to student assessment and assignment of homework tasks and individual preparation of students. Every fifth teacher, however, expressed reservations to the change for better as regards these practices (see Figure 16).

FIGURE 16. USEFULNESS OF THE ABF PROJECTS ACCORDING TO TEACHERS



This shows that a significant group of teachers shares a feeling that allocation of benefits of the new technologies among the teaching staff was unequal. In fact, more than half of teachers in the schools funded under the program recognize that they have not been able to

use at all or have had very rarely access to refurbished premises and the supplied equipment and software.

While these perceptions are valid, many of the ABF-supported projects have not been designed to target the entire students' population or all teachers. Each school has to choose among many deficiencies they face the one that constitute major obstacles to the educational process and develop a project to focus on it. If a K-12 school decides that science labs are the most important need, it is clear upfront that the kids at the lower grades won't have access to them and this has been a conscientious choice. For this reason, it is obvious that the outputs of the ABF projects did not reach out to all members of the school team in some of the schools.

The unequal distribution of access to resources generated by the projects in the beneficiary schools was testified by approximately 2/3 of teachers who said they never were able to use an interactive whiteboard and they did not conducted laboratory exercises and experiments. This proportion was similar in all schools and showed that the **availability of new equipment by itself did not lead to more widespread use by educators in the ABF supported schools.**

Approximately half of all surveyed students believe that their school provides access to a state-of-the-art computer with internet and technical resources whenever they need them for educational purposes. However, there are still two other large groups of students: those who believe that regular and fair access was not granted (about ¼ of all students) and those who have hesitated and have not responded (about 1/5 of all students). The indicators of accessibility are similar in all surveyed schools.

Research shows that new technologies can have a positive effect on the interest in learning and concentration of children with special educational needs. However, field visits revealed that most of the schools supported by ABF do not provide children with physical disabilities with the necessary facilities to ensure their access to labs situated upstairs. Those pupils often are restricted to the class rooms located on the ground floor where often no refurbished teaching spaces with high-tech equipment function.

In conclusion, the indicators and issues related to accessibility indicate that **the program did not realize its full potential in the schools where it was implemented** for two reasons. First, it only reached a portion of the students and teachers. Second, as a consequence of the unequal access it could have generated some disruptive feelings and opposition to innovation especially among teachers.

We believe that the program could demonstrate a significantly stronger effects through: *1) realization of comprehensive investments that are targeted at a holistic change, and not only covering specific patches of learning process or organizational development of the school; 2) more equitable distribution of benefits from the school improvement projects within the school community; 3) a comprehensive plan for teachers' professional development, through training, peer support etc.*

### 5.2.3. School attendance, order and discipline

Field visits, discussions with stakeholders, and the quantitative survey in schools suggest that a program for improving the learning environment can have a much broader impact on students' behavior and influence their discipline, self-control, and attitude towards school property.

TABLE 5. SCHOOL ATTENDANCE, ORDER AND DISCIPLINE REPORTED BY SCHOOL LEADERS (%)

Indicator	ABF Schools	Comparison Groups
Discipline challenges	10%	25%
Skipping classes without a good reason	9%	18%
Episodes of drug use every month	0%	9%
Cases of bullying once a month	25%	43%

The quantitative data confirms that ABF-supported schools have less problems with the discipline, attendance of classes, and adherence to internal rules.

Observations from field visits have confirmed that the improved learning environment in ABF-supported schools has changed the students' attitude towards it – accidental damages and a sense of ownership when using it. One of the parents has shared in an interview: *“Our children have learned to intelligently use and preserve the equipment. Environment has the power to educate. When you see something that has completely changed the image of the school then you feel as a host, not as a guest.”*

While there might be numerous explanation about the changed attitude of the students, a key factor in shaping it out is their involvement in project implementation. There were many examples of active participation of students and parents in the process of renovation. Furthermore, students participated in collecting funds to co-finance the project. Thus, they developed a sense of ownership of the school. It became their school.

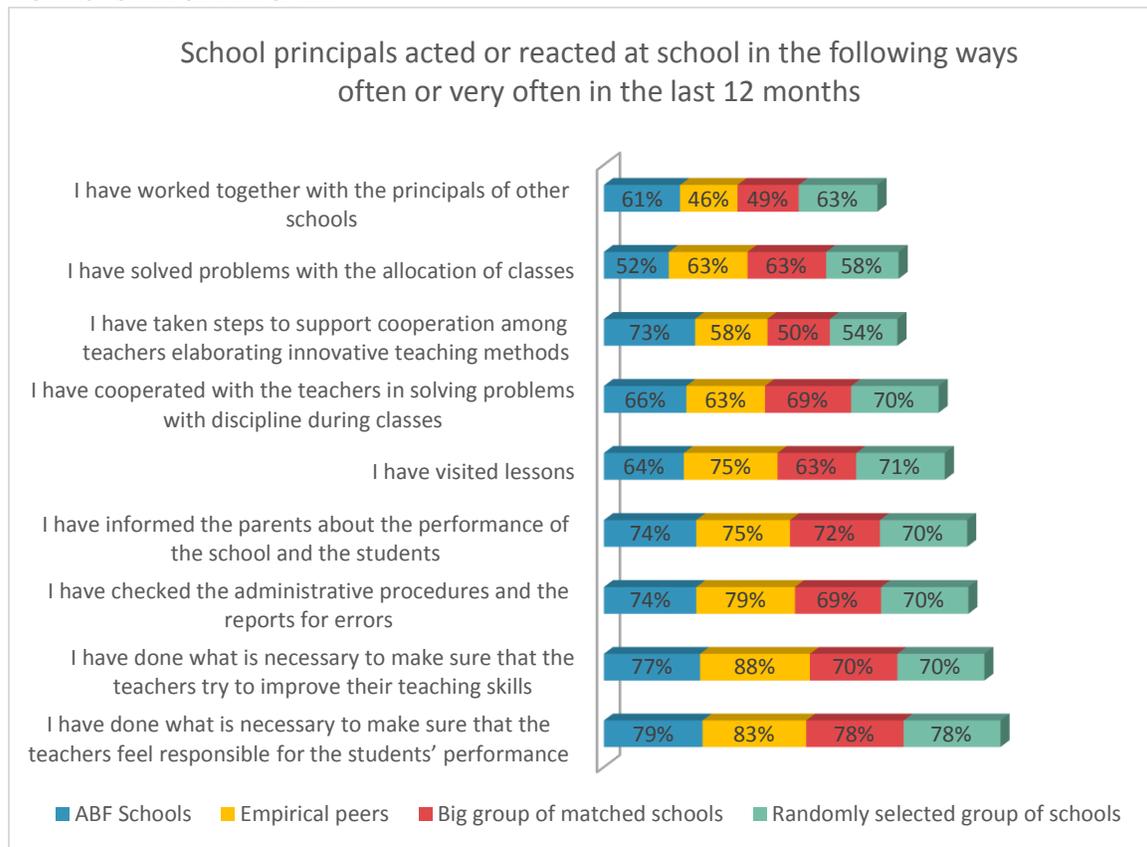
## 5.3 School community

### 5.3.1. Community and leadership

In the broader theory of school improvement the impact on community is considered as important outcome as student performance. On the other hand both leadership and community are drivers of change and are influenced by change.

Our study has concluded that the **overall the satisfaction with the management of the school is 6-7 percentage points higher among teachers in ABF-supported schools**. In attempt to explain this finding, we have compared how often the school principals have acted or reacted on particular issues in the past 12 months. The results are summarized on Fig. 17.

**FIGURE 17. HOW OFTEN SCHOOL PRINCIPALS ACTED OR REACTED AT SCHOOL IN THE FOLLOWING WAYS IN THE LAST 12 MONTHS - OFTEN OR VERY OFTEN**



While some of the findings might seem very similar in the different school groups, deeper analysis has found out **several things that make the ABF-supported schools different** and might explain the higher satisfaction with the management:

- School problems are assessed as less severe;
- A slightly higher share of school principals have allowed students to actively participate in the decision making process and are more willing to participate in solving school problems;
- 70% of the school principals have organized open discussion on school issues;
- School principals more frequently have taken action to support cooperation among teachers in developing innovative teaching methods and collaborate with other school principals.

The self-assessment of the teachers about the allocation of their time among key activities shows that compared to their peers at comparison schools, teachers in the ABF-supported schools:

- Spend less time on all key activities, except for participation in activities such as sports or cultural events;
- Spend less time on school management (between 1/5 and 1/3);
- Enjoy less administrative pressure and spend less time in dealing with organizational issues.

This could be due to the clear leadership role in these schools and to efficiency. But it could also be interpreted as less involvement with school matters such as discussing school issues with colleagues. (See Annex 4: A typical working day).

Schools supported by ABF were more active in the implementation of projects and in participating in programs for international exchange.

ABF investment triggered many additional initiatives in schools to build on the achievements under the projects. In many schools at the end of the project there were operational medium-term plans for equipment of additional classrooms with similar technical tools.

The effect of the “*widening circle*” of desire for new technological innovations can be illustrated with the newly set objective of a biology teacher. After the purchase of modern microscopes within the ABF program she decided to buy a state of the art technology – a digital microscope.

**Schools who benefited by the ABF support have a somewhat higher share of young teachers including young teachers assuming leadership roles.** All schools have predominantly principals and deputy principals aged over 50, but the share of this age group in the schools of comparison group is about 62%, while in the ABF schools it is 52%.

The improved school environment is a factor in attracting young teachers. The growing number of students (related to the perspective for school’s solidity and teachers’ job stability) and the sense of better potential for development (more optimism and less pessimism) in ABF schools contribute to their positive image and “good name” and thus build confidence and generate strive to belong to these schools both for teachers and students (parents).

Last but not least, new technologies have contributed to improving the intergenerational relations among teachers. Young teachers support their older counterparts in the use of ICT. While at the beginning the older teachers had resistances for the use of information technology, thanks to young teachers now some of them started to use it.

In general, it seems that investment in new technology in schools has supported more openness and a more democratic leadership. There are also signs of more involvement of students and parents in school life and of improved relations between older and younger generations of teachers. But the effects are not strong and not pervasive.

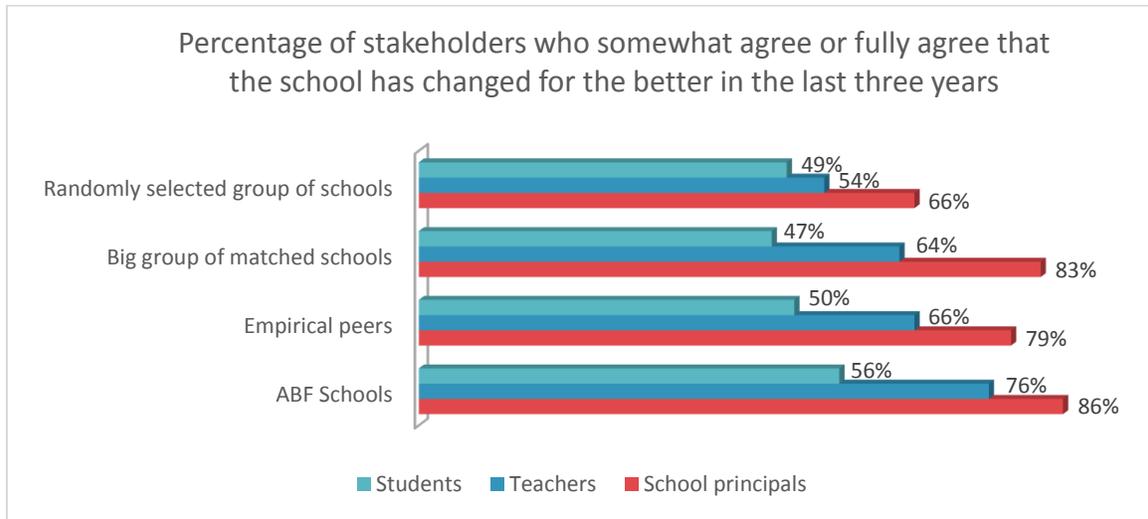
### 5.3.2. Attractiveness of schools and sense of belonging

It was stressed already that improvement in the environment and relations creates a stronger sense of ownership and a caring attitude. School attractiveness and a strong sense of belonging are very indicative of the potential of the school to develop and produce results for the students.

There is a **clearer commitment and sense of belonging to the school** among students and teachers in ABF-supported schools compared to comparison groups.

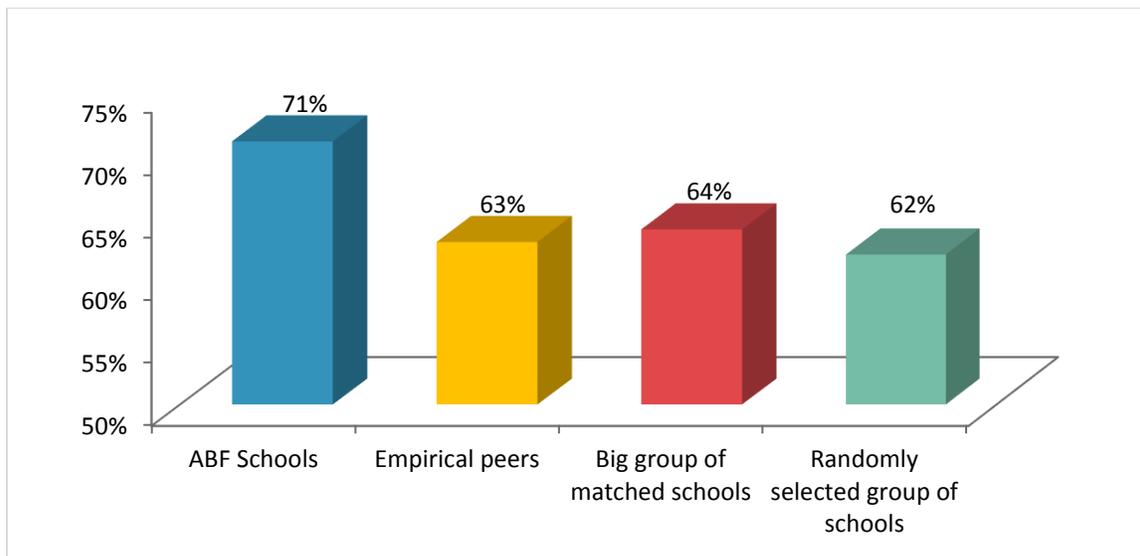
There is a higher degree of confidence of the leadership in ABF-supported schools that their school is changing for the better (see Fig. 18). A higher portion of the students in these schools are convinced that their school has been developing for the better over the past three years.

**FIGURE 18. PERCENTAGE OF STAKEHOLDERS WHO AGREE OR FULLY AGREE THAT THE SCHOOL HAS CHANGED FOR THE BETTER IN THE LAST THREE YEARS**



Students in the ABF-supported schools express greater **satisfaction with attending their school**.

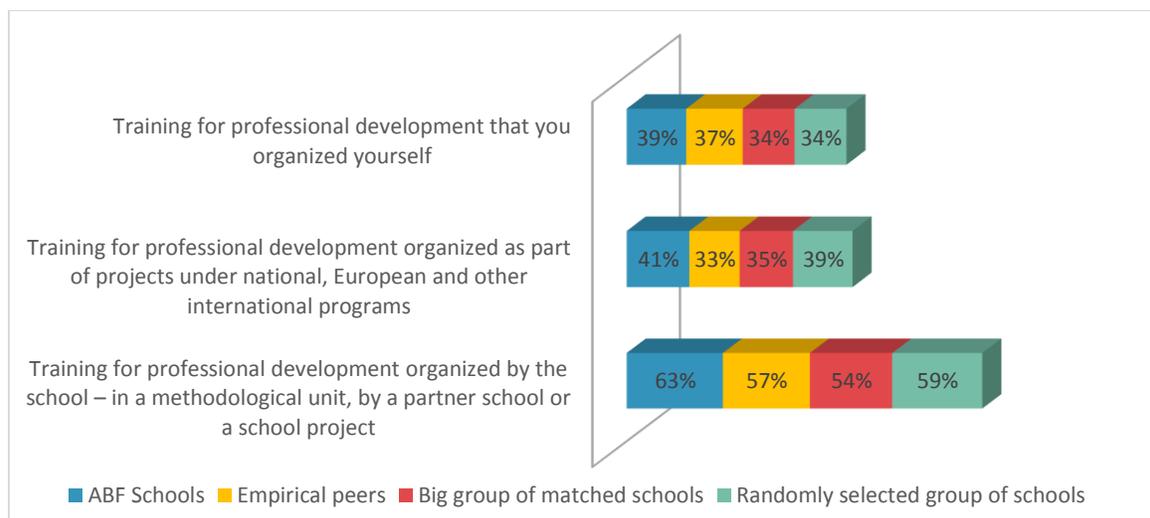
**FIGURE 19. PERCENTAGE OF STUDENTS AGREE OR FULLY AGREE THAT THEY ARE GLAD TO STUDY IN THIS SCHOOL**



Since the set of questions about satisfaction and sense of belonging was borrowed from the questionnaire of the international student survey PISA, we have the opportunity to compare results from PISA in 2012 with the results from our survey. Satisfaction with the school is one of not so many indicators where Bulgaria performs better than the OECD average. In 2012 on average in OECD countries less than ¼ of students expressed very strong satisfaction from their schools while in Bulgaria 1/3 did so. The percentage of those who expressed strong **satisfaction with their schools was even somewhat bigger in the schools supported by ABF (53%)**. In general the total of students who agreed and strongly agreed with the statement that they were satisfied with their schools was a bit smaller in our survey than in the OECD survey from 2012. The difference goes to a higher share of missing answers in our survey, which unlike the PISA survey was delivered electronically. But in general the results from the PISA survey were consistent with ours.

Teachers in ABF-supported schools express a slightly higher degree of **satisfaction with their participation in continuous professional trainings organized by the school**.

**FIGURE 20. TEACHERS FINDING TRAININGS EXTREMELY OR MOSTLY USEFUL**



The coverage of training programs is also better among the teachers from the ABF-supported schools. The improved school environment and higher sense of belonging to it correlates with higher satisfaction with the results of students and generally higher satisfaction from their own pedagogical work, which in turn is an incentive for new improvements. The significantly smaller degree of pessimism about the future in ABF schools is indicative of a better potential for development. The share of pessimists in these schools is 6.7% or almost twice lower compared with empirical peers and the big group of matched schools (12.9%).

All these findings reveal a better climate and a more favorable working environment in ABF-supported schools. However, ***the research did not register any differences between the comparison and the ABF supported in the degree of satisfaction with the relations within***

***pedagogical teams and between teachers and students.*** We can conclude that more time is needed to display the program effects on relationships within the school community.

Purchased technologies are meaningful beyond their direct use. First, the school community and in smaller settlements – the entire local community and even communities in neighboring villages – notice and value the technological innovations and the rest of improvements in the physical school environment. This automatically increases the prestige and attractiveness of the school. The field visits show that for students, for example, it is a signal that "the adults" who have the resources and authority to make changes happen do care about their education. For parents this is an indication for the school commitment with the education of their children.

Moreover, the **modern high-tech image of the school has the potential to attract not only students but also new teachers.**

Along with this the change has led to very highly valued by the teachers job security. In turn, it allows for more work to improve teaching quality and for more creativity in teachers' work.

On the other hand, the increased attractiveness and the related to it increased admission in schools raised the risk of undermining the quality of education. In the interviews some principals in the ABF-supported schools have explicitly mentioned that investment in new technology has attracted more students and teachers. The average number of students **in ABF schools is about two times higher than the average number of students** in the sample of randomly selected schools. A bigger number of pupils in one classroom does not allow for providing high quality individual support and effective use of the newly created laboratories.

Furthermore, school's "overcrowding" restricts the use of the teaching spaces for alternative forms of classroom activity during the school week.

## 6. Schools Making the Most of ABF Program

In this section we take a closer look on the effects of the ABF program on different categories of participating schools. So unlike other sections the analysis in this one is within the program itself. We take two groupings of schools, which actually overlap to a high extent but not completely. The first one is based on the size of the funding received by ABF and the second one is based on the type of settlement in which the school is located (the level or urbanity or rurality). The size of funding can be an important determinant of different developments at school. It overlaps with other school characteristics like the number of students and location in urban or rural areas: up to 15 thousand leva; from 15 thousand to 100 thousand leva and more than 100 thousand leva.

The complete analysis is in Annex 4, here we have provided a summary of the findings.

### Smaller and rural schools have good potential to innovate

Some practices which are conducive to pedagogical and organizational innovations are more widespread among smaller and rural schools. For example, such schools provide more encouragement to their students to seek information outside of the textbooks. 50% of the students from schools with the smallest funding is encouraged to look for information outside textbooks at least several times a week, compared to 30% in schools who got the largest funding. Another indicator are the field trips, i.e. leaving the school to visit other places, organizations etc. are also a sign of moving to a more open curriculum with more freedom to determine content and the pace of learning. Almost all students in the category of schools with the lowest funding had experienced a field trip while 40% of students in schools with the highest funding have never had a field trip.

Given the identified potential of the smaller and less funded schools to innovate and the bigger proven needs of their school communities compared to big urban schools, it seems promising to invest there if there is no risk of closure due to demographic or other reasons.

#### There is a clear relation between the use of equipment and the level of funding

55% of the students at ABF funded schools with less than BGN 15K use multimedia several times per term or several times per month. In schools with funding above BGN 15K 40% of the students use multimedia almost every day or several times per week.

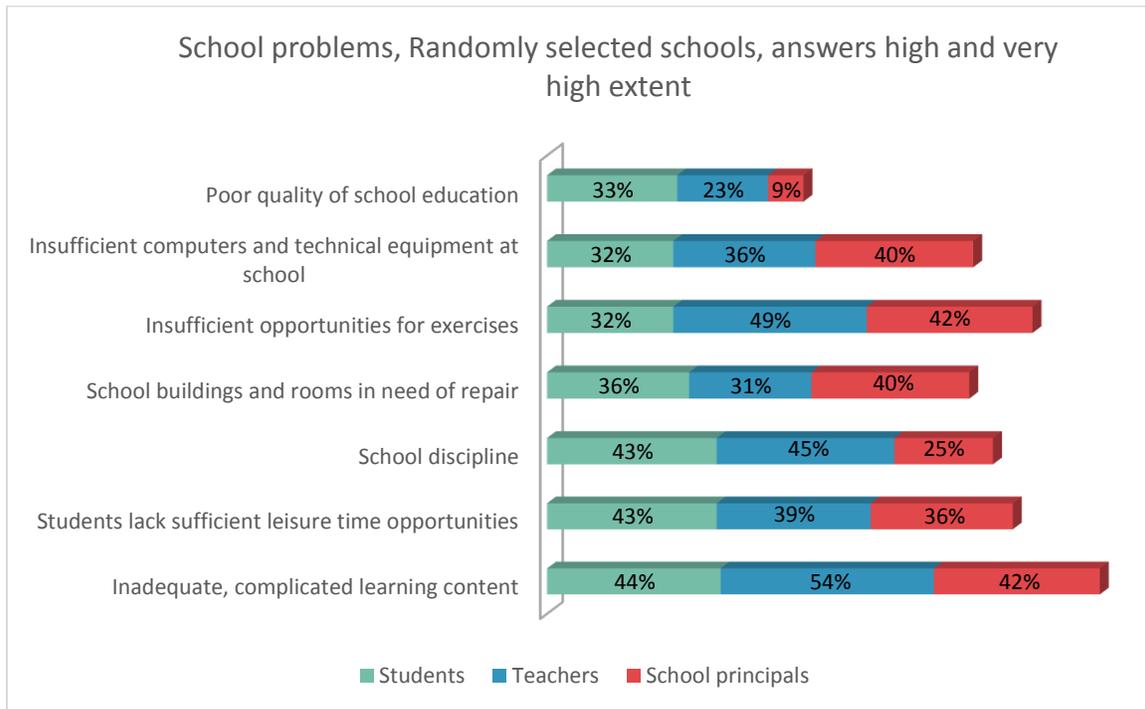
#### The maintenance of the school assets are a bigger problem for rural schools

48% of the teachers report the need of repair as acute needed or very important against 28% in the urban schools. These means that the limited ABF investment cannot address a big need of the smaller schools such as refurbishing classrooms or establishing a science center because of the higher contribution that the school will have to provide.

## 7. Relevance of the program

The relevance of the ABF program to the main challenges faced by the schools can be described as very high for the school management and medium for the students. Teachers perceive the main challenges rather related to the systemic factors beyond the school “control” – curriculum and syllabi, including extra school options for students’ skills development. This is what we see from the answers of the main representatives of school communities. We use the random sample of schools to demonstrate that these challenges are common for the whole education system (see Fig. 21).

**FIGURE 21. TO WHAT EXTENT STUDENTS AT YOUR SCHOOL FACE THE LISTED AND OTHER PROBLEMS ADDED BY YOU? – RANDOMLY SELECTED SCHOOLS - ANSWERS HIGH AND VERY HIGH EXTENT**



Improvement of buildings was the main component of projects supported by ABF to which over 50% of all funding was allocated. ICT and furniture accounted for slightly less than 30% of the funding.

**TABLE 6. DISTRIBUTION OF SCHOOL PROJECTS BUDGET BY MAJOR ITEMS<sup>12</sup>**

Construction and installation works	50.9%
ICT and furniture	28.2%

An important conclusion from observations in the schools we visited is that they must have some basic facilities in order to proceed to advanced technological solutions: *"We have the mandatory infrastructure – the necessary installations, radiators, windows - this allowed us to focus the project on technology and interior."* (School principal)

The program was highly relevant given the ICT trends in EU as regards the ICT Infrastructure and use at school level.

<sup>12</sup> Trainings and other activities comprise 9% of the budget and the rest 11.9% of budget expenditures include other expenses such as consumables and software.

In terms of the ratios of students to internet-connected desktop and laptop computers a recent international survey<sup>13</sup> positioned Bulgaria within the group of four EU Member States lagging behind (together with Romania, Greece and Italy). The positioning of the country as regards the white boards and beamers was equally unfavorable one – varying between the second and fifth lowest among 28 EU member states<sup>14</sup>.

The same survey showed that in Bulgaria computers were mainly located in dedicated labs and libraries and the share of computers used in classrooms was among the smallest in the EU<sup>15</sup>.

In 2011 Bulgaria performed considerably worse than most EU–28 Member States in terms of schools connectedness. The diffusion of virtual learning environment was below the EU-28 mean at all grades and significantly at 8 and 11 grades. This situation was to be changed for all types of schools and mostly for the schools involved in the ABF program where only 2 small schools in rural areas still did not meet the basic prerequisites of connectedness.

**TABLE 7. PERCENTAGE OF STUDENTS IN UNCONNECTED SCHOOLS (MISSING SCHOOL WEBSITE OR OTHER VIRTUAL LEARNING ENVIRONMENT)**

	Survey of Schools: ICT in Education Country Profile: Bulgaria, European Schoolnet and University of Liège, November 2012, p. 8		ABF Schools Survey, ABF, OSI, 2015, School Principals			
<i>Percentage of students in unconnected schools (missing school website or other virtual learning environment)</i>	EU Total - Percentage of students in grade 8 2012	Bulgaria - Percentage of students in grade 8 2012	ABF Schools	Empirical peers	Big group of matched schools	Randomly selected group of schools
	10%	14%	0,49%	0,00%	1,56%	6,17%

The survey also showed that Bulgaria was among the five EU-28 Member States with highest percentages of students in digitally equipped schools with no connectedness and with even worsening situation at grades 8 and 11<sup>16</sup>.

Bulgaria ranked in the bottom five at grade 8, and grade 11 in general education as regards the use of ICT. In Bulgaria ICT is used in about a quarter of the lessons, while on average in the EU Member States every third lesson includes the use of ICT<sup>17</sup>.

<sup>13</sup> Survey of Schools: ICT in Education Final Study Report, Benchmarking Access, Use and Attitudes to Technology in Europe's Schools, Final Report, European Commission DG, Communications Networks, Content & Technology, February 2013, pp. 34-37.

<sup>14</sup> Ibid pp. 40-43.

<sup>15</sup> Ibid pp. 37-39.

<sup>16</sup> Ibid pp. 51-53.

<sup>17</sup> Ibid., pp. 57-58.

## 8. Potential to stimulate overall transformation of the educational system

In the literature on school improvement there are many channels described, which could lead from pilot experiments at separate schools to a broader effect on the education system. The most significant of these channels include spill-over, bottom-up multiplication and centralized initiatives or programs. Any of these can lead to anything from limited diffusion of innovation to system-wide changes.

### Spill-over effects

There is some evidence that **work under the ABF program in the majority of schools has produced some spill-over effects of the technological modernization beyond the particular schools**. When headmasters and teachers from other schools learned about program achievements, they began looking for ways to equip their schools in the same way.

Indicative of the "inspiring effect" of the program is the fact that in 2016 ABF received 270 proposals from 133 locations. The likely channels through which the project became known to other schools were professional networks of teachers, communication between school headmasters and by word of mouth within the parent and student communities.

Investment in modernizing the learning environment has also generated some potential for bottom-up pressure for systemic change in education coming from teachers and parents who demanded increased access to new technologies in schools and better educational outcomes. The project created a resurgence of parenting communities in helping with the required fundraising and in identifying opportunities for further improvement of school environment. Parents in the ABF schools value the program achievements, but along with this they have started requesting measures to make all classrooms look as the renovated teaching spaces.

The ABF program contributed to the multiplication of the schools using modern technology and even stimulated the first steps towards promoting exchanges between beneficiary schools. This process has the potential to lead to quantitative accumulation that can trigger a change in the entire educational system based on the united voices of school communities. One of the ABF principals has shared her belief that *"The more schools transition to this way of working, the easier it would be for us to force the system to do it as well."*

The first signs of initiated major changes in the educational system could be recognized even within the evaluated programming period. For example, in one of the schools participating in the program the management had attempted to promote the implementation of similar programs at national and local level. The school principal invited the minister of education to visit the new laboratories. The minister was accompanied by a delegation of experts. The objective was to convince the professional staff of the ministry and representatives of the media to start discussing how best program practices could be mainstreamed nationally. This

particular attempt did not end with much of a success. According to the representatives of school management "*Everything faded away the moment the meeting was over.*"

### Potential for impact on national level

In recent years, the Ministry of Education and Science (MES) has adhered to standard forms and limited budgets for renewal of the technological resources in a limited number of schools.

The data in the 2013 and 2014 annual MES reports on the implementation of the national programs for the development of secondary education show an increased number of schools that have received equipment under the Program of Information and Communication Technology (ICT) in Schools. For example, in 2014 620 schools purchased over 8,000 terminals, PCs, tablets and laptops, with co-financing from the program. In comparison, the number of supported schools was 517 in 2013. These programs, however, continue to suffer from the lack of a comprehensive and coherent intervention including lack of integrated activities for the overall improvement of the learning environment, purchase of software, training to use the new technologies, and training for effective integration of ICT in teaching strategies and methodologies.

There is no assessment of the MES programs for supplying ICT at schools, but looking at their design we believe that they have all the disadvantages of the ABF program and none of its advantages. The program of the Ministry of Education has opted for an even more limited interventions – only one classroom per school. It does not have any instruments or ambition to change the methods of teaching and thus to take advantage of the IT. It does not envisage a broad range of interventions, which can reinforce effects in multiple areas either. For example, the program of the Ministry of Education can hardly have any influence on student achievement in natural sciences where there are large and pervasive deficits. In general, the lessons from the implementation and evaluation of the ABF program seem very relevant for the improvement of the national policies of school development and are worth sharing.

Another lesson from the ABF program is that overall improvement of the school environment produces much larger effects than just the supply of equipment. The reshaping of space and putting it to new use is an essential part of the change. We should note that non-technological improvements are equally and sometimes more valued by students. Students believe that even just the “material” improvements and refreshment of part of the school buildings create a more pleasant environment for learning, even without new equipment and technology. In fact, such minimalist attitudes and lower expectations are indicative of the serious challenges posed by the maintenance of school buildings that needs to be addressed adequately by the system.

The competition organized by the ABF has a strong element of “self-selection”. To some extent self-selection is present in all competitions, but the large national programs administered by the Ministry of Education and Science and funding hundreds of schools, the “self-selection” plays a smaller role than in competitions with more specific targets and smaller coverage. This should be considered when planning a possible transfer of ideas from the ABF model to wider public investment programs in education.

Investment in improving the learning environment in a limited number of schools creates a gap between the lucky winners and those who were not successful. This in turn can deepen the educational inequalities that already exist in Bulgarian school education. Inequalities in access to and use of technology can further augment inequalities in the quality of education and training and educational outcomes. If a program for modernizing the learning environment is applied nation-wide, we believe a national emergency program is needed to ensure the application of equal conditions and standards. This means developing a national program addressing the needs of individual schools by carefully assessing their status quo and undertaking tailored investments. Further, the experience of the project can be used in the development of the State educational standard of the school learning environment.

New technologies create opportunities to generate pressure for another set of key changes in the educational system as a whole – through the introduction of new electronic textbooks among other things, lower the burden of printed manuals and bureaucracy.

Experience of the ABF program strongly suggests the need for improvement of the curriculum. The information culture has to become part of students' training from the very beginning. Today informatics is taught in secondary schools but "*...teachers in informatics are 10 steps behind the students.*" (School principal). This subject should become part of the curriculum much earlier.

In addition, "Informatics" should be "taught" as a transversal topic in different classes and not separated as a subject per se. Moreover, the initial academic training of all teachers should integrate teaching objectives related to the development of ICT skills.

Teachers express special concern and make recommendations for technological support of the schools in small settlements, as well as in the so-called focal schools, and schools with fewer students. This is why it is essential that a national program puts a strong accent on schools, which are disadvantaged in terms of access to new technology. Investments in these schools can yield even greater added value, as access to new technologies for them creates conditions for easing the restricted school's delegated budget by reducing the cost of textbooks and materials. In a similar way, access to Internet provides opportunities for teachers to find information easier and to use more literature that the school cannot otherwise obtain because of budgetary constraints. As one of the teachers has pointed, "*A printed map costs 50 – 60 levs and we cannot afford it. But on the internet it is available for free.*"

Digital technology also indicates opportunities for change beyond the school level – for example, they may allow effective use of distance teaching and learning for which new legislation started to appear. It may contribute also to improving the indicators of adult education, on which Bulgaria is among the lagging EU Member States.

An important area of change through technology is the reduction of red tape and simplifying the administration and information management in school: "*The new technologies make it possible to have an integrated school system - including digital content in the library, electronic records*

*and an electronic system for training and administration. It allows decreasing writing on papers. At least as regards the information flows inside the system we will save time..."* (School principal)

New technology also creates opportunities for teachers to develop innovative products, conduct and share with other educators applied research which can influence the development of the entire system.

Last but not least the high standards of the ABF program give good ground for reflection on the issue of the use of unlicensed software within the school system. Such practices exist and most likely continue in many schools that cannot afford buying licensed tools.

## 9. Summary of the findings

### 9.1. Impact on the Students

**Use of technologies is higher at ABF-supported schools, though still gaining speed:** 35% of the students at ABF-supported schools use ICT equipment almost every day or several times a week, 5% higher than the usage in all comparison groups. The most often used technologies are multimedia and interactive boards. In all groups, 25% of the students use Internet-based tutorials and lessons. Almost 2/3 of the students use the equipment supplied under the ABF supported projects at least twice a week.

The increased usage of new technologies for learning apparently contributed to **better performance at national standardized tests and competitions**, such as matriculation exams, competitions at national, district and school level.

Positive change in student achievement has for a long time been considered the most important impact of any program investing in school education. We found that **the implementation of the ABF program had more added value<sup>18</sup> than comparable schools in Bulgarian language (statistically significant) and natural sciences** using the combined scores in physics, chemistry and biology. While investment in natural sciences was one of the consciously set objectives of the program, the improvement in Bulgarian language comes somewhat as a surprise. The program did not have any special tools to influence Bulgarian language teaching. We believe a possible explanation for the high added value from the program in Bulgarian language is that improvement in any field of learning is intrinsically related to improvement in the mastering of the language in which it is taught.

Another reasonable explanation is that the BLL exam is mandatory and as such it is representative of the overall achievements of the students in the school. From that perspective, the BLL exam can be considered a good measure of the complete effect of the ABF program.

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<sup>18</sup> The added value model shows the contribution of each school to the student test scores beyond a baseline projected by his/her previous achievement. See Annex 1 for more details.

The significantly better results of ABF-supported schools reflect the changes that have occurred in terms of improved quality of teaching and learning.

The analysis the results in the natural sciences should take into consideration the fact that they are optional and that only students who are interested in these sciences go and take the test. The fact that ABF-supported schools have added more value even to these subjects indicates the substantive impact of the program on student achievements.

**In foreign languages**, schools supported by ABF and the comparison groups had a similar level success in 2010. At the matriculation exams in 2015, students in ABF-supported schools did much better than their peers in other schools. Recognizing the influence of many other factors, a valid conclusion is that ABF program has contributed to the improved foreign language results of the students.

**There is no any added value in mathematics** and further analysis showed that this is due mainly to the fact that ABF selected into the program schools, whose students were already very good in mathematics before the program started. With this set of schools it is unlikely that the ABF program will be able to have more added value in mathematics even if more time passes. The only way to achieve higher added value in mathematics is to support schools where students have deficits in their numerical skills. This is a main argument for our recommendation to diversify the school investment portfolio of ABF by including different types of schools.

Among cognitive skills we found that students in ABF-supported schools outperform their peers in comparable school **in the strong memory test and in practical numeracy**, i.e. reading and interpretation of charts, tables, schedules and numeric information presented in pictures and words. Memory is usually considered one of the most unmalleable and inborn skills. So a question arises naturally how memory could possibly have been influenced by an investment in technological modernization. Our answer is that the memory test delivered through computers has a component measuring IT skills. This includes the skill to quickly grasp and process information delivered on a screen. So, good results in a strong memory test of the students in schools supported by ABF is also a sign that **their IT skills have improved**. Apparently, the use of IT and the participatory process of learning which evolved in some of these schools were conducive to the development of practical skills in the field of numeracy. **Students at ABF schools have demonstrated ability to link theoretic knowledge to the solution of practical problems**, something that continues to be one of the deficits of the Bulgarian school education.

The test measuring the non-cognitive skills has shown a **statistically significant positive difference in the characteristics of the students in schools supported by ABF**. The most important one was in the lower level of hostile bias. This means that they are less likely to display hostile bias, i.e. they have a more positive perception of others. They are also a bit more emotionally unstable, which is actually a common characteristic of better performing students with high ambition. The other factor displaying substantial positive difference included **decision making, conscientiousness, grit, achievement striving and openness to experience**.

In addition to their better results at exams and student competitions, ABF-supported schools have demonstrated better achievements in terms of student **discipline**. Cases of bullying once a month are reported by 25% of the school principals in ABF-supported schools while they reach up to 45% in comparison groups. Instances of drug use every month occurred in 8-9% of the schools in comparison groups, while no such cases were observed in ABF-supported schools.

## 9.2. Impact on Teachers

Approximately 40% of the teachers say that as a result of the ABF program positive changes have occurred in their schools in: personal use of new technologies; introducing extracurricular and out of school activities and forms; presentation of teaching materials and organization of the classroom work; the approaches to student assessment and assignment of homework tasks and individual preparation of students.

ABF projects have improved the access to state-of-the-art computers with Internet connection in the supported schools. As a result, 75% of the teachers there have access to the new technologies, 6-7% higher than those in the comparison schools. Despite the accessibility of the new technologies in general, almost **67% of teachers at ABF-supported schools have not been able to use an interactive whiteboard**. Estimated **45% of the teachers used the premises and equipment supplied under the ABF supported projects at least twice a week**. This is a great achievement, having in mind the nature of the projects – language, science, and IT labs – which clearly define the pool of teachers who will be able to use them.

Despite the established IT environment in all schools there is a feeling among students of relatively low frequency of use of the new technologies by the teaching staff. 41% of the students at ABF-supported schools shared that teachers do not use ICT equipment often in class. This percentage is higher (48%) with the big comparison group.

The IT environment demands improved capacity in the field of information technology and contributes to lessening the deficiency of qualified ICT teaching staff. With ABF support many teachers were trained to work with new technologies – computers, multimedia and interactive boards. **The ABF program has contributed to mitigating the shortage of well-trained key teaching staff in schools and to the development of teaching capacity in the field of information technology**. As a result, the majority of the managerial staff at ABF-supported schools (87) are satisfied with the qualification of the teachers in informatics and believe they help the learning process against less than 75% in comparison schools.

## 9.3. Program Impact on the School

Both, teachers and students in ABF-supported schools express a **stronger sense of belonging to the school** than in the comparison groups. Not surprisingly the **ABF schools are positioned**

**better to attract more students** and the average number of students they have is about two times higher than in the schools from the comparison groups.

However, "overcrowding" sometimes restricted the effective use of the new classrooms and weakens the school capacity to provide individual support. Furthermore, the schools are still impeded to make the most of the better IT environment due to relatively **low frequency of use of the new technologies by teachers and insufficient trainings** to work with new technologies.

**The satisfaction of the students at ABF-supported schools is way above the average for the country and reaches 53%.** In 2012 PISA survey less than ¼ of the students in OECD countries expressed very strong satisfaction from their schools while in Bulgaria 1/3 did so. ABF schools are doing much better, so no doubt the School of the Future projects have contributed to this.

One of the reasons for the stronger sense of belonging to and satisfaction with the school described above is the fact that ABF program beneficiaries significantly overpass the comparison groups in terms of the overall quality of the learning environment, technical facilities and equipment. **The ABF program has the biggest impact on the refurbishing of the schools with interactive boards, tablets, microscopes, laptops and multimedia projectors** – these assets increased by 20% to 57% in the different schools as a result of project implementation.

With the ICT equipment provided by the School of the Future program, over 55% of the school managers at ABF-supported schools believe that the computers are up-to-date and support the educational process.

Approximately half of the students in all schools believe that their school provides access to a state-of-the-art computer with internet whenever they need. However, the school of the future program allowed the ABF-supported schools to overtake the schools in comparison groups in terms of ITC equipment per student.

Ensuring an adequate connection with the Internet is no longer considered an impediment for learning at ABF-supported schools. In this ranking schools under the program demonstrate results, which are commensurate with the average score for the OECD schools assessed by the OECD PISA Survey in 2012.

Limitations of interventions which covered a small part of the whole school made **equal access to assets an important challenge**. School principals report that more than 1/3 of students do not use the projects' outputs regularly (at least twice a week). The same is true for more than half of the teaching staff.

The program has changed the attitude of the management of the supported schools to value the importance of doing things in the best possible way, with a vision for the future, and to make choices based on quality and potential for sustainability. Making a funding contribution a requirement for the schools has developed their ability to fundraise and to better work with the community. The principals of the ABF-supported schools have reported that the average amount raised by a school after the project completion has went up from BGN 23,000 in the first

year to BGN 62,000 in the 4<sup>th</sup> – an amount comparable to the average of BGN 6,000 contributed by each school during project implementation.

Another important change inspired by the program is the spill-over effect on the school itself. Parents in the ABF schools value the program achievements, but along with this they have started requesting measures to make all classrooms look the same as the renovated teaching spaces. A big number of the principals have reported continuous effort for improving the learning environment at the entire school following the high quality standards of the ABF program. Many of them claim that the entire school meets the contemporary requirements for supportive learning environment.

Smaller and rural ABF-supported schools have introduced practices conducive to pedagogical and organizational innovations. Every second student from schools with the smallest funding is encouraged to look for information outside textbooks at least several times a week, compared to 30% in schools who got bigger funding. Field trips are also a sign of moving to a more open curriculum with more freedom to determine content and the pace of learning. Almost all students in the category of schools with the lowest funding had experienced a field trip while almost 40% of students in schools with the highest funding have never had a field trips.

#### 9.4 Broader Impact

**ABF program has produced some spill-over effects of the modernization of the learning environment beyond the supported schools.** When headmasters and teachers from other schools learned about program achievements, they began looking for ways to replicate the examples of their peers.

The likely channels through which the project became known to other schools were professional networks of teachers, communication between school headmasters and by word of mouth within the parent and student communities.

Investment in modernizing the learning environment has also generated some potential for bottom-up pressure for systemic change in education coming from teachers and parents who demanded increased access to new technologies in schools and better educational outcomes. The project created a resurgence of parenting communities for fundraising and searching options for further improvement of school environment.

## 10. Conclusions and recommendations<sup>19</sup>

### Conclusions

**The most lasting effect of the program can be expected in terms of the overall school organizational development (team interaction, school climate and practices) and teaching strategies and pedagogical approaches.** They underpin sustainable change and create a school environment that is able to produce consistently high-quality results for many cohorts of students. Most likely these would be the most durable results although they take time to appear and are difficult to achieve. This poses the requirement for ABF to continue monitoring the process of change in schools. This does not need to be done necessarily by an external assessment. Mechanisms of internal monitoring and self-assessment can be built into the projects. For example, schools that obtain funding from ABF can be required to provide data at the beginning and/or end of the projects through questionnaires filled by the school management and teachers. Portions of the questionnaires developed for the purposes of this evaluation can be directly used or adapted.

**The whole program was highly relevant to the needs in Bulgarian education.** Computers, other technical tools, and run-down classrooms are equally important deficiencies. Students prioritize the improvements of the school environment, while teachers prefer new equipment. The need of technological renewal and modernization of the learning environment is positioned among the top three issues identified by the school principals. Improving the learning environment was a main component of the projects supported by ABF, to which over 50% of the funding was allocated. ICT and furniture used almost 30% of the money.

ABF program interventions cover a **relatively small part of the supported schools.** These areas differ substantially from other classrooms, hallways and WCs that due to lack of investment in the building were quite neglected and in need of refurbishment. Despite covering a small part of the school, **the effects are strong enough to become visible at school level by influencing significantly the overall student performance and initiating also some significant school wide changes** which are likely to evolve.

The comparative analysis of the randomly selected schools and the ABF-supported schools strongly suggests that the results achieved within the ABF program are not indicative of the overall potential for modernizing Bulgarian school education. Most of the supported schools fall into two or three groups that generally have students with educational results markedly above the average. The inclusion, though limited, of schools with diverse profiles in the ABF program

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<sup>19</sup> By the time these conclusions and recommendations were finalized a new round of the ABF program was already launched. We noticed that some of our recommendations had already been reflected in the design of the program.

was extremely valuable because it allowed us to evaluate the process of implementation, and look at the specific risks and challenges in different schools and communities.

The ABF investment in state-of-the-art technology confirms **that technologies can be effective when the whole ecosystem of learning is changed, not just some pieces of equipment.**

Technology apparently can trigger a change in teacher-student relations, in classwork and home assignments, and in assessment procedures.

Quite interestingly **from the evaluation of the ABF program we can conclude that** contrary to popular assumptions that student results come at the end, **it is possible to improve performance and specific cognitive skills of a cohort of students within a relatively short period of 3-5 years.** Improvement of non-cognitive skills appears to come harder, while making the impact sustainable and changing irreversibly the whole learning environment and school communities seems to be the hardest of all. This change had started in many of the schools supported by ABF even before the start of the program and the program reinforced it. But it will take much more time to achieve stable results with many cohorts of students.

The size of the funding drives the type of the implemented project. There is a clear relation between the use of multimedia and other equipment and the level of funding – 55% of the students at ABF funded schools with less than BGN 15K use multimedia several times per term or several times per month. In schools with funding above BGN 15K 40% of the students use multimedia almost every day or several times per week;

The maintenance of the school assets is a bigger problem for the village schools. 48% of the teachers report the need of repair as acute or very important against 28% in the urban schools. These means that the limited ABF investment cannot address a big need of the smaller schools such as refurbishing of classrooms or establishing a science center because of the higher contribution that the school cannot afford;

Most of the ABF-supported schools belong to the category of town schools with bigger number of students and often considered “elite”. However, some smaller schools outside big cities were also reached by the ABF program though with much smaller funding. Those schools responded well to the incentives of the program and it apparently contributed significantly to their technological upgrade. Given the fact that some important prerequisites for innovation are apparently in place in smaller and less funded schools and having in mind the bigger proven needs of their school communities compared to big urban schools, it seems promising to invest there if there is no risk of closure due to demographic or other reasons.

## Recommendations

The ABF program contains some lessons for the Ministry of Education which can be helpful in developing effective national programs for school improvement. Therefore our first recommendation is to **popularize the results from this evaluation and engage experts,**

**educationalists, teachers, and school principals in a discussion about the challenges of technological innovation in Bulgarian schools.** This can be done through a series of events, some involving the expert community and others opening to the general interested public, which is rather broad when school education is concerned.

This evaluation demonstrated that program results can be captured by using external standardized tests already at a quite early stage. This kind of assessment can be done at a very acceptable cost. The use of additional instruments such as tests for skills and general purpose questionnaires provides even more useful detail about the impact and functioning of educational programs. **ABF joins forces with Bulgarian NGOs to advocate for broader use of evaluation in publicly funded education programs in Bulgaria.**

ABF support was largely dependent on the initiative and entrepreneurial drive of the school leadership, as well as on the existing capacity for change and development. In the subsequent cycles of the program it makes sense to explore further opportunities to broaden the selection criteria and diversity of schools selected in the program.

We therefore recommend **expanding the scope of the program to include different types of schools.** Results of the evaluation show that such a diversification of the ABF portfolio can increase “the bang for the buck” invested in Bulgarian education. The program, can benefit from partnership with other organizations.

By organizing joint study visits and trainings the ABF program sets the basis for promotion of interschool initiatives. ABF may also consider further use of the positive momentum of this process and developing it by **creating a network of supported schools for exchange of experience, continuous professional development and common initiatives which can seek funding from European funds and municipal budgets.** We learn that such a network has already started to take shape informally. The schools submitting proposals to the program were seeking advice and information from the previous successful applicants.

One of the strands of support for schools mentioned by teachers and headmasters is the provision of more information on the concepts of modern education and the organization of school processes. Examples and experiences from school improvement and good teaching and learning practices are welcomed by program participants as well. Some have suggested that good models from schools in Bulgaria and abroad could be shared to successful applicants funded under the ABF program. The increased demand for information and sharing of experience is a very positive and encouraging sign. We believe that the ABF program has contributed to this positive development and recommend that ABF should respond to it. Some suggestions how this could be done are given in the next two paragraphs.

The impact of investment in technology can be increased by stepping up training activities. There is a need to further enhance teachers’ competence to use new technology experiment with new methods of teaching and continuously improve their practice. We therefore recommend to **dedicate more funds to training in the new wave of the program or encourage**

**schools and teachers to look for opportunities to upgrade their own understanding of new technology and sharpen their skills in combining technology with innovative teaching.** This can be done by using other sources of funding for training available to schools from the national budget and EU funds.

Schools do not encourage enough research and experimentation by teachers. The potential of teachers to innovate needs to be unleashed because the purchase of equipment and technology itself does not guarantee a real change in the process of learning and in outcomes. One possible way to tap the teachers' energy is to provide them with space where they could share the practices stemming from the ABF program. We recommend **creating a biannual or quarterly newsletter where teachers could publish articles, lessons, vignettes describing specific practices; share approaches, methodologies, and other materials.**

The concept of innovative schools which was developed for the first time in the new legislation of school education can be very useful for the schools within the ABF program. It gives opportunities to innovate by changing more radically the school curriculum and adopting unconventional methods of teaching and learning. These opportunities need to be explored and eventually used by the ABF program. **School management of supported schools can be encouraged to think how to prepare proposals for innovations and acquire the status of an innovative school.** The ABF investment can be very supportive as it creates a suitable track record of previous innovation and valuable technological assets to build on.

We recommend **keeping the contacts with schools already supported by ABF.** This can be done by supporting the building of a network of schools which experiment with technological innovation and by involving previous and current program beneficiaries in events and informal communication for discussing school improvement through technological innovation.

Finally, comprehensive investments, more equitable distribution of benefits and enhanced capacity building would definitely increase the program's outcomes significantly and would further boost its potential to impact the overall technology driven transformation of the educational system.

## ANNEXES

### Annex 1. Detailed Methodology

To carry out the evaluation the evaluators' team designed packages of qualitative and quantitative instruments with methodologies and usage guidelines. The combination of different research tools ensures methodological triangulation to enhance the validity of data.

#### The Research Instruments include:

1. Desk research and analysis of the implemented projects; analysis of the approved project documentation, reports and outputs. The desk research included an initial catalogue of schools with a statistical factsheet for each school. The type and amount of each project (each investment made by ABF) was described. This was the basis for deciding what type of impact could the specific support from ABF have had based on previous experience and research.

2. In-Depth Interviews with beneficiaries, school principals, teachers and the project actors (project team members, trainers, project managers).

3. Focus groups with students and teachers

4. On-line surveys among direct and indirect beneficiaries, for evaluating the products and outcomes. Collecting information through on-line questionnaires for students, teachers, and the school management in all schools supported by ABF and a number of peer schools selected as a comparison group

5. On-the-spot visits and registration card for direct observation and description of the available facilities and its current status quo.

6. Matrix containing quantitative data on activities, participants and outcomes regarding the schools participating in the model implementation pilot project.

Tables 1 and 2 summarize the different research instruments as well as their scope.

TABLE 1: SUMMARY OF THE QUANTITATIVE METHODS USED

Method	Type of Stakeholders	Number
On-line Survey	Students in schools from comparison groups	37,916
	Students in ABF schools	14,534
	Teachers in schools from comparison groups	5,048
	Teachers in ABF schools	1,346
	Representatives of the school management in schools from comparison groups	354

	Representatives of the school management in ABF schools	77
Anonymized results of external evaluation – 2010 – 7 <sup>th</sup> grade	Students in schools from comparison groups and students from ABF schools	60,684
Anonymized results of external evaluation – 2015 – 12 <sup>th</sup> grade	Students in schools from comparison groups and students from ABF schools	54,507
Table containing quantitative information	Principals from ABF Schools	42

TABLE 2: SUMMARY OF THE QUALITATIVE METHODS USED

Method	Type of Stakeholders	Number
In-depth Interviews	ABF schools – principals	22
	ABF schools – interview with project coordinator	22
	ABF schools – parents	25
Focus Groups	ABF schools – students	266
	ABF schools – teachers	175
Semi-structured interviews	ABF Program Management	2

The assessment of the school improvement program focused on the main effects measured through the progress of students. In order to say that the program had positive effect it was necessary to prove that students in schools supported by the program improved faster than their peers in similar schools not included in the program.

The main evaluation approach was based on **comparative analysis** of schools supported by ABF and comparison groups of reference schools and **retrospective study** of the students' standardized results at national tests before and after project implementation.

**Comparison Groups:** The assessment was commissioned long after the implementation of the program had started. This meant that carrying out a true randomized experiment was not possible. Instead a matching procedure was used based on a set of criteria to pair each school in the sample with at least one similar school not from the sample. For the purpose of simplicity, we call the units not supported by ABF and selected through such a procedure a *comparison group*<sup>20</sup>. This procedure worked well enough with all schools including language, math and science, rural school, and schools with disadvantaged students. **Matching criteria included**

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<sup>20</sup> The term control group is often reserved for true randomized experiments so strictly speaking what we will get are quasi control groups, i.e. units identified as similar to the ones that got the treatment *after the intervention has already taken place*. Such groups are usually called in the research literature comparison groups.

school level variables such as size and location of the school, as well as socio-economic data characterizing the settlement or community where the school is located. We used a geocoded database of settlements and municipalities linked to schools with geocoded locations.

For the purpose of the assessment we designed three different comparison groups. To subject the ABF program to an even harder test we designed three different comparison groups of reference schools, which had a different size and schools were selected in them using different methods. Outperforming simultaneously three groups is harder than outperforming just one.

One of the groups includes 17 schools which were short-listed for the second round of the bid, but did not make it to the final. We call this group **empirical peers**. In assessment theory it is often believed that units which were not treated almost by chance should differ from the treated group at most by a small margin. Very often a comparison group designed in such a way is a much better match for the treatment group than groups designed by statistical methods.

The second group includes 35 schools, i.e. comparable to the number of schools targeted by ABF (45 schools). We call this group a **small group of matched schools**. The third group includes approximately three times as many schools as the ones supported by ABF (108 schools). We call this group a **big group of matched schools**. The small and big groups of matched schools were designed by the method of propensity score matching. It allows to choose a set of indicators, which very likely characterize the units in the treatment group and then to find peers that are as close as possible to the treatment group on this set of indicators.

We also used a group of 116 randomly selected schools in order to have a useful reference for background information about the school education system, i.e. typical Bulgarian schools. For obvious reasons this group was not used for direct assessment of the ABF program.

Table 3 defines the different comparison groups used in the assessment.

**TABLE 3. TYPE SCHOOLS IN THE MAIN AND COMPARISON GROUPS**

Type of schools in the ABF supported and comparison groups	Definition	Number of schools
ABF Schools (ABF supported)	Schools funded by the ABF program	45
Empirical peers	Schools which were short-listed for the second round of ABF bid, but did not make it to the finals.	17
Small group of matched schools	Matched schools were identified by using a method called propensity score matching. The idea of the method is to choose a set of indicators, which very likely characterize the units in the treatment group and then to find peers which are as close as possible to the treatment group on	35

	this set of indicators. In the smaller group of matched schools only the closest schools were included.	
<b>Big group of matched schools</b>	Matched schools were identified by using a method called propensity score matching. The idea of the method is to choose a set of indicators, which very likely characterize the units in the treatment group and then to find peers which are as close as possible to the treatment group on this set of indicators. In the big group of matched schools to the small group of matched schools were added the second and third closest schools.	108
<b>Randomly selected group of schools</b>	Randomly selected schools from the whole list of primary and secondary schools (VET schools included).	116

**Assessment of Students' Performance:** We measured the improvement in students' performance from three different aspects:

- The academic achievements as documented at the national standardized tests after 7<sup>th</sup> and 12<sup>th</sup> grades;
- Cognitive skills measured by a special module in a student questionnaire; and
- Non-cognitive skills also measured through a set of items in a questionnaire for students.

**Academic Achievements:** We obtained disaggregated school level results from external evaluations after the 4<sup>th</sup>, 7<sup>th</sup> and 12<sup>th</sup> grade (state matriculation exams) for each of the past six years, 2010-2015. These data allowed a longitudinal analysis of progress made by students on standardized tests to be conducted. This analysis provided some insights on the possible effects of the ABF investment in schools. The issue with confounding variables was addressed by using a model of added value with random effects.

The **added value model** was developed in the last decade specifically to assess educational programs. It was designed to correct the shortcomings of previously widely used and quite crude measures of progress which focused on year-on-year changes of successive groups of students. Obviously along with the genuine school improvement such measures capture a lot of other factors such as the social composition and the different abilities of different cohorts of students, which do not depend on the school. This makes such measures very volatile. The added value concept instead focuses on the progress of the same students over time<sup>21</sup>. This approach effectively eliminates

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<sup>21</sup> Gray, J., Goldstein, H. and Sally Thomas "Of Trends and Trajectories: searching for patterns in school improvement," *British Educational Research Journal* (29, no 1), 2003, pp. 83-88.

confounding factors related to student characteristics. Additionally, it allows to assess the contribution of each school to student performance.

*“Value-added models can provide measures of school performance that for most education systems will greatly improve the data and information currently used to inform decision-making. Importantly, value-added measures provide accurate measures of the contribution of the school to student performance that overcome many of the problems with current school performance measures.”<sup>22</sup>*

The model of added value started gaining popularity after it was included in pilot projects by international organizations like the OECD and the World Bank. It thus started to spread to countries beyond the USA and the UK where it originally started and was broadly used<sup>23</sup>. In Bulgaria, an added-value evaluation of the whole school system based on standardized national examinations was initiated by the World Bank. A report is expected to be published soon. This evaluation uses the same methodology for estimating the added value of each school but includes one additional step, which is necessary for the evaluation of the ABF program – a statistical analysis of the difference in scores of schools supported by ABF and schools included in the comparison groups.

The added value model is mainly used to assess the whole education system because it is very demanding in terms of the number of available observations (usually many thousands are needed as a minimum). Technically it is based on a hierarchical regression with fixed and random effects. The main random effect which loads into the analysis of the ABF program is the school. The other random effect is gender, which is known to influence significantly student results. The idea of the model is to track the *additional effects* of each school on the student results at the matriculation exams in 2015 beyond the result which can be predicted from the results at the external examination in 2010<sup>24</sup>.

Students after grade 7 can choose to attend from 13 exams, among them Bulgarian Language and Literature (BLL), mathematics and three in natural sciences – biology, chemistry and physics and foreign languages. After the 12<sup>th</sup> grade students have a mandatory examination in BLL and another 13 subjects among which they have to choose one in order to graduate and obtain a diploma. Bearing in mind the nature of ABF investments in Bulgarian schools, BLL, mathematics, sciences, and foreign languages were considered highly relevant.

The idea of the evaluation was to track the performance of the same students in successive external examinations in order to see if students from schools supported by ABF have made more progress. The preliminary examination of results from standardized tests between the 4<sup>th</sup> and the 7<sup>th</sup> grade showed that there were no observable differences between schools supported by ABF and the reference schools. This was predictable bearing in mind that the main focus of

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<sup>22</sup> Jensen, B., Brown, H., Ray, A., Ferrão, M., Haegeland, T., Jakubowski, M. and van de Grift, W. , Jensen, B., (eds.) *Measuring improvement in learning outcomes. Best practice to assess the value-added of schools*, OECD, 2008, p 23.

<sup>23</sup> Jensen et al, 2008, p 4.

<sup>24</sup> A detailed description of value added models can be found in Fielding A, Yang M, Goldstein H. 2003. *Statistical Modelling* vol. 3, 127-153

the ABF program was on the last years of the lower and the upper secondary level. The analysis therefore concentrated on the student progress between the external examination after grade 7 in 2010 and after grade 12 in 2015.

The results from the external evaluation were used for two types of comparisons:

1. Exploratory description and statistical confirmatory analysis of results in 2010 and 2015, i.e. approximately at the beginning and at the end of the period of the ABF interventions, which were to be evaluated;
2. A rigorous regression model for assessing the added value at school level.

The exploratory description and confirmatory analysis is less rigorous than the added value model but still provides statistically validated insights into the effects of the ABF program.

**Assessment of Cognitive and Non-cognitive Skills:** For the purpose of the assessment, we adapted the STEP (Skills to Employability and Productivity) instrument developed by the World Bank<sup>25</sup>.

The cognitive module of the instrument contains 30 questions, which can be divided into four main categories:

- Memory, tested by 12 questions of increasing difficulty;
- Semantics of words and expressions (six questions);
- Semantics of sentences/statements (one question);
- Reading and interpretation of data (10 questions) represented by tables, pictures and graphs.

The Non-cognitive module includes 36 questions on personality scales. Five of them represented the Big Five personality dimensions<sup>26</sup>:

- Extraversion
- Conscientiousness
- Openness to experience
- Emotional stability (opposite of Neuroticism)
- Agreeableness.

Each one of these scales comprised 3 items with the exception of Agreeableness which comprised 2 items. **Self-control** was covered by one item, **Achievement striving** by three items, **Grit** by three items, **Hostile bias** by two items and **Decision making** by 4 items.

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<sup>25</sup> The Skills Towards Employability and Productivity (STEP) program was designed by the World Bank to better understand the interplay between skills on the one hand and employability and productivity on the other. The STEP program developed survey instruments tailored to collect data on skills in low- and middle-income country contexts. Bulgaria was one of the surveyed countries and OSI collected the data for Bulgaria.

<sup>26</sup> Norman, 1963; for review see John and Srivastava, 1999.

Responses to the cognitive and non-cognitive items were analyzed using **factor analysis**, a specific type within the broad set of methods using latent variables. The factor analysis reduces the dimensionality of data by using a combination of the original data to construct a smaller number of factors, which are actually unobservable (latent) variables. One of the main weaknesses of the factor analysis, for which it is often criticized, is the choice of the number of factors to be used. In some of the models of factor analysis this number has to be defined in advance. An alternative is to experiment with a different number of factors and observe several available statistical criteria for the improvement of the underlying model.

The factor analysis uncovers the underlying categorization of the cognitive module. The statistical procedures used in factor analysis do not “know” that there is a suitable grouping of questions into categories which makes sense from an expert point of view. Therefore the fact that factor analysis suggests latent variables that overlap with understandable and well – founded categories like memory and semantics is a good sign for the reliability of the procedure.

We addressed the problem of the definition of the number of factors in the following way. We experimented with an increasing number of factors from 2 to 9 by observing key statistical criteria for improvement of the model. While the model in general kept improving with the increase of the number of factors, four of them remained stable and reappeared even in models involving more factors. These were: 1) the general memory module; 2) the difficult questions from the memory module (roughly these represented the second half of the questions; 3) the semantics module, and 4) the numeric/graph module.

The additional factors that appeared were difficult to interpret theoretically and did not make any distinction between the schools funded by ABF and the rest of the schools. We therefore decided to use the model with four factors, which also delivered a significant improvement compared to the models with 2 and 3 factors.

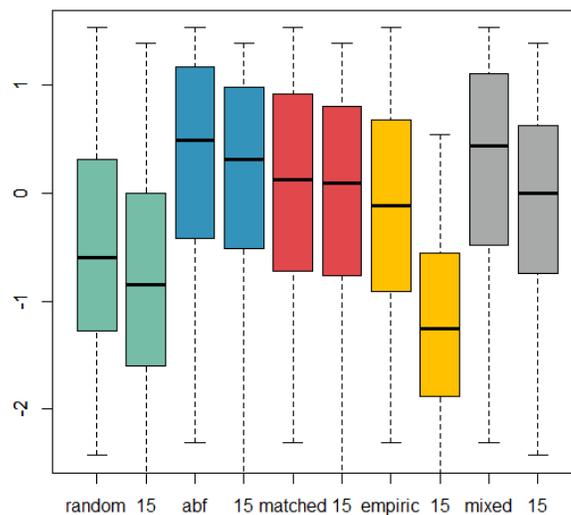
## Annex 2. Students' Achievements

### 1. Performance on external examinations

#### Mathematics

In mathematics we did not find any difference in the added value generated by schools supported by ABF. Most likely this is due mainly to the fact that students in the schools supported by ABF were already very good in mathematics before the project started. The histogram on Fig. 1 shows performance measured in standardized scores in mathematics of students at ABF-supported schools and from schools in all comparison groups at the test in 2010 (after 7<sup>th</sup> grade) and in 2015 (after 12<sup>th</sup> grade). The chart shows that in 2010 the ABF schools were already better than the ones in the comparison groups. In 2015 they preserved the leading position.

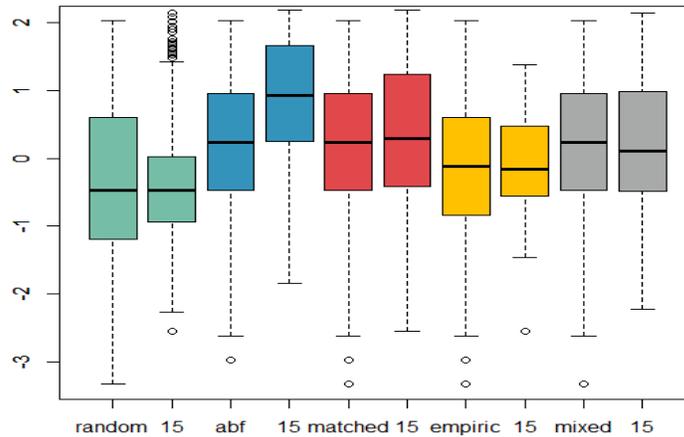
**FIGURE 1. STANDARDIZED TESTS AFTER 7<sup>TH</sup> GRADE IN 2010 AND MATRICULATION EXAMS IN MATHEMATICS IN 2015. "MIXED" IS A MIXTURE BETWEEN MATCHED SCHOOLS AND EMPIRICAL PEERS. ON THE Y-AXIS STANDARDIZED SCORES ARE DISPLAYED. THE FIRST BOXPLOT REPRESENTS THE EXAMS AFTER 7<sup>TH</sup> GRADE IN 2010 AND THE SECOND OF THE SAME COLOR REPRESENTS THE MATRICULATION EXAMS IN 2015.**



#### Natural Sciences

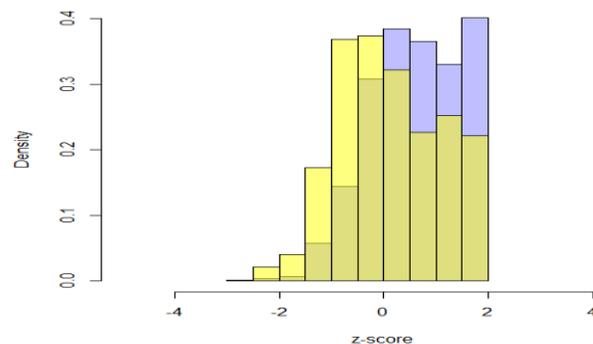
The analysis has also confirmed that students in ABF-supported schools have made a significant progress in natural sciences, which is evident from the distribution of their standardized scores on Fig. 2. The distribution of scores in 2010 (before the program started) has a somewhat bimodal shape, which means that there were two groups of students: a group that was quite good in biology, chemistry and physics and a group that was quite bad. In 2015 the distribution of scores in natural sciences at the schools supported by ABF has changed into one with a lot of strong performers.

**FIGURE 2. STANDARDIZED TESTS AFTER 7TH GRADE IN 2010 AND MATRICULATION EXAMS IN NATURAL SCIENCES IN 2015. "MIXED" IS A MIXTURE BETWEEN MATCHED SCHOOLS AND EMPIRICAL PEERS. THE FIRST BOXPLOT REPRESENTS THE EXAMS AFTER 7TH GRADE IN 2010 AND THE SECOND OF THE SAME COLOR REPRESENTS THE MATRICULATION EXAMS IN 2015.**



We cannot explicitly attribute this positive development to the ABF intervention because those who sit at the matriculation exams in physics, chemistry and biology are the ones who have chosen them (assumably the ones who are good in these subjects). We have to note, however, that in the comparison groups the same bimodal distribution in most cases transformed into a distribution with a lot of poor performers in natural sciences (with a heavy left tail). This pattern is shown on Figure 3.

**FIGURE 3. PERFORMANCE OF STUDENTS IN SCHOOLS SUPPORTED BY ABF ON THE MATRICULATION EXAMS IN NATURAL SCIENCES (BLUE HISTOGRAM) COMPARED WITH THE PERFORMANCE OF THE STUDENTS FROM THE BIG GROUP OF MATCHED SCHOOLS ON THE SAME EXAMS (YELLOW TRANSPARENT HISTOGRAM OVERLAID ON THE OTHER). THE X-AXIS DISPLAYS STANDARDIZED SCORES; THE Y-AXIS DISPLAYS DENSITY ON A SCALE FROM 0 TO 1. THE BLUE HISTOGRAM HAS A HEAVY RIGHT TAIL (MANY GOOD PERFORMERS), WHILE THE YELLOW ONE HAS A HEAVY LEFT TAIL (MANY BAD PERFORMERS).**



## 2. Cognitive skills

Cognitive skills were analyzed using a factor analysis. Schools supported by ABF showed significantly better results in strong memory skills and in practical numeracy skills like reading and understanding graphs, tables, schedules and texts containing numeric information. Positive difference in semantic skills was observed with only one of the comparison groups. We believe that the measurement of cognitive skills delivered through computer interface also captured some IT skills. This means that better performance in memory and numeracy showed by students in schools supported by ABF is due to some extent to their better skills in working on computers.

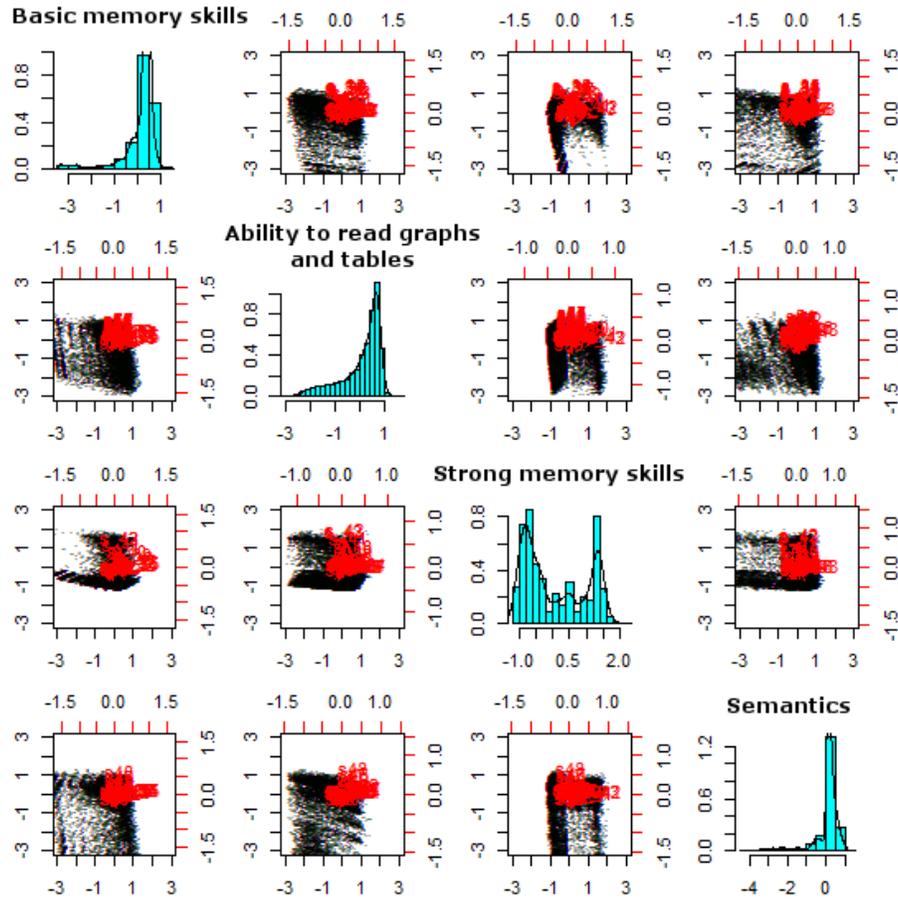
When empirical peers are removed from the model and the ABF schools are compared just to the matched schools using again a model with 4 factors, ABF schools perform better on graphs, the difficult part of the memory test, and (not so strongly) on semantics. Results on semantics are still somewhat better and the difference is valid with a p-value of 0.05, but is not so pronounced as with memory and graphs. In the easier part of the memory test the smaller group of matched schools perform even a bit better, but the difference is very small.

An interesting observation on Fig. 4 is the bimodal distribution of strong memory skills. Top performance in memory divides the set of students into two distinct groups – those who strongly succeed and those who fail. Students from schools supported by ABF are most likely to belong to the category of those who succeed. In the memory section the 6-7 more difficult items behave differently than the 5-6 easier items. The boundary lies somewhere after the fifth or the sixth item. The memory test was designed in a classical way using sequences of numbers of increasing length, which appear for a fixed time and then have to be reproduced by memory. While the time for memorizing was fixed, the time for reproduction of the sequence was not limited.

The issue of memory deserves some further comments. Memory differs from the other cognitive skills. It is considered the most in-born of all cognitive skills, which also means that it is the least malleable. So one may legitimately ask how it is possible that a school modernization program could have influenced memory skills.

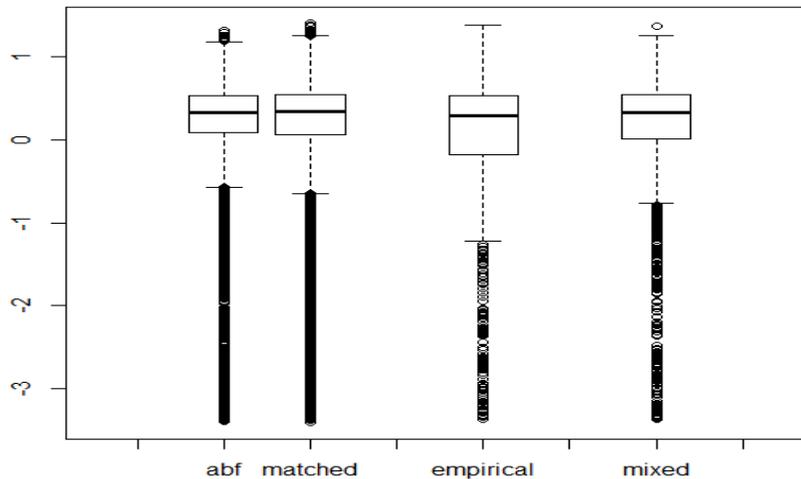
We believe that in our case the memory test has a strong component of IT skills like grasping and understanding information delivered on a computer screen. Like the other questions the memory test was delivered in an electronic form, which means that numbers to be remembered appeared on the computer screen in a matter of seconds depending on the length of the sequence. Ability to “see” quickly information appearing on a screen, which plays an important role in this test, is no doubt a key IT skill.

**FIGURE 4. SCHOOLS SUPPORTED BY ABF COMPARED TO THE LARGE GROUP OF MATCHED SCHOOLS. THE HISTOGRAMS SHOW THE DISTRIBUTION OF SCORES ON EACH FACTOR. THE DOT PLOTS SHOW THE POSITION OF SCHOOLS SUPPORTED BY ABF (RED DOTS) RELATIVE TO THE SCHOOLS FROM THE BIG GROUP OF MATCHED SCHOOLS (BLACK DOTS) ON A TWO-DIMENSIONAL PLANE FOR EACH PAIR OF FACTORS. THE DOTS REPRESENTING SCHOOLS SUPPORTED BY ABF ARE RATHER CLUSTERED RELATIVE TO THE LARGE SET OF BLACK DOTS, WHICH IS A SIGN OF POTENTIAL DIFFERENCES ON THE CORRESPONDING FACTORS.**



The six easiest memory items are actually so accessible to most of the people that performance on those items is indicative more of their motivation to answer the test than of the power of their memory. So it may be taken to represent a non-observable non-cognitive skill and it makes sense to put those memory items together with items measuring non-cognitive skills. We actually did this experiment but the six items remained in their own group as a separate factor, clearly distinct from non-cognitive skills. In general on the ordinary memory skills (the easy part of the memory test) schools supported by ABF do not differ from the matched schools.

**FIGURE 5. BASIC MEMORY SKILLS. THERE IS NO DIFFERENCE BETWEEN THE SCHOOLS FUNDED BY ABF (ABF) AND THE MATCHED SCHOOLS (MATCHED). THE EMPIRICAL PEERS (EMPIRICAL) PERFORM WORSE, ESPECIALLY AMONG POOR PERFORMERS, I.E. THE 25<sup>TH</sup> PERCENTILE (THE LOWER BOUNDARY OF THE BOX) IS SIGNIFICANTLY LOWER THAN AMONG THE SCHOOLS SUPPORTED BY ABF AND THE MATCHED SCHOOLS.**



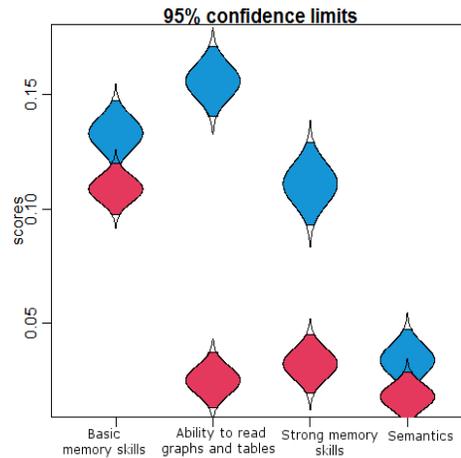
On factor number 3, which has a strong semantic component the ABF schools perform better than the empirical peers but no better than the two groups of matched schools. As far as cognitive skills are concerned the empirical peers seem to be a bad match for the schools supported by ABF. The difference on certain indicators is so large that it is not plausible to attribute it solely to the support provided by ABF. This means that somehow the ABF staff was able to sense which schools are most likely to succeed. This does not exclude some contribution to the difference in results of the ABF support but it cannot be disentangled from the difference between those schools which was apparently present before the ABF program started.

Factor number 4 is composed mostly of the ability to read graphs, tables and other numeric information but includes also some semantic skills though with lower weights. The schools supported by ABF perform better than all other groups. The difference is statistically significant at  $\alpha = 0.05$ . Apparently the use of IT and the participatory process of learning which evolved in some of the schools supported by ABF were conducive to the development of practical skills in the field of numeracy. The ability to link theoretic knowledge obtained at school to the solution of practical problems is among the main deficits of the Bulgarian school education. This is reflected in the comparatively bad results of Bulgarian students in international programs for student assessment such as PISA.

Figure 6 summarizes the results from the assessment of cognitive skills on all 4 factors. We show

only the comparison with the large group of matched schools. The comparison with the small group of matched schools produces similar results, while empirical peers perform in general much worse.

**FIGURE 6. CONFIDENCE INTERVALS OF SCORES ON ALL 4 FACTORS COMPARING SCHOOLS FUNDED BY ABF AND THE LARGE GROUP OF MATCHED SCHOOLS. THE DIFFERENCES ON STRONG MEMORY SKILLS (FACTOR 2) AND GRAPH AND TABLE READING (FACTOR 4) ARE VERY LARGE. CONFIDENCE INTERVALS OF SCHOOLS SUPPORTED BY ABF ARE MARKED IN BLUE.**



### 3. Non-cognitive skills

Non-cognitive skills displayed some differences between schools supported by ABF and two of the comparison groups. Students in schools where the ABF program was implemented have less hostile bias and better personal characteristics on a range of scales, including decision making, conscientiousness, grit, achievement striving and openness to experience. With the small group of matched schools we did not find any differences in non-cognitive skills.

After the analysis the non-cognitive skills were also grouped in 4 unobservable factors.

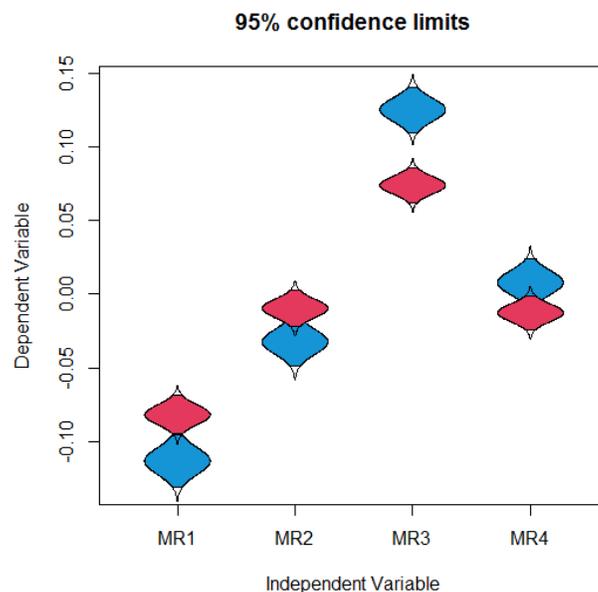
Factor 1 includes almost all items but most heavily decision making which participates with all four items, conscientiousness, grit, achievement striving and openness to experience which participate with 2 out of 3 items each. Agreeableness and extroversion are represented with one item each and fixed mindset is represented strongly with a total of five items. It should be noted however that three of the items belonging to the fixed/growth mindset scale which load into the factor overlap with achievement striving and behave somewhat differently than the other items. Higher scores on this factor indicate bad performance on all included items and scales. The persons who score high are rather careless and inconsiderate for others when making decisions, lack perseverance in their endeavors (the grid items) are not striving for achievement are not interested in learning new things and have more of a fixed than a growth mindset. On this factor using 95% confidence limits there is a statistically significant difference between the schools supported by ABF and the 17 empirical peers but no such difference is observed with the large group of matched schools. There is no difference with the small group of matched peers either.

Factor 2 is almost entirely composed of items belonging to the Dweck's fixed mindset scale mixed with some items from the emotional stability (neuroticism) scale. Using 95% confidence limits we did not discover any difference on the fixed/growth mindset scale between the schools supported by ABF and any of the other groups.

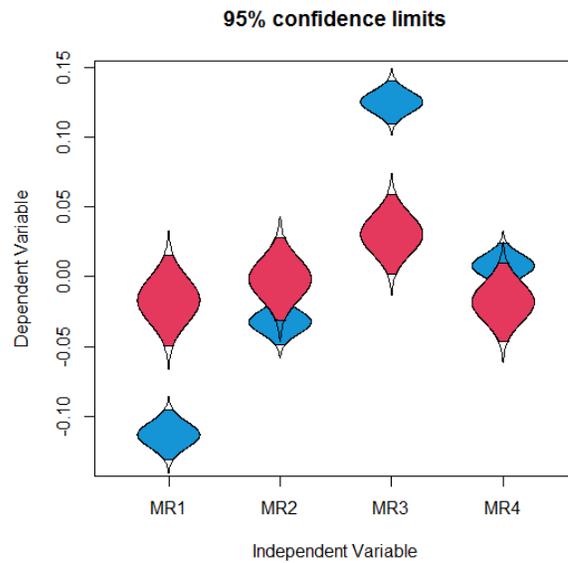
Factor 3 includes strongly the items on hostile bias and some items from the Dweck's scale, emotional stability and some others with minor importance. Students who are strong on this factor do not have a hostile bias to others, have some elements of a growth mindset but are a bit emotionally unstable (neurotic) but emotional instability does not play a major role in the factor. Students from schools supported by the ABF have high scores on this factor compared to the comparison groups of empirical peers and the matched schools. This means that they are less likely to display hostile bias to others, i.e. they have a more positive perception of others. They are also a bit more emotionally unstable, which is actually a common characteristic of better performing students with higher ambition who experience pressure from their peers, teachers and their parents to show constant good performance.

Factor 4 includes items from the extroversion scale, the emotional stability scale and self-control. Persons who are strong on this scale are emotionally stable, introvert and with a strong self-control. At 95% confidence limits no significant differences were found on this factor between the schools funded by ABF, the empirical peers or the matched schools. Results are summarized on the two charts below.

**FIGURE 7. CONFIDENCE LIMITS FOR THE 4 FACTORS IN NON-COGNITIVE SKILLS. THE COMPARISON IS BETWEEN THE SCHOOLS SUPPORTED BY ABF AND THE LARGE GROUP OF MATCHED SCHOOLS. THE ONLY OBSERVABLE DIFFERENCE AT A P-VALUE OF LESS THAN 0.05 IS ON FACTOR 3 (N HOSTILE BIAS, EMOTIONAL STABILITY AND SOME CHARACTERISTICS OF A GROWTH MINDSET).**



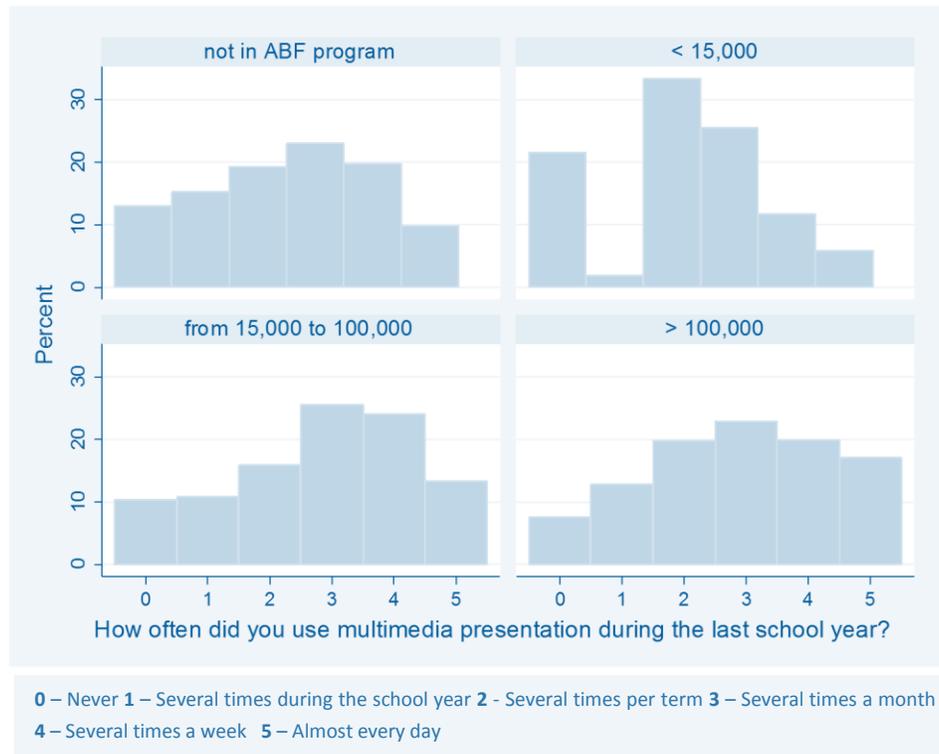
**FIGURE 8. CONFIDENCE LIMITS FOR THE 4 FACTORS IN NON-COGNITIVE SKILLS. THE COMPARISON IS BETWEEN THE SCHOOLS SUPPORTED BY ABF AND THE EMPIRICAL PEERS. STATISTICALLY SIGNIFICANT DIFFERENCES AT ALPHA = 0.05 ARE OBSERVED ON FACTOR 3 (N HOSTILE BIAS, EMOTIONAL STABILITY AND SOME CHARACTERISTICS OF A GROWTH MINDSET) AND FACTOR 1 (A COMPLEX FACTOR INCLUDING MANY ITEMS FROM THE BIG FIVE AND OTHERS). NOTE! HIGH SCORES ON FACTOR 1 MEAN POOR SKILLS AND NEGATIVE PERSONAL RATES.**



### Annex 3. Schools Making the Most of ABF Program

The size of funding can be an important determinant of different developments at school. The size of funding overlaps with other school characteristics like the number of students and location in urban or rural areas: up to 15 thousand leva; from 15 thousand to 100 thousand leva and more than 100 thousand leva. Figure 1 shows that multimedia is used less in schools that got funding of less than 15,000 leva. The same is true for other pieces of equipment.

FIGURE 1. USE OF MULTIMEDIA BY THE SIZE OF ABF FUNDING.



The same difference can be found between bigger and smaller schools when we ask students to assess the availability of computers and technical equipment in their schools. Students in bigger schools among those funded by ABF are more likely to say that computers and other pieces of technical equipment are sufficient in their schools.

The opinions shared by teachers confirm the conclusion that for smaller schools in less urbanized settlements low investment in real assets and equipment is a serious issue. Teachers in rural schools more often say that the building and rooms of their school are in need of repair.

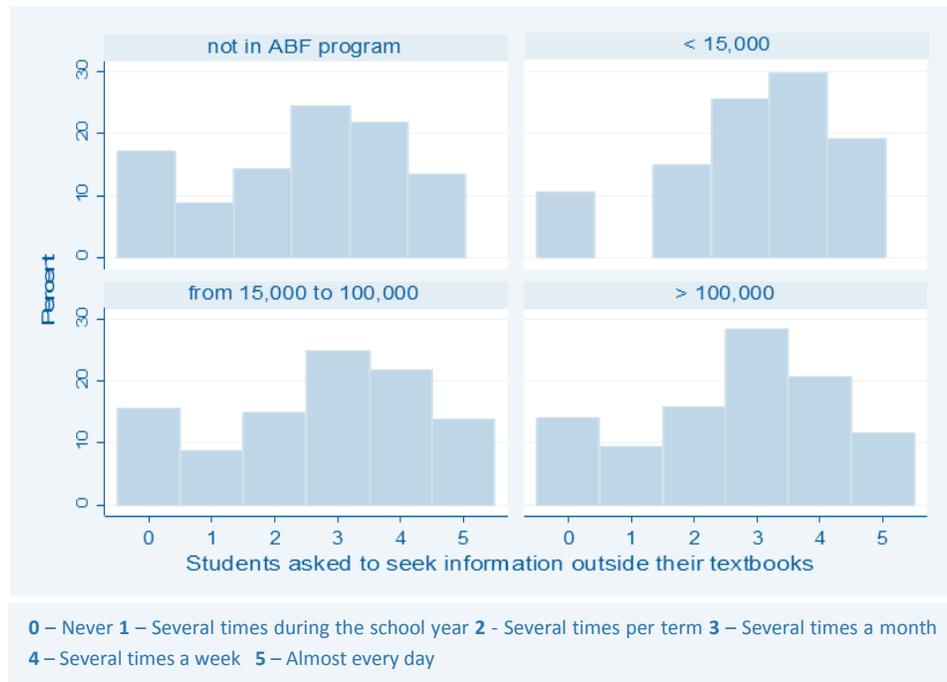
FIGURE 2. SCHOOL BUILDINGS AND ROOMS IN NEED OF REPAIR ACCORDING TO TEACHERS BY THE LEVEL OF URBANITY



As can be seen from the chart above (Fig. 2) school buildings and rooms in village schools are more often reported by teachers to be in need of repair. The situation depicted in this picture comes after the ABF investment. These data can be interpreted as follows. Most of the school improvement programs including the ABF program invest in schools in proportion to the number of their students. Such approach works very well with pieces of equipment for individual use such as computers. It works less well, but still well enough when premises such as laboratories are concerned. It creates a very inequitable situation when buildings are concerned. Repairing a building for 50 students does not cost 20 times less than repairing a building for one thousand students. It can cost three times or five times less but not 20 times less. This means that small schools may experience more challenges in funding the refurbishment of their buildings and rooms.

But it seems that smaller schools and rural schools in general are more open to pedagogical experiments and various flexible approaches. For example such schools provide more encouragement to their students to seek information outside of textbooks (see Fig. 3). Every second student from schools with the smallest funding is encouraged to look for information outside textbooks at least several times a week, compared to 30% in schools who got the largest funding.

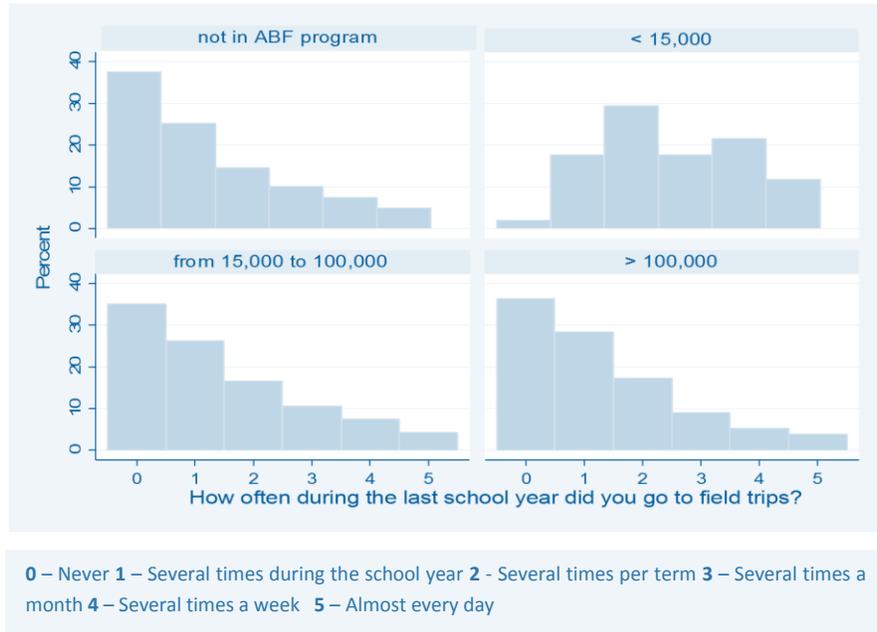
FIGURE 3. SEEKING INFORMATION IN SOURCES DIFFERENT THAN TEXTBOOKS BY THE SIZE OF ABF FUNDING



Work of students in small groups is another sign of breaking with traditional pedagogy based on the assessment of individual performance, especially of students in lower and upper secondary school. Schools that got less funding have more work in small groups. In general work in small groups in Bulgarian education is not widely used. We can summarize that schools which got less funding seem more open to more student centered methods of teaching and to innovative methods of organizing student work.

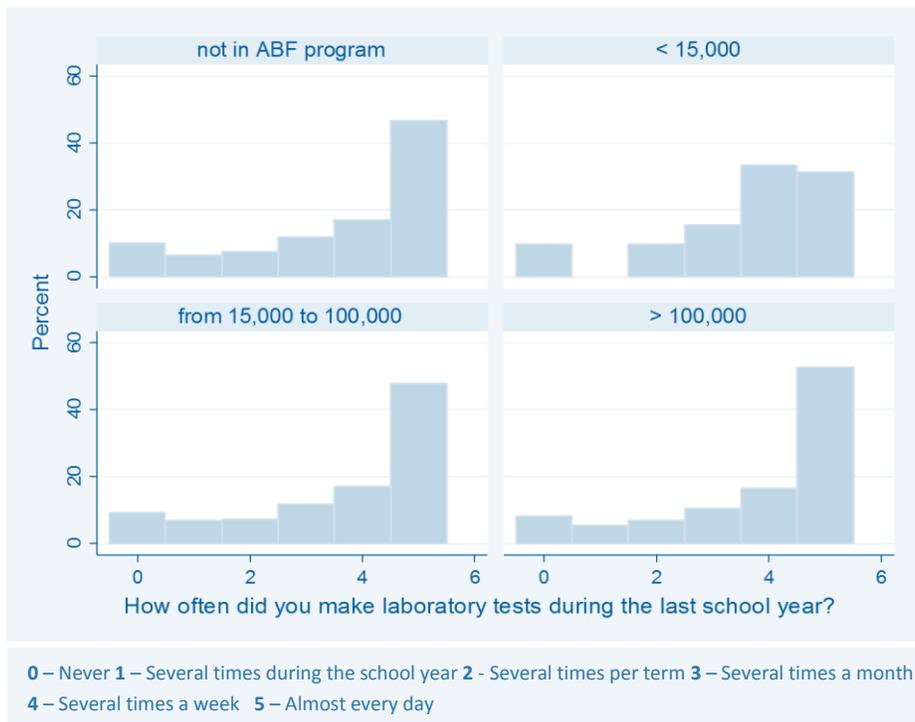
Field trips, i.e. leaving the school to visit other places, organizations etc. are also a sign of moving to a more open curriculum with more freedom to determine content and the pace of learning. The next chart shows that schools that got less funding are actually organizing more field trips. Almost none of the students in the category of schools with the smallest funding never had a field trip while almost 40% of students in schools with the highest funding never had a field trip. Again it should be noted that this pattern is probably not related directly to the ABF funding but to the size and location of the schools, but it does show that schools, which hitherto occupied a small portion of the overall program can be actually quite flexible and display some important prerequisites for innovation.

**FIGURE 4. GOING OUT OF SCHOOL FOR FIELD TRIPS (OUT-OF-SCHOOL ACTIVITIES) BY THE SIZE OF ABF FUNDING**



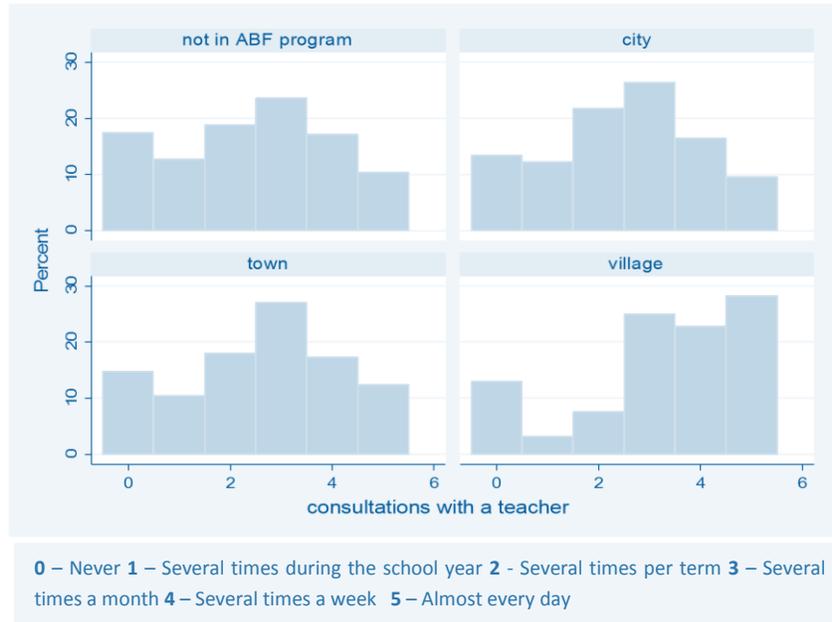
A different picture emerges when we look at laboratory tests. This is a setting which requires some substantial investment in equipment and generates also significant operational costs for materials and consumables. It does not come as a surprise that schools in the category with smallest funding are less able to involve their students in laboratory tests (see Fig. 5 below).

**FIGURE 5. PARTICIPATION OF STUDENTS IN LABORATORY TESTS BY THE SIZE OF ABF FUNDING**



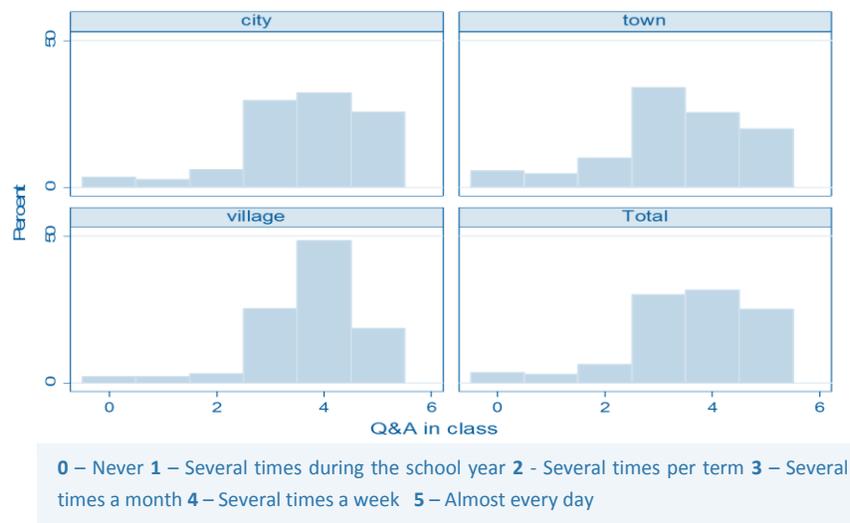
A very clear difference between schools from all these categories according to the location emerges when accessibility of teachers is concerned. From the chart it is evident that students in village schools report much more opportunities to have consultations with their teachers. Towns come next with a large margin behind villages and with a small margin ahead of cities. Again this is indicative that a lot of additional value can be generated in schools that got less funding if they are prioritized.

**FIGURE 6. CONSULTATIONS WITH A TEACHER IN HER OFFICE HOURS BY THE LEVEL OF URBANITY**



The same pattern emerged when students were asked about the opportunity to have questions and answers in class. In village schools students have more interactive classes than their counterparts in towns and cities.

**FIGURE 7. QUESTIONS AND ANSWERS IN CLASS BY THE LEVEL OF URBANITY.**



In general however there is a significant difference in the overall satisfaction of students with their school, which is not in favor of schools which got less funding. Students who study in schools that got less funding are less likely to say that they are glad to study in their school. Willingness to stay in the same school and reported satisfaction from the choice of a school both represent a very reliable measure of student and parent attachment to the school. There can be many reasons why smaller schools away from the big cities may not be so attractive to students. Firstly, students and their parents often did not have a choice because there were no other suitable schools or any other school nearby. Secondly, these schools are often perceived as less “prestigious” within the Bulgarian education system which is very elitist. Finally, there are real disadvantages of smaller and remoter schools in terms of access to resources, so they really often provide an overall learning environment of poorer quality.

FIGURE 8. HAPPY WITH THE SCHOOL BY THE SIZE OF FUNDING PROVIDED BY ABF



## Annex 4. A typical working day

Usually in a typical working day how much time (in astronomic minutes and hours) have you spent performing the following activities? – average per school groups (the teaching time excluded e)

	<i>Planning and preparing lessons at or outside school on your own</i>	<i>Joint work and discussion with colleagues at school</i>	<i>Checking/ marking students' work</i>	<i>General administrative work (including verbal, written and other activities you do as a teacher)</i>	<i>Counseling students (e.g. vocational guidance)</i>	<i>Participation in the school's management</i>	<i>Contacts and cooperation with parents/guardians</i>	<i>Participation in extracurricular activities (e.g. sports or cultural events)</i>	<i>Studying computer programs</i>	<i>Using the Internet to prepare lessons at or outside school</i>	<i>Other activities</i>
ABF	01:38	00:28	01:30	00:58	00:28	00:11	00:26	00:24	00:19	00:55	00:31
Empirical peers	01:49	00:34	01:31	01:12	00:32	00:17	00:30	00:22	00:20	00:59	00:26
Big group of matched schools	01:44	00:32	01:34	01:07	00:33	00:14	00:30	00:28	00:20	00:57	00:24
Randomly selected group of schools	01:40	00:37	01:26	01:16	00:40	00:17	00:33	00:30	00:21	00:56	00:27
ABF (time distribution)	20,9%	6,0%	19,2%	12,3%	6,1%	2,4%	5,6%	5,1%	4,2%	11,7%	6,6%
Empirical peers (time distribution)	21,2%	6,6%	17,7%	14,0%	6,2%	3,4%	5,9%	4,4%	3,9%	11,4%	5,1%
Big group of matched schools (time distribution)	20,6%	6,4%	18,6%	13,2%	6,7%	2,8%	6,0%	5,6%	4,1%	11,3%	4,8%
Randomly selected group of schools (time distribution)	19,1%	7,0%	16,4%	14,4%	7,6%	3,3%	6,3%	5,8%	4,2%	10,6%	5,1%
Share of time of the teachers in ABF schools as % of the time of teachers in smallest comparison group (Empirical peers)	90%	83%	99%	80%	89%	65%	86%	105%	98%	94%	118%

Share of time of the teachers in ABF schools as % of the time of teachers in largest comparison group (Big group of matched schools)	94%	87%	96%	87%	85%	81%	86%	85%	95%	96%	127%
Share of time of the teachers in ABF schools as % of the time of teachers in randomly selected schools (Randomly selected group of schools)	98%	76%	105%	77%	71%	65%	79%	79%	90%	99%	115%

## Annex 5. School Assets

School assets (Data from School Principals – Quantitative Survey 43 schools)

	Interactive boards	Multimedia Projectors	Desktop Computers	Laptops	Tablets	Desktop Computers with internet connection	Printers	Microscopes	Paid subscriptions for access to websites/libraries	Books in the library - total	Books received in the library in the last 12 months
assets from the ABF project	128	143	365	472	210	372	34	136	3	709	538
share of ABF project assets	48,5%	19,6%	15,6%	30,4%	57,4%	16,2%	6,4%	37,1%	3,1%	0,2%	9,6%
students per unit of assets from the ABF project	265,45	237,61	93,09	71,99	161,80	91,34	999,34	249,84	11325,88	47,92	63,16
ABF Schools total assets	264	730	2335	1553	366	2297	528	367	98	399505	5632
ABF Schools students per unit of assets	128,70	46,54	14,55	21,88	92,84	14,79	64,35	92,58	346,71	0,09	6,03

Comparative Analysis of School assets (Data from School Principals – Quantitative Survey all schools) – after completion of ABF program

	Interactive boards	Multimedia Projectors	Desktop Computers	Laptops	Tablets	Desktop Computers with internet connection	Printers	Microscopes	Paid subscriptions for access to websites/libraries	Books in the library - total	Books received in the library in the last 12 months
<b>ABF Schools total assets</b>	264	730	2335	1553	366	2297	528	367	98	399505	5632
<b>ABF Schools students per unit of assets</b>	128,70	46,54	14,55	21,88	92,84	14,79	64,35	92,58	346,71	0,09	6,03
<b>Empirical peers total assets</b>	61	204	654	364	91	642	139	106	17	91224	1164
<b>Empirical peers students per unit of assets</b>	207,81	62,14	19,38	34,82	139,30	19,74	91,20	119,59	745,66	0,14	10,89
<b>Big group of matched schools total assets</b>	275	1332	5145	2850	575	4639	1005	660	110	683726	9403
<b>Big group of matched schools students per unit of assets</b>	302,66	62,49	16,18	29,20	144,75	17,94	82,82	126,11	756,66	0,12	8,85
<b>Randomly selected group of schools total assets</b>	158	568	3235	1076	184	2959	782	471	60	423395	3896

Randomly selected group of schools students per unit of assets	260,40	72,43	12,72	38,24	223,60	13,90	52,61	87,35	685,71	0,10	10,56
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**Comparative Analysis of School assets (Data from School Principals – Quantitative Survey all schools) – without implementation of ABF program**

	Interactive boards	Multimedia Projectors	Desktop Computers	Laptops	Tablets	Desktop Computers with internet connection	Printers	Microscopes	Paid subscriptions for access to websites/libraries	Books in the library - total	Books received in the library in the last 12 months
ABF Schools total assets	136	587	1970	1081	156	1925	494	231	95	398796	5094
ABF Schools students per unit of assets	249,84	57,88	17,25	31,43	217,81	17,65	68,78	147,09	357,66	0,09	6,67
Empirical peers total assets	61	204	654	364	91	642	139	106	17	91224	1164
Empirical peers students per unit of assets	207,81	62,14	19,38	34,82	139,30	19,74	91,20	119,59	745,66	0,14	10,89
Big group of matched schools total assets	275	1332	5145	2850	575	4639	1005	660	110	683726	9403

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<b>Randomly selected group of schools students per unit of assets</b>	260,40	72,43	12,72	38,24	223,60	13,90	52,61	87,35	685,71	0,10	10,56