

Successful MOOC project “IT School” for informatics education on secondary level

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Abstract

Warsaw School of Computer Science has launched a multi-annual MOOC project “IT School” to prepare and open on-line a number of popular courses and other materials in the area of “basics of computer knowledge” for students of secondary level.

The main objective of the project “IT School” is to popularize basic knowledge of computer technology, to encourage young people to study in the field of Information Technology and thus facilitate the study of the core courses.

In the framework of Project twelve online courses was prepared and opened with particular care in preparing self-assessment tests, allowing students to check the level of understanding of the learning material after each course (<http://www.it-szkola.edu.pl>). The final test assesses student knowledge and its completion allows to receive a certificate.

The education technology used for preparing the lectures is explained in this paper in details.

Keywords: *innovation, research projects, IT education – secondary level, MOOC*

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The core of any student's education was once the 3Rs: reading, writing and arithmetic. But in the 21st century, educators are just as likely to be talking about the 4Cs: critical thinking, communication, collaboration and creativity.

Anthony Doesburg, *Online learning – the future of education*, “New Zealand Listener”, 2012

1 Introduction

One of the statutory objectives of the Warsaw School of Computer Science is conducting educational activities and popularizing science for students and teachers of secondary schools, known as the outreach. This “coming out” of higher education institutions outside the traditional target group – university students, including students and teachers of secondary schools is one of the relatively new elements of the university mission. Institutions of higher education as highly specialized centers of teaching and research are increasing their involvement in the educational life long learning projects, addressing more and more of their actions to the pre and post university communities. What encourages implementation of such activities is among others the European Union's policy in which a lot of attention is paid to increasing involvement in economic activities and in improving and obtaining new skills at different stages of life. Apart of “missionary” dimension of this type of activities, for higher education institutions there are undoubtedly other important reasons to be active in this area – the reasons of informational and promotional nature, encouraging to make use of the university's educational offer and the choice of a particular faculty and place of study by prospective future students.

In the area of lifelong learning a lot of space is devoted to current issues of digital literacy in the context of their impact on the competitiveness and innovativeness of the economy. Warsaw School of Computer Science as a university specializing solely on the computer science, for obvious reasons, has been engaged for many years in the implementation of various activities related to the improvement of digital literacy, also addressed to people outside the traditional academic community of students, including students and teachers of secondary schools. Activities aimed at secondary school students, aiming to enhance their ICT skills, were performed by the Warsaw School of Computer Science since 2000 under successive educational projects “IT Education for secondary schools” (2000-2007) – for schools in Mazowieckie Voivodship, “Informatics Plus” (2009-2012), implemented in the Mazowieckie, Lodz, Warmia, Mazury, Podlasie and Lublin Voivodships and the MOOC project called “IT School” (2013-). Project IT School is aimed at secondary school students throughout the whole country. In total, in the projects targeted at secondary schools, conducted by the Warsaw School of Computer Science participated in the years 2000-2013 more

than 50 000 students from 700 schools. The transfer in 2013, the overwhelming majority of the activities for secondary school's students on the online internet platform, gave them the new character of the Massive Open Online Courses (MOOCs).

2 IT School project aims

The main objective of IT School project is to increase the competence of the Polish secondary school students in the field of information and communication technologies (ICT). The specific objectives are:

- 1) the development and implementation of innovative methods of teaching students key competencies in ICT, based on Internet technologies,
- 2) improve the quality of extra-curricular forms of activities that enable students to acquire key skills in ICT,
- 3) adaptation of secondary schools educational offer to the needs of the labour market and improvement of preparation the students for future employment,
- 4) enable talented students to develop their interests in the field of ICT,
- 5) improve the performance of secondary school's students in the subjects of computer science and information technology,
- 6) open up to other schools (including academies) sources of obtaining information and knowledge on ICT, and
- 7) increasing teachers' competence in working with students talented in computer science.

In addition, the project assumes:

- 1) to inform schools of available in the project teaching resources that can be used both by student's for self-study and by teachers, acting as a support in the teaching process,
- 2) implementation of activities for students with the involvement of academics (in collaboration with other academic centers in the country),
- 3) promoting computer science education among secondary school students in order to increase the percentage of students choosing the studies in technical fields (with the involvement of the other universities).

3 Pre-project research of expectations of IT School potential students in the field of computer science

At the stage of project Informatics Plus and IT School planning has been identified the following issues in relation to the intended purpose of the project:

- 1) differences in level of key competences in the field of IT of students in different schools,

- 2) lack of attractive forms of extra-curricular activities in the field of IT,
- 3) the gap between knowledge acquired from the school in the field of computer science and the range of skills needed to use information technology in daily life and work,
- 4) lack of educational tools supporting the work of teachers of informatics,
- 5) difficulties in individual work with students talented in the field of computer science.

On this basis were formulated specific objectives to research the needs of secondary school students in extracurricular forms of skills development in the field of computer science, implemented. Research was performed on a sample of 236 secondary school teachers of computer science.

The specific objectives of the research were:

- 1) to examine which curricula of Computer Science and Information Technology are mostly carried out in schools to decide about the context of reference for the authors of extra-curricular activities programs and educational materials for classes,
- 2) identify areas/ fields of computer science that are not adequately represented in the curriculum or because of the lack of qualifications of teachers are not included in the educational process at school – to formulate recommendations for the authors of the program of extra-curricular activities and authors of educational materials for classes,
- 3) identify the teachers' problems in the teaching of computer science in secondary schools (to low number of hours for performing materials provided, difficulties in working with students especially talented in the field of computer science, etc.), in order to determine recommendations for the support of teachers during workshops planned in the project,
- 4) diagnosis of the condition and needs of schools in organizing extra-curricular activities in computer science subjects – a recommendation for the design of the organization of the planned activities and recommendation for modifications in the didactical forms or their teaching quantitative proportions.

The teachers indicated a lack of competence, and the need to extend most of the topics in the field of informatics subjects such as multimedia, graphics, web technologies, “algorithmic and programming”. According to the teachers, it was advisable to organize teacher training workshops and enable them participation in lectures in the field of computer science conducted by academic staff.

Results of the study indicated that computer science teachers encounter problems at work with a student. They pointed to the lack of suitable software, equipment, classrooms, and teaching materials. Another recommendation, therefore, was to prepare the appropriate methodological instructions and proposal to attend by students and teachers in laboratories equipped with the proper hardware and software.

In a similar extent, the teachers pointed to the need to implement additional activities and expanding knowledge of computer science subjects. The scope of secondary student's knowledge may thus differ from the requirements of the university to a prospective student.

Teachers recommended extending and complementing the areas that are not sufficiently developed in schools.

Another recommendation by the teachers interviewed was the inclusion in the project indicated difficulties related to the lack of time for the implementation of the expanded program for students talented in the field of informatics subjects. Research showed the specially gifted students are not able to expand their scope of knowledge during regular school activities.

The study identified also forms of extra-curricular activities in the field of ICT and institutions that conduct such activities in secondary schools (Fig. 1 & 2). The results of the research confirmed the existence of problems diagnosed at the planning stage of the project and identified key areas to which should be paid attention during the stage of implementing the project.

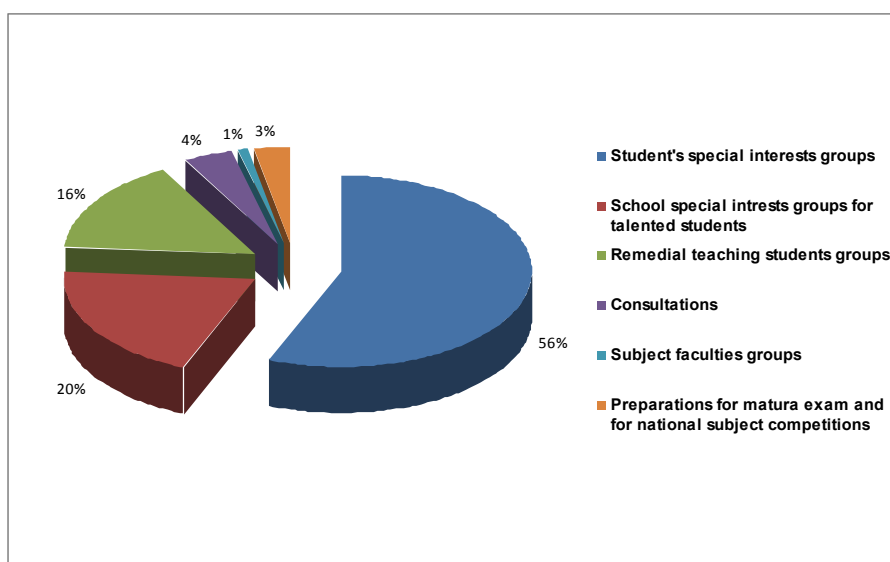


Figure 1. Organizational forms of additional ICT activities in Polish secondary schools

Source: *Research of the needs of secondary school students in extracurricular forms of ICT skills development*, WSCS 2010.

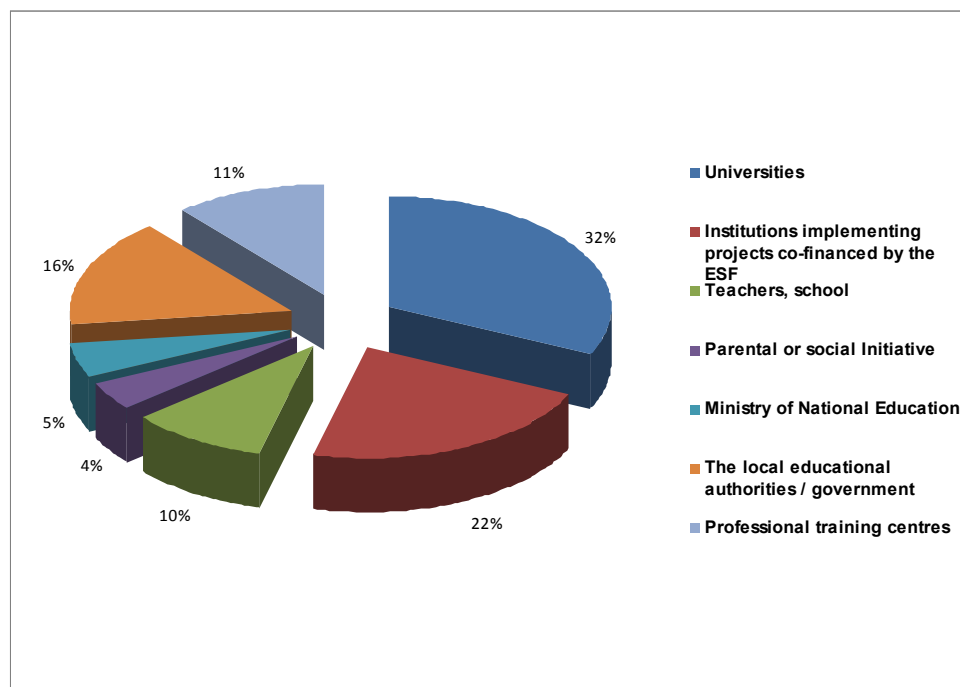


Figure 2. Who provides additional ICT activities to Polish secondary school students

Source: *Research of the needs of secondary school students in extracurricular forms of ICT skills development*, WSCS 2010.

4 IT School project main characteristics

For the implementation of the objectives of the project WSCS developed IT School own platform of MOOC type, enriched with elements of social and individual and group motivational tools. It was decided to create WSCS own web-based platform, which in a simple, student-friendly way will ensure the implementation of the objectives set in the project. The key to the success of the project was its:

- 1) social nature during planning and execution stages, involving in the processes all the stakeholders,
- 2) high utility of the project for all stakeholders,
- 3) incorporation into the project incentive mechanisms to ensure interest in participating in the project and what was the starting and most important point of the project activities,
- 4) high quality of the IT School didactic materials.

4.1 Social nature and usefulness of educational activities carried out on IT School platform

Social nature of learning activities conducted on the online platform of IT School is expressed in the creation of conditions for such formulation of the objectives of the activities and methods of execution that actively stimulate the involvement and cooperation of the various stakeholders of the project. The main objective of the IT School project is improvement and development of ICT skills of secondary school students through the activities carried out in cooperation with universities and secondary schools throughout the country. In the intended objectives of the project were taken into account the needs of all individual and institutional stakeholders involved in the implementation of the identified at the stage of research needs of secondary school students in extracurricular forms of skills development in the field of computer science.

Secondary schools are given the opportunity to enrich the educational offer of their classes in academic dimension and participation in the implementation of the Digital Agenda for Europe, particularly the part concerning the development of e-skills of the students. Institutions of higher education through the project activities fulfill part of their mission to popularize research activities in communities different from academics and promote their research and educational offer among potential students. Computer science teachers in secondary schools receive valuable tools to assist in classroom and extracurricular activities in computer science and offer of free e-learning training in improving their professional skills.

Academics by participating in the project have among others the opportunity to view the state of knowledge and skills of students who after the start of the university studies are the subject of the implementation of the learning outcomes set out in the computer science program of study prepared in accordance with the objectives of the National Qualifications Framework. The project has the status of a network project, co-implemented by many actors (individuals and institutions). All secondary and higher schools (their lecturers, teachers, and other staff) involved in the project contribute to the project voluntarily committed contribution in the form of selected activities for the project. The project is a non-profit. The funds collected for the project come from the final beneficiaries, partners, sponsors, government and EU funds, they can only be used to finance the maintenance and development of the project.

4.2 High quality materials and the activities of the IT School portal and built-in incentive mechanisms

High quality of the materials and project activities is due to diligence preparation of teaching materials in the planning stage of the project and is a sine qua non for the success of the project. In preparation of the materials took part outstanding academics of the leading Polish computer science universities. Project activities form an innovative system, which

consists of various components, many of them have the nature of competition between students and schools.

The best students, teachers and schools are rewarded for their achievements. Forms of activities carried out in the project are following:

1. Open lectures in computer science conducted in Polish outstanding academic centers. Lecture topics include the most interesting issues in the area of theory and application of computer science and information technology. The lectures provide an opportunity to meet with academics at the premises of colleges and familiarize with the unique atmosphere of this traditional academic form of knowledge transfer.
2. Online lectures in computer science. Lectures recorded in the Informatics Plus project were given by the best Polish academics, University of Warsaw and Cracow, Wroclaw University, AGH, Warsaw Military University of Technology and many other renowned Polish universities.
3. E-learning courses in computer science for secondary school students, allowing to acquire the knowledge and skills of ICT and to obtain certification self-IT School.
4. E-learning courses for secondary school teachers of computer science.
5. Special interest secondary students groups.
6. National computer science competitions.
7. Online ranking of the best Polish secondary schools in IT.

5 Selected statistics of IT School audience, October 22, 2012 – October 1, 2013

What is characteristic of the MOOC type of projects, in addition to providing their content to users in the form of digital media is the scale of participation in the project. The first seven months of the project resulted in over 100.000 unique visitors to the portal and nearly 3 million page views. The program registered more than 25.000 students from 400 high schools throughout the country (Fig. 3).

Shown in Figure 4 map of geography entrance to portal IT School is another example of the mass nature of the project, during the period October 2012 June 2013 portal recorded logins from 498 localities in Poland.

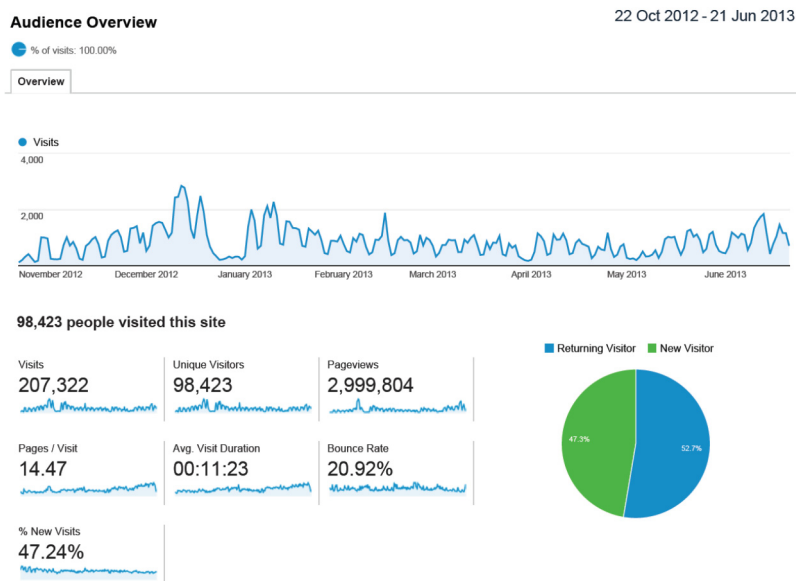


Figure 3. IT School audience overview

Source: Google analytics.

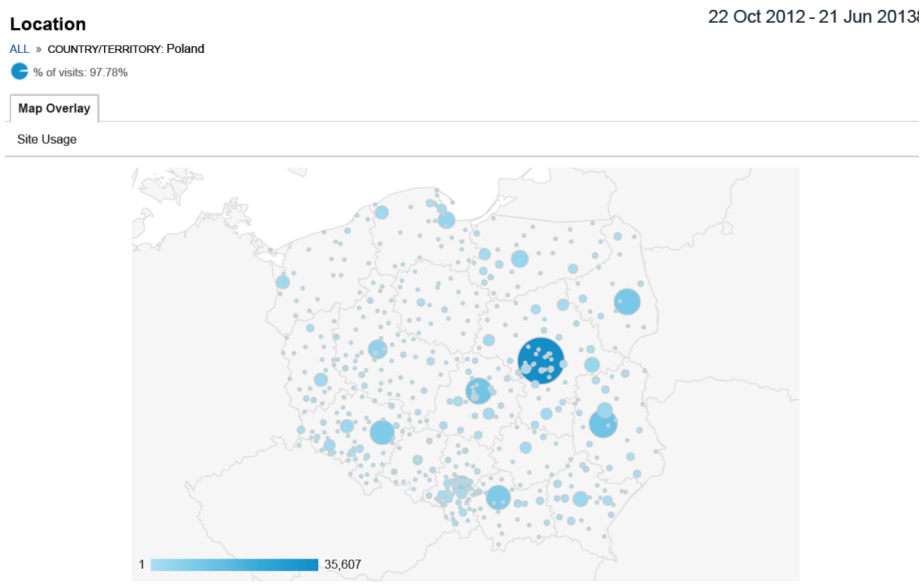


Figure 4. IT School Login Location in Poland

Source: Google Analytics.

The primary determinant of massive participation in the project is number of courses carried out by students and teachers presented in Table 1.

Table 1. Number and kinds of realized courses on IT School platform, October 22-21 June 2013

Subject of the course	Number of completed courses
Processing and visualization of images	12263
Web application development	8537
From abacus to ENIAC machine and the Internet	7343
Photo realistic graphics – how it works in practice	4761
How to protect your privacy on the Internet	7322
Protecting computers against attacks from the Internet – good practices	7255
The site on the Internet – how are established and functioning	4767
Communication networks	4149
Basics of designing and implementing databases	3575
WAN Management	3666
Will computers be doing business?	3817
Total completed courses	67455

Source: IT School data.




Totally students registered in the project IT School received 67.455 certificates confirming the execution of one or more of the courses offered.

6 Assessment of the first year of the IT School portal in the opinion of its members – registered in the project teachers and secondary school students

In July 2013 was carried out the first study of IT School portal users. It should be noted that the responsibility for achieving the main objective of the project – increasing the ICT skills of secondary school students is the responsibility of the teachers in secondary schools. Portal is an open educational system to assist the student's education in computer science in schools and at home. Therefore, the main research question focused on assessing the usefulness of the portal and the scale of usage by teachers and students. Research concerning the evaluation of ICT skills improvement acquired through the use of the materials available on the website is planned in the second year of operations (2014).

The first survey questions answers were given by 147 computer science teachers and 833 students.

One of the questions addressed to teachers was whether the content offered by the IT School portal is useful for students?

		n	%
Definitely yes		81	59.12
Probably yes		55	40.15
Probably not		1	0.73
Definitely not		0	0.00







The number of respondents who answered this question: 137

Figure 5. How useful to the students is content offered by IT School

Source: IT School research, 2013.

As definitely or probably useful the content proposed by IT School recognized 99.27% of the respondents, which indicates that very high, has been evaluated the usability of portal, which was one of its main aims.

Another question was to determine which resources of the portal are the most useful according to teachers for the students.

		n	%
Lectures in the form of films		97	71.32
Teaching Papers		98	72.06
Presentations		107	78.68
Knowledge tests		85	62.50
Groups of special interests for gifted students		31	22.79
Other		2	1.47








The number of respondents who answered this question: 136

Figure 6. Which in Your opinion were the most useful resources for the students?

Source: IT School research, 2013.

Based on the answers, it can be concluded that the utility of all the resources was of about 70%, which is another confirmation of the relevant from the point of view of students and teachers choice of teaching content posted on the site.

In the survey was also published a question, what according to teachers encourages students to use the IT School recourses.

		n	%
Access to learning materials tailored to their needs and level of knowledge		74	54.81
Taking part in competitions with prizes		75	55.56
Opportunity to learn without leaving your home		63	46.67
The possibility of obtaining a certificate		55	40.74
The fact that the school is registered in the IT School project		37	27.41
Students are rewarded for their involvement in the studies using materials from IT school by the teacher		82	60.74
Other		3	2.22

The number of respondents who answered this question: 136

Figure 7. What according to teachers encourages students to use the IT School (please select up to three answers)

Source: IT School research, 2013.

The highest number of indications received rewarding students for their involvement in the study using materials from IT School by the computer science teacher, which is also a confirmation of creative involvement of teachers in motivating students to work on improving ICT skills using available on the website of IT School teaching resources.

7 Conclusion

The huge success of IT School portal in the first year of operation results from several factors. It is certainly the effect of novelty of the MOOCs on the Polish educational map. It also follows the extraordinary diligence work carried out at the designing stage of the portal, including the selection of relevant content on the basis of research and finally high-quality materials. Also open online access to materials is very relevant. For Gen Y internet is becoming the most important source of knowledge about the world. The answers given by the students to the question, “How you spend your time on the Internet – specify the frequency?” indicate that the vast majority of students use the Internet very often or often, which naturally points to the inevitability of the entry of educational activities on large-scale, like other activities to the internet environment.

Table 2. How you spend your time on the Internet – specify the frequency?

	Very often	Often	Rarely	Never	Average
I look on social networking sites	424 (51.46%)	244 (29.61%)	93 (11.29%)	58 (7.04%)	1.74
Checking e-mail	319 (38.71%)	347 (42.11%)	150 (18.20%)	3 (0.36%)	1.80
Talking with friends	426 (51.70%)	257 (31.19%)	118 (14.32%)	14 (1.70%)	1.66
I play games	145 (17.60%)	170 (20.63%)	350 (42.48%)	144 (17.48%)	2.61
Look at online stores, auctions	93 (11.29%)	308 (37.38%)	354 (42.96%)	53 (6.43%)	2.45
I learn using educational platforms	69 (8.37%)	209 (25.36%)	418 (50.73%)	110 (13.35%)	2.71
I'm looking for the information you need to learn	268 (32.52%)	409 (49.64%)	112 (13.59%)	13 (1.58%)	1.84
Using the resources of the portal IT School	35 (4.25%)	185 (22.45%)	395 (47.94%)	187 (22.69%)	2.92
I'm looking for entertainment content, music	436 (52.91%)	300 (36.41%)	57 (6.92%)	9 (1.09%)	1.55
Browse news	199 (24.15%)	343 (41.63%)	224 (27.18%)	36 (4.37%)	2.12

The number of respondents who answered this question: 824

Source: IT School research, 2013.

In conclusion, it is worth noting that within the IT School project, currently are run by the Warsaw School of Computer Science two new innovative cross-regional projects co-financed from EU funds, addressed to students and teachers of secondary schools:

- 1) Informatics – my way to explore and describe the world and
- 2) Virtual Physics Laboratories.

The projects will develop a model curricula for computer science subject (for the baseline and extended level), and physic. Course content will be carried out from an interdisciplinary perspective in conjunction with one of the subjects: mathematics, physics, biology or chemistry, which is an innovative characteristic of these programs. The programs are to be equipped with sets of teaching materials in the form of lesson plans, educational videos, presentations, simulations, interactive tasks and knowledge tests. The aim of the projects is to encourage teachers of computer science and physics, to cooperate actively with teachers of other subjects in both supporting with information technology teaching of these subjects, but also in the context of the development of an interdisciplinary approach to learning in

school by showing close links between fields such as computer science, mathematics, physics and computer science applications in the fields of physical and mathematical sciences.

IT School project basis as all in social media projects are critical thinking, communication and collaboration between users and the creativity of the whole IT School project community with the essential support of IT technologies.

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