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Networked Virtual School - beyond OER and MOOC

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Abstract

In the article there are presented genesis, basic assumptions and pedagogical results of IT School Program based on personalized IT virtual learning system (PITLS) designed and implemented for secondary school students and teachers in Poland, run from November 2012 by Warsaw School of Computer Science.

Author explains the aims of the Program, its theoretical key layouts such as usefulness, partnership, networked learning environment, diversified and high professional level of materials, interactivity mechanisms, personalization mechanisms, built-in incentive mechanisms, and automation of selected elements of the educational process and system data analysis. Some examples of the virtual educational tools and techniques used within the Program are presented. Great emphasis is put to explain the pedagogical and statistical results of the Program based on author's own research surveys done within three years of Program duration on population of teachers and students taking part in IT School Program and on the basis of big data analysis results generated by PITLS. Computer assisted web interview (CAWI) research method was used as the main source of getting research material to be analyzed. Finally the main future directions of IT School Program development are shortly discussed.

In conclusions author will among others try to answer the question what is the reason of the phenomena that almost 70 000 students from over 500 secondary schools registered in the Program within 2,5 years since its starting and have performed altogether almost 400 000 online courses and how it corresponds to achieving pedagogical aims of the Program.

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The openness of the program places it within Open Educational Recourses ideas, massive number of participants involved and number of courses performed resembles MOOCs. But the Program has a unique networked virtual organization (NVO) structure, thus it is rather Networked Virtual School (NVS), which has characteristics going beyond what is described today as OER or MOOC. Although no formal comparison study is made, one of the aims of the paper is to prove that NVS is much more effective in achieving expected pedagogical results then OERs and MOOCs.

Keywords **–** innovation, IT education- secondary level, OER, MOOC, Networked Virtual School

> "The invention of the automobile and the airplane did not come from a detailed study of how their predecessors, such as horse-drawn carriages, worked or did not work. Yet, this is the model for contemporary educational research. The standard paradigms for education research take the existing classroom or extracurricular culture as the primary object of study, but the real question, one might say, is whether we can invent the – educational automobile".
>
> Seymour Papert

1 Introduction – ICT and New Educational Paradigms

Nigel Willetts linked information technology to the technology of building roads saying that when you come face to face with a rolling road technology you must decide to take the operator role or become part of the road! [1]. ICT has become undoubtedly a kind of rolling machine serving the construction and development of modern societies. Education is also taking part in this process and ICT is playing the role of a machine enhancing children's development while learning, when used properly. Therefore, using ICT in education especially of children and youth, one must take caution and prudence that they will became aware technology operators knowing how to make best of it and how to avoid the risks and threats that it can bring.

ICT is the powerful tool that changes business, industry, communication, healthcare and many others including education, so many scientists indicate the necessity to define new objectives of modern education of children and youth and to change the paradigms of education, which is the result of disruptive technological change. Anthony Duisburg described the process of changing educational purposes as a transition from

literacy and numeracy (three "R") to learning critical thinking, communication, collaboration and creativity (four C) [2]. There are attempts of a new interpretation of Bloom's taxonomy of educational objectives in the era of digitalization of the learning process [3].

Everybody agrees that ICT plays a very important role in changing traditional educational systems from proving performance oriented classrooms into personalized (networked) learning environments oriented on improving learning as described by Chris Watkins [4].

Table 1. Proving Performance vs. ImProving Learning. Source: [5].

Traditional Classroom (Proving – Performance Orientation)	**Personalized Learning Environment (Improving – Learning Orientation)**
Teacher-centered	Learner-centered
Learners follow instructions	Learners actively participate in learning
Goal is correct answer	Goal is for deeper understanding
Whole class lesson with learners working alone	Learning happens individually, in pairs, in threes and in groups
Teacher gives time to answer questions	Message is on improvement with a focus on effort
Learners focus on tests and grades	Performance linked to effort and progress

Also other authors appreciate the important role of ICT in changing of educational landscape. Barbara Bray and Kathleen McClaskey develop the idea of personalized learning which according to them is a controversial term that means different things to different people depending on where and how it is referenced. Some educators believe it is the alternative to "one size fits all" instruction where others promote programs or tools that personalize learning for you and others emphasize that "learning starts with the learner", also stress that "technology is moving the idea of 'personalized' forward everywhere we look" [6].

The very important factor which can accelerate changing the educational systems into personalized ones apart technology itself, is young peoples' attitude to new technologies. Tamar Lewin headlined her article in the "New York Times" [7] – after discussing the results of the report – *Generation M2: Media in the Lives of 8 - to 18-*

Year-Olds [8]. When we look at the results of the report it looks as new media consume most of children's free time. Sometimes they balance on the borders of addiction as the research shows. In the past children used blackboard chalk for playing hopscotch, nowadays they use computers for plenty of different activities, not only for playing one game.

Table 2. How you spend your time on the Internet – specify the frequency. Source: [9], [10]. Number of respondents who answered this question: respectively 824, 289.

Activity	Very often		Often		Not very often		Never	
	2013 %	2014 %	2013 %	2014 %	2013 %	2014 %	2013 %	2014 %
I browse social networking Sites	51,46	48,44	29,61	32,87	11,29	11,42	7,04	7,27
Checking e-mails	38,71	23,88	42,11	32,22	18,20	39,45	0,36	3,46
Talking with friends	51,70	31,83	31,19	33,91	14,32	28,03	1,70	6,23
I play games	17,60	29,41	20,63	21,45	42,48	35,99	17,48	13,15
Look at online stores, Auctions	11,29	13,49	37,38	32,18	42,96	42,21	6,43	12,11
I learn using educational recourses in the net	8,37	28,72	25,36	47,06	50,73	21,45	13,35	2,77
Using the resources of the portal IT School	4,25	11,07	22,45	34,26	47,94	43,25	22,69	11,42
I'm looking for entertainment content, music	52,91	51,90	36,41	38,75	6,92	8,30	1,09	1,04
Browse news	24,15	32,53	41,63	42,21	27,18	21,45	4,37	3,81

Many reports concerning the importance of the new media in the lives of children and young people when they are online, show significant role they play in shaping perceptions of all aspects of the world around them, also on education. Results presented in table 2 show the frequency of chosen activities done in internet by IT School students, giving an idea of time they take in their life but also of their priorities in using internet.

The indexes of over 80 % very often and often activities done in internet for all students are assigned to: looking on social networking sites (81,07%), checking e-mails (80,82%), talking with friends (82,89%), and looking for entertainment content, music (89,32%). In two consecutive surveys there are two distinctive trends one is

raise of percentage of students who very often play games (up by 11,8%) and of students who very often and often use educational recourses in Internet while learning (up by 42,9%!) Internet becomes whether we want it or not every day educational children's educational assistant. The above values correspond to Cisco Report [11] results of more general nature according to which for 78% of students the primary way of getting information and news are laptop, computer, smart phone and tablet, 81 % of students consider the internet as important or almost as important to their life as water, food, air, and shelter and most important technology in daily life for 83% of students are laptop, computer, smart phone and tablet.

2 Genesis of IT School Program

The way to IT School Program was probably similar to those experienced by many other universities in the world, starting from OER in the beginning and then going on to more sophisticated educational tools. For Martinez OER has to be part of the Universities' social mission. He says that universities are not isolated islands, or, at least, they shouldn't be. They are part of a big framework and this framework is the one that has to benefit from using OER. Universities have to commit themselves to provide support to the society, and the best way to achieve this is by making the access to a good education easier for everybody [12].

The very initial idea of the IT School Program was born when over ten years ago (2004) Warsaw School of Computer Science (WSCS) launched Polish Open Computer Science Online Academia (POCSOA) [13], with the support of 15 best Polish Universities. In result over 30 excellent Computer Science video lectures were produced for open public, mostly addressed to computer science students and academic lecturers. Watched by thousands of viewers it was (and still is) a form of internet open recourse, having very limited possibilities of interaction (viewers can only evaluate lectures, giving the opinion on their quality after watching).

Next step (2009) towards IT School Program, sometime before MOOCs were shown by American consortia, was Informatics Plus project supported by EU funds launched and run for four years (till 2012) by Warsaw School of Computer Science. IT was serving over 20 000 students and teachers from 300 Polish secondary schools. Its main aim was to improve secondary schools students' e-skills. To achieve this result among others there were prepared high quality materials: 150-20 hrs IT courses and 100-1,5 hrs lectures authorized by 100 distinguished academic professors from top 10 Polish universities. Also over hundred of written (electronic) scripts were produced and video recordings as well. This program we could call first Massive Open Course type, but not online, the biggest of such type in IT and secondary schools area in Poland

ever. From the point of view of IT School Program one of the most important Informatics Plus project results was research made in the population of the secondary school teachers before starting the program (2010), trying to find out what are the most missing areas (subjects) to be covered by the program, not represented sufficiently in the nationwide computer science curricula.

To identify areas of computer science, which were represented in the curriculum insufficiently, in the opinion of the teachers they were asked the following question "What subjects and areas represented in the framework of national curriculum would you like to provide students more broadly, especially in the context of extracurricular forms of education?". The teachers' for and against subjects to be more broadly represented were: algorithmic and programming: 155 – YES, 69 – NO, databases: YES – 132, NO – 92, multimedia, graphics, web technologies: YES – 170, NO – 54, Computer Networks: YES – 138, NO – 86, trends in the development of computer science and its applications: Yes – 70, No – 154.

As indicated in the results of the survey, these have been the subjects considered by the vast majority of teachers as not sufficiently represented in the curriculum, which pointed to the need to broaden their (teachers and students) knowledge in the field of these areas. The most needed support expected by teachers were found in the areas: "Multimedia, Graphics, Internet technologies", followed by "Algorithms and programming" [12]. Especially the algorithms and programming mentioned by teachers caused many doubts about how students can learn informatics properly not having sufficient recourses to learn fundamental concepts of computer science.

Finally, basing on experience gained in two projects mentioned above, IT School Program was launched in November 2012, as neither OER nor MOOC. It was planned to go beyond these e-learning concepts trying to construct new quality of Networked Virtual School which is to some extent similar to "Networked Common School", introduced by Leonard J. Walks [15].

3 IT School Program aims, organization and main assumptions

The main pedagogical objective of the Program is to increase the level of ICT competences (e-skills) of all secondary schools' students registered in the program. Other aims are: popularize basic knowledge of computer technology to those who are not interested in ICT, encourage and prepare young people to study in the field of Information Technologies and thus facilitate the study of the core courses in Universities, give the teachers tools for individualized learning with ICT talented students. The Program is addressed also to these (secondary and non-secondary school users) who want to improve their labor market "attractiveness" by obtaining

the e-skills confirmed by WSCS accreditation or simply for self-studies as a form a non-formal learning.

From the organizational point of view IT School resembles the regional network of secondary schools which may also be defined in a larger sense as a networked school of schools or common networked school, a virtual counterpart of a multi-campus state university. The regional network as a virtual organization has its own organizational identity but also provides a larger organizational context for local school 'branch campuses' with identities of their own [15]. The IT School organizational structure is a very flat one consisting of teachers (called coordinators of the program) and their students representing the secondary schools registered in the Program. Warsaw School of Computer Science role is integrating and innovating one, mostly from content (materials) and technical (virtual platform)point of view. But surely IT School has its own organizational identity visualized in IT School brand mark and represented by huge students and teachers community.

Leaving aside discussions on contemporary educational theories connected with IT technologies such as constructionism, connectivism, cognitive apprenticeship, learning in collaboration, learning in partnership and learning in a situation [16], [17], in this paper I will concentrate on presenting pragmatic approach to the learning process and its results taking as the basis of IT School educational concept such ideas as usefulness, partnership, networked learning environment, diversified and high professional level of materials (content), built into the system interactivity mechanisms, personalization of education, built-in incentive mechanisms (individual and team), and automatization of selected elements of the educational process, management and system analysis (big data).

4 Evaluation of assumptions of the IT School Program

To evaluate conceptual assumptions of the Program and its pedagogical effects the CAWI (computer assisted web interview) research methodology was applied. The teachers who had 20 or more students assigned were interviewed each year. The research sample and returned answers ratio in three surveys was as follows in table 3.

Additionally to supplement the information received from teachers' CAWI some data from students' CAWI are used. Also data from Google analytics and IT School PITLS system are included to present some statistical results of the Program.

Table 3. Research sample and returned answers ratio in teachers' CAWI. Source: [9], [10], [18].

Year	**2013**	**2014**	**2015**
Sample (number of teachers)	204	210	224
Number of answers received	137	84	124
Percentage of received answers	67,1	40,0	55,3

To make sure that application of the concept of usefulness of the program for beneficiaries will be as accurate as possible a research survey asking the teachers, what they and their students need most to support computer science teaching/ learning was done before starting the Program [14]. Ex post usefulness of the Program was evaluated by getting teachers opinion on content offered to the students after each year of Program.

Table 4. Is content offered to the students by IT School Program useful? Source: [9], [10], number of respondents who answered this question: 2013 – 137, 2014 – 84.

Answer	**Number of answers**		**%**	
	2013	**2014**	**2013**	**2014**
Definitely yes	81	61	59.12	72,62
Yes	55	23	40.15	27,38
Rather not	1	-	0.73	-
Definitely not	-	-	-	-

The high percentage of positive results obtained confirmed very well performed consultancy stage, in the first part of the project. Participation of teachers in establishing the areas and materials process gave excellent results.

Table 5. How often do you use educational resources of IT School Program in classes with your students? Source: [18], the number of respondents who answered this question: 124.

Answer	**%**	**Number of answers**
More than 3-4 times per month	26,61	33
About 3-4 times per month	17,74	22
About 1-2 times per month	34,68	43
Less than once a month	20,97	26

To confirm usefulness of the program in a survey from 2015, the teachers were asked also about the frequency of using IT School resources during classroom lessons.

The above results show that over 50% of teachers use the resources almost on every computer science lesson each month, giving a clear evidence that IT School Program is very useful for teachers and students. The usefulness of the program is also expressed by massive participation in the program and its different activities, by the students and teachers (table 6).

Table 6. IT School – chosen statistics. Source: [9], [10], [18].

IT School data	**2012/2013**	**2013/2014**	**2014/2015**	**2012-2015**
Number of registered Schools	385	73	72	530
Number of registered users	24173	20190	21867	66230
Number of registered Coordinators	672	386	287	1345
Number of courses performed	66902	193498	188858	449258
Number of tests performed	138164	408582	271065	817811
Number of competitions' participants	538	2600	3419	6557
Number of page views*	3 030 565	7 049 921	9 275 214	19 355 700
Number of unique users*	115 302	160 757	336 602	612 661

* Google analytics data, as on 27.05.2015.

Quantitative data as above, show the growing interest of students and teachers in using IT School recourses over the past three years and thus confirming its important role in the process of supporting learning of computer science in IT School community.

Partnership is next important principle of the Program. Partnerships are established in subprograms within IT School on different levels: horizontal among universities cooperating in realizing the Program, secondary schools from the same Voivodships, academic teachers form different universities, secondary school teachers and secondary schools' students from different schools and vertical among universities and secondary schools in Voivodships, academic and secondary school teachers, secondary schools' and universities' students. These partnerships are built on the basis of IT School activities such as planning every school year's events, competitions, team projects, evaluation of the results of the Program, consultancy on different aspects, IT courses for secondary schools' teachers delivered by academics, IT courses for secondary schools' students delivered by university's students and many others. Partnership is characteristic which aim is to create the culture of learning ICT community both as a whole and as small groups dedicated to solve sub aims of the Program. Partner-

ships should be evaluated in quality terms rather than in quantitative ones. This sociological phenomenon will be a subject of separate research in next school year. It can be although already observed that in secondary schools who pay special attention to building partnership culture the pedagogical results are better than in others.

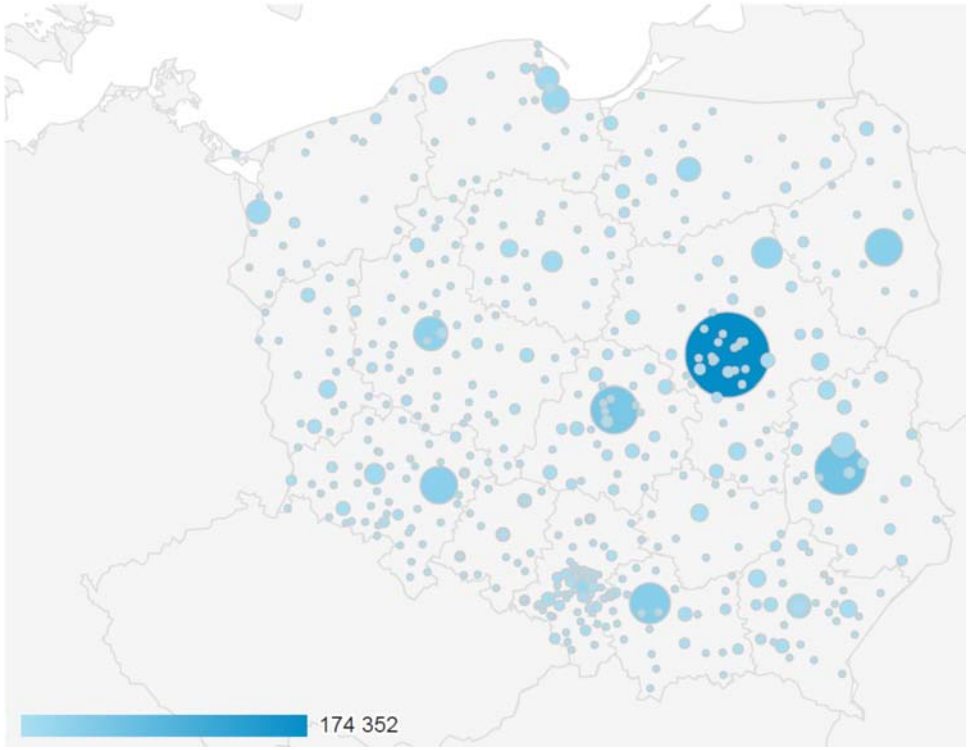

Figure 1. Geographical logins to IT School PITLS in Poland according to sessions numbers. Source: Google analytics data 22.10.2012–30.04.2015.

Internet networked learning environment is natural for the Program which is being implemented in over 500 secondary schools all over Poland and is being used also by users from abroad. For the purpose of the Program a dedicated web platform was projected and implemented by WSCS, with functionalities supporting achievement of the aims of the Program. It among others enables forming interschool groups working together on different projects or delivering lectures from distant localizations like USA or Japan.

In analyzed period the users of IT School Program logged in to PITLS platform from 619 localizations in Poland and 3444 in the world taking part in IT Schools' activities. As can be seen on picture 1 login places in Poland cover whole country territory with heavy internet traffic in biggest educational centers (cities) like Warsaw, Łódź, Lublin, Wrocław and Kraków.

Diversified and high professional level of materials was and still is next important principle of the Program. Quality of the content is the thing that makes the Program so well accepted both by students and teachers. The results presenting level of students and teachers acceptance of chosen Program content is shown in table 7.

Table 7. Which of the Program resources are most useful for students? Source: [9], [10], number of respondents who answered this question: students – 752, teachers – 136.

IT School chosen content	**Teachers**		**Students**	
	Number of answers	**%**	**Number of answers**	**%**
Video lectures	97	71.32	221	29,39
E-scripts	98	72.06	229	30,45
Presentations	107	78.68	292	38,83
Tests	85	62.50	352	46,81
Scientific distance groups	31	22.79	65	8,64
All are useful	2	1.47	223	29,65

Five out of six chosen resources are useful for 30% or more of students. Almost 30% have the opinion that all materials are useful to them. Teachers evaluation on quality and usefulness of the content are approximately twice higher than students ones'. It explains why the program is so widely used by teachers for learning purposes As it was mentioned earlier for developing the Program such pedagogical forms and tools are used as courses, lectures (traditional and online), competitions, games, visits to IT firms, online academic scientific groups for secondary school students run by academics, participation in professional IT courses and many others. In cooperation with some universities open computer science lectures conducted in Polish academic centers take place. Lecture topics include the most interesting subjects concerning the theory and applications of computer science and information technology. Lectures are an opportunity to meet with academics

at the premises of universities and get acquainted with the unique atmosphere of this traditional academic form of knowledge transfer.

Online computer science lectures given by the best Polish academic teachers, among others from Warsaw University, Jagiellonian University, University of Wroclaw, Warsaw University of Technology, Military University of Technology and many other renowned Polish universities. E-learning computer science courses for secondary school students, allow to acquire the knowledge and ICT skills and to obtain IT School certificates. The important tool are also nationwide knowledge and skills competitions such as using computer graphics to make posters, algorithmic contest, Grand IT test and many others.

High marks given by teachers to chosen recourses (table 7) brings immediately the question in what way the teachers use the materials. The answers are presented in the next table no. 8.

Table 8. In what way do you use IT School Program resources with your students? Source: [18], the number of respondents (teachers) who answered this question: 124.

Answer	**%**	**Number of answers**
I use IT School materials in computer science classes	70,97%	88
I recommend studying IT School materials as homework	52,42%	65
I use IT School materials in additional classes (e.g. special interest groups)	40,32%	50
I recommend studying IT School resources to most talented students to broaden their standard curriculum knowledge	72,58%	90

As shown, IT School Program is used in different ways, what is especially satisfying is the use of the program in additional classes and for work with most talented students, which are one of the important aims of the program.

Interactivity and automating mechanisms such as immediate information about the test results or number and kind of activities done by the student available to them in real time are built in the PITL system. Also the teachers have at their disposal a special panel which enables them monitoring their students activities and progress in learning. Automatization of selected elements of the educational process, management and system analysis are developed to monitor students' performance and to help teachers to personalize students learning. There are special sub

programs enabling collecting and processing big data in real time and on that basis formulating further proceedings.

Personalization of learning is expressed in possibility of choosing by student any courses to be performed to make a specialized set of skills and knowledge ie. in computer networks, in computer graphics or in databases. Also the online contests are the form of involving students according to their personal interests like computer graphics, algorithms, databases, programming etc. Each student can plan his/her own activities in the program for school year, and after registering to the system to monitor progress he/ she has done (by getting points for each activity). Each student's activity is also assigned to his/ her school enabling each month and school year to rank all registered schools by their students' activities. After accomplishing a set of chosen courses each student can get her/his own personalized certificate confirming the skills he/ she gained.

Built-in incentive mechanisms (individual and team), they are mechanisms which make the students more interested in Program's activities like competitions or public voting on best in their opinions works. Also the final competition for the title of most active schools of the Program nationwide and regional (Voivodships) rankings release a lot of students' engagement. The students are especially engaged in "Magic of Christmas" (December) and the Best IT School ranking of the Year. The number of competitions' participants raises every year (see table 6). In the table the numbers concerning students' participation in Best IT School competition (ranking) are not shown, because it's all IT almost 70 000 School population who is involved.

5 Pedagogical Effects of IT School Program

The pedagogical results of the Program have been the main part of research surveys. Such problems were evaluated as improvement of students' IT competences, average students' test results, the ways of monitoring students' work by the teachers, increase in motivation to learn computer science subject in school and more general technical subjects, **the impact of students' participation in IT School on particular effects of education, some general remarks on IT School Program influence on students' attitude to learning process and finally general benefits for students from participation in IT School Program.**

The first and most important one was research on the level of ICT competences improvement by students taking part in the Program.

Table 9. To what extent the contribution in IT School Program improved the IT competences of students in the opinion of teachers and students? Source: [10], the number of respondents (teachers) who answered this question: teachers – 84, students – 289.

Answer	Teachers		Students	
	Number of answers	%	Number of answers	%
To a very large extent	17	20,24	34	11,76
To a large extent	51	60,71	84	29,07
Moderate	16	19,05	119	41,18
To a very small extant	0	0	25	8,65
Not at all	0	0	27	9,34

81% of teachers and 41% of students think that participation in IT School Program raised students ICT competences to a very high or high extant. The teachers' opinion is much better about students' progress in raising IT competences than student themselves see their progress. One of the measures on which such opinions are formulated apart from surveys are test results, performed by students after each course.

Table 10. Average students' test results generated by PITLS. Source: [17], scale: 1-100, Successful result > 70.

Test results according to attempt	2012/2013	2013/2014	2014/2015
Average result of the tests during first attempt	72,5	78,1	82,8
Average results of the tests	64,7	58,9	77,6
Average results of the tests during successful attempt	89,3	93,5	94,7

Test results and answers (tables 9 and 10) show that participation in the program brings conviction about raising students' ICT competences shared both by students and teachers, confirmed by test results generated by PITLS. As it was signaled earlier an important issue is teachers role in learning process. The teachers are called IT School Program coordinators to stress their supportive and advisory role in learning. To learn how they support students in learning they were asked in what ways they monitor students' work while using IT School Platform.

Table 11. What is the way you monitor students' work while using the IT School platform? Source: [18], the number of respondents (teachers) who answered this question: 124.

Answer	**%**	**Number of answers**
I use the teacher's panel monitoring the activity of students registered in IT School Program	59,68%	74
I verify students' knowledge using test results available on the platform	41,13%	51
I include the educational content from IT School materials to exams, tests and tasks checking students' progress	45,97%	57
I motivate students for additional activities in the program, like taking part in competitions, taking individual additional courses from outside the standard class syllabus.	67,74%	84
I take the student activity in IT School program into consideration in final computer science class assessment	54,03%	67

The range of ways used by teachers to monitor students' work and progress is far wider than those listed in table 11. All of them stress coordinating and supporting role of teachers in students learning rather than traditional teacher centered position as content deliverer and supervisor.

In next question of the last IT school teachers' survey I wanted to learn to what extent including IT School Program resources to teaching resulted in improving students involvement in studying the IT subject.

Table 12. Please assess to what extent having IT School Program included to teaching computer science has improved the students involvement in studying the subject; as well as their interest in IT. Source: [18], the number of respondents (teachers) who answered this question: 124.

Answer	**%**	**Number of answers**
To a very large extent	8,06	10
To a large extent	41,94	52
Moderately	39,52	49
To small extent	6,45	8
I do not see connection	4,03	5

For half of the teachers' surveyed including IT School program in obligatory curriculum is a decisive motivator to increase the students' involvement in learning and interest in IT. Only 4% of teachers can see no influence of IT School Program on learning IT improvement.

Teachers were also asked to assess the results from table 12 in deeper details by indicating the impact of IT School Program on particular effects of education in different thematic and "life" connected areas.

Table 13. Please assess in percentage how big is the impact of your students' participation in IT School on particular effects of education. Source: [18], the number of respondents (teachers) who answered this question: 124.

Answer	**% and number of answers ( )**		
	Largely	**Moderately**	**Poorly**
Growth of basic computer skills, including: searching, analyzing, processing information	42,24% (49)	42,24% (49)	2,59% (3)
Growth of poorly represented in general paths of education skills, such as: computer graphics, multimedia, Internet technologies, computer networks, databases	53,45% (62)	32,76% (38)	3,45% (4)
Growth of awareness on IT use in everyday life and work (except for studying)	37,93% (44)	43,10% (50)	4,31% (5)
Growth of proficiency in using ICT for studying	37,93% (44)	44,83% (52)	5,17% (6)
Better understanding of the role of security and proficiency in use of ICT; as well as improved competences in these areas	37,07% (43)	42,24% (49)	7,76% (9)

In teachers' opinion, the important growth (from 37 to over 50%) can be observed in all categories. The above results confirm that massive participation in the Program is the effect of its holistic approach putting the learner in the center of the system.

Most of the teachers agree with the statements shown in table 14, which make the essence of personalized learning paradigms such as new learning culture, open learning environment, deeper learning and partnership in learning [6].

Table 14. Below you can find few statements concerning the IT School Program – please tick those you agree with. Source: [18], the number of respondents (teachers) who answered this question: 124.

Answer	**% and number of answers ( )**		
	I agree	**Hard to say**	**I disagree**
Participation in IT School Program develops students' responsibility for their own education	69,83% (81)	28,45% (33)	1,72% (2)
The possibility to choose the courses encourages students consciousness on their own predispositions and interests	87,93% (102)	12,07% (14)	0,00% (0)
The educational resources available at the platform are useful for working with IT talented students	88,79% (103)	11,21% (13)	0,00% (0)
The platform delivers educational resources supporting the individualization of education	81,90% (95)	17,24% (20)	0,86% (1)
It is possible to notice the growth of interest in technical studies among the students using IT School Program	42,24% (49)	54,31% (63)	3,45% (4)

Finally, it's worth learning what benefits of participating in IT School Program can students see. The answers show that some personalized learning values as possibility of improvement of students' own IT skills and knowledge and access to content customized to their needs and level of knowledge are crucial in perception of the Program.

Table 15. What benefits can you see from using IT School Platform. Source: [10], the number of respondents who answered this question: 289.

Answer	**%**	**Number of answers**
Possibility of IMPROVEMENT of my own IT skills and knowledge	70,93	205
Possibility of using the knowledge and skills acquired in future work or while studying in university	31,49	91
Access to content customized to my needs and level of knowledge	29,07	84
Possibility of personal learning at home, after school	37,72	109

6 Conclusions

IT School evolved from OER through MOOC fazes reaching the new quality of Networked Virtual School which is innovative combination of both previous, with special stress put on partnership in different aspects among academic and secondary level educational organizations, making it academic outreach program for secondary schools students and teachers. As a Program designed to accompany regular school curriculum it avoids some restrictions of a fixed curriculum, by freeing educators to think outside of the old curricular box to experiment with learning designs more in keeping with new patterns of rational action emerging in the network era. On the other hand it does not reject, but offers a means for enlivening, curricular learning, as students bring relevant real-world experience into curricular situations and take curriculum-based knowledge back out into real world problem settings for application [12]. The networked virtual school is a learning model prepared in close cooperation with secondary school teachers. The Program is not to replace but to support weak points of national computer science curriculum in Polish secondary schools.

It is an open, massive online educational virtual organization serving precisely identified and constantly evaluated users' needs, established in close cooperation with them. Usefulness, understood as customizing the level, quality and organization of IT School to students and teachers expectations gives the answer to the question why in two and a half years it became the biggest such program in Poland. IT School Program is not obligatory, so usefulness is one of the main values that makes the program so important for the secondary schools students and teachers community in learning process. One of the aims of the research was to underline the differences between OER, MOOC and NVS and prove that NVS is a better model to serve the educational needs. MOOC and OER by nature are presentations of universities' educational potential while NVS is built as a virtual organization which is to serve precisely planned in close cooperation with beneficiaries pedagogical aims. What teachers appreciate most as NVS advantage over MOOC and OER is possibility to take active part in creating the shape of IT School Program. In this paper I used only these parts of surveys which intention were to exploit the evaluation of key layouts and pedagogical effects of IT School Program. An important part of each survey not mentioned in paper are teachers' opinions on what and how to modernize and make the Program better serve students' educational needs.

The second aim of the research was to confirm and evaluate pedagogical effects of the Program. Examined from different points of view teachers and students confirmed efficacy of achieving main aim assumed, which is improvement of e-skills. Also other

goals such as development of students' responsibility for their own education, encouragement of students consciousness on their own predispositions and interests, usefulness for working with IT talented students, supportive role in the personalization of education and the growth of interest in technical studies among the students using IT School Program were observed.

On the basis of teachers' opinions and results of the research there are a lot of new concepts and ideas planned to be introduced in future especially in the personalization of tutoring and further automatization the big data analysis gathered by the system to the benefit of the users.

Warsaw School of Computer Science is not listed amongst the best an biggest Polish computer science universities/faculties, but we share deep understanding that outreach in the best form of partnership with secondary schools community which can bring benefits to both sides. That's why we put special attention to making the IT School Program more effective, in that way improving our own pedagogical skills and knowledge. There are many papers presenting benefits coming from OER and MOOC ideas, which surely they have, but none of them is a result of such a close cooperation between all actors of educational scene as Networked Virtual School, where learner is in the centre, with all system elements supporting him in his knowledge and skills improvement.

ICT technology because of its flexibility, mobility, capacity, versatility of possible usage, networking nature and most of all because of very positive students' attitude to them seems to be a long awaited holy grail for personalized education, understood as unlimited source enabling to improve learning process and results enormously according to learner individual needs.

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