

# **Digital textbooks and learning materials**

Research and development in Hungary

**2019**

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## **Foreword**

Many Hungarian educators, researchers and specialists are working on harnessing pedagogical options enabled by digital technologies to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” - as the promoters of the TECHBOOK project also advocated.

We would like to highlight some typical aims, directions and results of Hungarian research and development through three examples.

The National Portal for Public Education was developed by Hungarian Institute for Educational Research and Development, Eszterházy Károly University. This new portal is Hungary's foremost web-based education platform in which textbooks are available in two versions, for free.

Educational researches aiming at the implementation of electronic learning environments in the public education sphere (1999-2017) were carried out by Department of Media Informatics, Eszterházy Károly University.

The eDia Online Diagnostic Assessment System for utilizing the outstanding power of technology-based assessments was developed by Institute of Education, University of Szeged.

We believe that these examples profoundly represent the work of Hungarian experts and can be used effectively for the preparation of recommendations made by the TECHBOOK project.

## **Digital textbooks on the educational platform**

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### **National Portal for Public Education**

The government emphasizes the importance of the digital education. It supports any approaches that points to this direction.

The National Portal for Public Education (Nemzeti Köznevelési Portál, NKP) is Hungary's foremost web-based education platform in which currently textbooks are available in two versions freely for all the students between the grade 5 and 12 (11-18 years old children). This can be a bridge between the regular paper based and the modern digital educational methods. The themed, easily searchable and secure educational space helps teachers prepare for class, while for pupils learning at home is also facilitated through enclosed interactive exercises which signal back to students in various ways. Currently the system does not support the access of the portal contents and functions in offline mode.

There are exercise editors for NKP. It also stores information on how students solve tasks, while in the case of an incorrect answer directs the user to relevant and helpful textbook content. To facilitate discovery and involvement-oriented, active learning the NKP connects users through already existing and well-functioning portals and public collections of material.

In the framework of a new project (2017-2021) the development of the NKP continues in order to build a more motivating learning environment that inspires learning and creativity, and encourages teachers and students to use the modern ICT devices and opportunities at schools.

The aim of the NKP is to collect and treat digital pedagogy-related solutions, developments and opportunities on the national level, executing one national strategy in the process. The new NKP is not only terabytes of textbooks, guides, exercises and digital supplements, but also provides an easy-to-use, free service for teachers and

students as well. It will be not just simply a collection of digital books but a complex e-learning system that is capable of helping the teachers to build private lesson plans, smart exercises, assignments, online tests and more. The thousands of verified interactive exercises, videos, 3D simulations, digital maps, etc. can be big help for teachers to make the everyday lessons more exciting and attractive for their students.

It provides a platform for teachers for the assessment of the students' performance. The personal information of the users is handled as it is defined by the GDPR. The usage statistics will only be used in the validation and improvement of the portal.

The system will contain a large amount of pre-defined lesson plans, so teachers can grab the most suitable tools for their needs that they can also customize. The collection of "best practices" is also available in the form of digital books on our platform that can give the teachers guidelines.

There are dozens of digital books being developed but another 100 will be added in the near future along with thousands of new interactive content. The new developments have not been made openly available on the NKP yet. Neither have been published any scientific publications about the system.

The NKP project is based on a government tender. Most of the primary and secondary school students and their teachers are supposed to use the system when it becomes published. This means that the software is planned for up to 1.2 million users including the students, their parents and teachers as well. The whole infrastructure is in Hungary and this is a scale-able system that allows to expand it when the demand comes up. In other words, new servers can be added quickly to support more users if necessary.

### **Smart textbooks**

The first generation of textbooks were downloadable PDF documents of paper-based textbooks which means platform-independency and full mobility that is internet-independency. However, there is not much room for interaction.

The second generation comprises of flipbooks which still display content similarly to printed books, although internet connection is required for continuous usage. It is possible to attach supplementary content to certain individual lessons (animations,

simulations, interactive maps, diaporamas, videos, interactive exercises). These are viewable in separate browser tabs.

In the case of the third generation content is not displayed identically to printed textbooks. Thus, a fully responsive experience is possible. Furthermore, the content itself is adjusted to the medium of display not only in terms of structure, but the controls as well. This enables usage from smart phones to smart whiteboards. In the third generation of digital textbooks supplementary content is displayed differently from type to type, regardless of their pedagogic relevancy.

Smart textbooks follow a particular educational guideline identified in advance which is based on the contents of the NKP. This makes the two products (digital textbook and the NKP) inseparable. The robust framework of the NKP aims to help students in learning more effectively and direct teachers towards more enjoyable classes with the help of an AI and education favoring contemporary mediums.

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## **Best practices in the promotion of digital culture in education**

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### **The main achievements of the Department of Media Informatics**

The Department of Media Informatics integrated into the Faculty of Natural Sciences in 2018 has been from its very foundation a major factor in the promotion of educational technology research and developmental efforts related to teacher training programs and the higher education arena in itself.

Its predecessor established in 1976 as the Independent Instruction Technology group was preparing students enrolled in teacher training programs to meet current requirements of instruction technology.

The Group was transformed into the Department of Instruction Technology and Informatics in 1989 whose professional profile was extended to include Informatics instruction. In addition to research into and development of multimedia-based educational packages applied informatics-based media development and e-learning programs and courses were introduced as well. The organization was expanded with the establishment of three more units, the Instruction Section, the Informatics Service Centre and the Multimedia Research Laboratory in 1997. Furthermore, the Institute supervised the implementation of the integrated communication system of the College.

In 1999 full time training programs were launched in library informatics or information management and in 2000 the Institute of Media Informatics was established with the following components:

- Department of Informatics,
- Department of Instruction and Communication Technology,
- Multimedia Research Laboratory,
- Regional Informatics Centre,
- Informatics Service Centre
- Liceum Television

In Autumn 2009 the Department of Motion Picture Culture was established followed by the formation of the Department of Cultural Heritage and Cultural History. In the past decades the original "Group" grew into an Institute containing 4 departments hosting an internationally acclaimed research and instruction centre. The centre was in charge of the strategic design, development, and maintenance of the information and communication technology aspects of the institutional infrastructure.

As of the 1990s in addition to the research and development of multimedia-based educational packages programs and courses aimed at multimedia development and e learning were launched. Also, the instructors of the Department have played a crucial role in the University's Doctoral School on Pedagogy and Educational Science.

In the past decades hundreds of multimedia educational materials and e-learning applications were produced by the Multimedia Research Laboratory.

Since 2010 the Demonstrations School of the Institution has been the scene of complex educational and pedagogical experiments related to mobile-based instruction. These research programs resulted in the preparation of several iBook-based interactive experimental textbooks and methodology manuals.

Since 1992 the Institute has hosted the internationally acclaimed Agria Media Conference on Information and Instruction Technology on a biennial basis. The Director of the Institution was Dr. Lajos Kis-Tóth between 1989-2016.

As of 2018 the Institute has functioned under the name of the Department of Media Informatics. In addition to its substantial instruction profile the Department has become active in the arrangement and organization of scholarly programs and various research efforts. Presently it plays a crucial role in the design and implementation of the Digital Instruction Strategy.

### **The development of electronics-based curricula promoting blended and distance learning programs**

Mostly due to an overall institutional commitment to the concept and practice of distance learning since 1990 the Eszterházy Károly University has been in the vanguard of the development of electronic educational materials. Furthermore since 1996 distance learning and especially electronics-based open training schemes have gained strategic

importance at the institutional level demonstrated among others by the accreditation of the information management program by the Hungarian Accreditation Commission in 2002 and its subsequent launching in a distance learning format in the same year.

In the past 20 years the University has participated in almost 100 projects focusing on the development of educational materials for e-learning programs and distance learning. The professional cooperation included such institutions as the Fernuniversitat of Hagen for Distance Education, the University of Miskolc, the Apertus Public Foundation, the National Institute for Vocational Education etc. Furthermore, project partnerships were formed within the Phare Program, and professional cooperation schemes were financed by the Economy and Competitiveness Operative Program (GVOP) of the National Development Plan (NFT) and the New Hungary Development Plan (ÚMFT).

Below we list a few examples of distance learning and e-learning development projects implemented in the past years:

TÁMOP-4.1.2.A/2-10/1-2010-0009 (2010) (Social Renewal Operative Program)

The primary objective of this project was the development of electronic educational materials. Accordingly 37 electronic instructional texts including 3 in English language were created for the following programs: Wine technologist post-secondary program, Viticulture and wine analysis specialization of the Chemistry undergraduate (BA) program, Wine tourism specialization of the Tourism-Catering undergraduate (BA) program, Wine culture specialization of the Cultural Heritage MA program

TÁMOP-3.2.1/B-09/2-2010-0024

The project provided opportunities for acquiring a high school diploma via Internet-based educational programs at the Demonstration School of the Eszterházy Károly College through a novel and innovative opportunity in adult education.

TÁMOP- 3.2.3/08/2-2009-0022

The main goals of the project included the elaboration of a cultural project cycle management training program, the training of E-counselors for the improvement of the digital competences of the general public, and the implementation of extracurricular programs complementing traditional educational schemes.

TÁMOP-4.1.2-08/1/B-2009-0002

The project aims at the development and implementation of complex higher educational subject contents, programs and research methods along with providing high level related services.

TAMOP -4.1.2-08/1/A-2009-0005

The adaptation of the foundation and main tier subject content and related educational materials of the Information management undergraduate BA and postgraduate MA programs to electronic learning environments.

TAMOP-4.1.2.-08/1/A-2009-0038

The development of ICT competences via Bologna compatible electronic educational materials and subject matter content for postgraduate MA programs in education in Mathematics, Geography and Informatics.

TAMOP 4.1.2-08/1/C-2009-0002

The aim of the project is to provide continuing training programs for Mathematics, Natural Science, Technology and Informatics (MTMI) instructors and full time instructors in management positions via accredited adult training schemes and the development of relevant educational materials.

TAMOP-4.1.2.A/1-11/1-2011-0021

This project resulted in the adaptation of 54 e-Learning programs in the field of Information Technology and Instruction Design into the Hungarian higher education environment via cooperation with the Open University Malaysia.

### **Educational experiments aiming at the implementation of electronic learning environments in the public education sphere (2006-2016)**

The research, development, and innovation efforts of the Institute of Media Informatics were launched in 2006 both on the institutional level and in the Demonstrations School of the Eszterházy Károly College. The primary objective was the elaboration and development of an appropriate methodology for personal electronic learning environments both in the higher education and public education arena. Consequently, all students enrolled in the College in the 2006-2010 period could start their studies in an uniform electronic learning environment via the institutional laptop program and the related educational materials. This 4 year long educational experiment using a sample of 3600 students resulted in the development of the 1:1 model.

The next stage of the development project included the cooperation between the Eszterházy Károly College and the Demonstration School. The respective teacher training programs were implemented via mentored innovation (*Dorner & Kárpáti, 2008*). Accordingly, teachers took part in continual training programs before the start of the semester or the school year in order to prepare them for functioning or working in a new learning environment. Furthermore, weekly incubation programs were provided in a form of personal consultations with technological and methodological experts. The aim of these personalized consultations was to provide help with problem solving and answering the respective questions of the participants. The program also included a web surface offering a closed forum for discussion (<http://byod.ektf.hu/>), both for the participants of the experiments and the support staff. Teachers were also helped by multimedia materials compatible with the interactive boards.

The experimental program utilized the interactive board, the Classmate PC and the e-Presentation option. The e-Presentation requires a remote control operated IP camera in the rear of the classroom and a special software enabling virtual participation in the education process. Consequently, students physically absent from the classroom and interested parents—via authorized access— were given an opportunity to monitor the respective events while following the actual teaching and observing the projected educational materials and subject matter contents. These developments gave rise to an open classroom in which actual physical presence is not a requirement for participation.

As a next step in 2010 e-Books were introduced in public education. Within the framework of the program 7th and 11th grade students received an e-Book reader for personal use along with the necessary educational materials in e-Book form. Since these machines could be taken home the students could use the same ICT device while preparing for school. The research demonstrated that the age of the participants and the content available via the respective device significantly influence the scope of the given application. Furthermore, students' ability to study at home with the same machines as used in school proved to be a crucial aspect of the experiment. Students appreciated the additional opportunities including the availability of computers during travel and leisure time activities. Accordingly, students were not only able to download and read the relevant content, but became more familiar with the operation of the respective device.

Research results suggest that the e-Books can be best used with the older age groups in a supplementary, mostly text collection form. Students in higher grades used the e-Book reader in a much more creative manner, as they developed a Hungarian language keyboard, and searched for and downloaded contents. Younger students rather used the device for solving targeted tasks given by the teachers and were less tolerant towards the respective disadvantages including the limits on playing the multimedia contents along with the lack of or slowness of Internet connections. All in all, in case of both age groups access to the Internet was essential (*Kis-Tóth, Fülep & Racsko, 2013*).

The next experiment was performed in 2011 and focused on enabling teachers to expand their methodological arsenal via the use of tablets and the relevant applications supporting the education process. Due to the respective disadvantages including difficulty in working with multimedia content and declining battery capacity, and the unavoidable amortization caused by excessive use the previously used Classmate PC and the e-Book readers were exchanged. In one class in addition to tablets students received textbooks produced by the Mozaik Publishing Company. At this point the textbooks were provided in a static pdf format combining the traditional texts and contents available on new platforms. The research program aimed to identify the conditions facilitating the effectiveness and efficacy of tablet use in public education along with pointing out the ideal learning or education support application.

The main form of support was the previously mentioned technological and methodological incubation or consultations providing help for the solution of the respective pedagogical problems along with promoting the professional development of the instructors. The experiment focused on the following subjects: English, Biology, Geography, Physics, Informatics, Chemistry, Literature, Mathematics, Motion picture culture and Media Studies, History, Students, however, could not take home the respective devices, they could only use them in school. The experiments suggested that e-Books could be applied with any age group, however, compared to earlier experiments content and quality were considered of higher importance. Teachers gave complex searching tasks to students and the respective discovery and activity based learning is reported to have promoted their transversal skills.

The next phase of the research program was launched in the first semester of the 2012/2013 academic year during which the static textbooks were superseded by

interactive iBook devices. The respective materials were elaborated by the development team of the Institute of Media Informatics and the participating instructors. The subject matter provided by the texts of the National Textbook Publishing Company was medialized according to the instructions of the respective teachers and newly developed interactive tests were included as well. During the term of the experiment traditional printed textbooks were not used. While the interactive textbooks contributed to the expansion of learning and teaching options, platform-dependence as the electronic textbooks were only available via iPad devices limited usability options. The other problem was that the given devices could not be taken out of the classroom, thus students could not take advantage of the given options during home preparation.

In the 2013/2014 academic year a new program aimed to expand the use of tablets and interactive educational materials as one class from grades 1, 3, 6, 9, used such devices. In grade 9 students used Samsung tablets and the rest studied with iPad2 devices. While first grade students primarily used the instruments for practice, an electronic workbook was prepared for third grade pupils. The device titled *éRTEm* was designed to improve reading comprehension skills including interactive tasks and talking books for listening comprehension practice as well. The professional subject matter was prepared by Lászlóné Molnár, while the multimedia context was developed by the ICT research group of the Eszterházy Károly College (*Antal & Kis-Tóth, 2015*). A similar workbook was prepared for grade 6 for natural science subjects as well.

Each of the school experiments emphasized new methods while highlighting the autonomy of the teachers and providing the respective technological and methodological support. The results suggest that long term application of the given methods and devices cannot be imagined without the creativity of teachers (*Herzog & Racsko, 2015; Kis-Tóth, Borbás & Kárpáti, 2014*). Another important aspect of the methodological renewal was the developmental e-Bibliotherapy program (*Gulyás, 2015a*) proven to be effective in improving reading comprehension and digital literacy. Furthermore, it has a definite positive impact on communication and conflict resolution and its flexible applicability allows its inclusion into the full day school schedule.

During the abovementioned experiment we initiated a pilot project (*Kis-Tóth, Gulyás & Racsko, 2014*) in the Demonstration Elementary, Secondary School and Basic Level

Art Institution and Pedagogical Institute of the Eszterházy Károly University in the 2015-2016 academic year. Accordingly we selected 10 schools from Borsod-Abaúj-Zemplén County whose scores at the competence tests administered by the Türr István Training and Research Institute were listed among the lowest 139 participants.

In order to enable instructors to hold the developmental or remedial programs in bibliotherapy and e-Bibliotherapy we submitted a 30 hour training program titled *Thematically structured application of developmental bibliotherapy and e-Bibliotherapy in public education* for accreditation. Until now 36 people completed the program.

The participants of this complex experiment were divided into two groups according to the respective mentors' affinity to using ICT devices during the training program. We believe that instructors with a negative attitude to using ICT devices cannot be credible when they demonstrate the practical application of such instruments. Also, we wanted to avoid placing an additional burden on those teachers who volunteered to hold the session, or forcing anyone to use ICT tools, especially in the initial stages of the program.

Consequently the experimental group included the students of 5 institutions enrolled in developmental bibliotherapy sessions and the members of the other group participated in developmental e-Bibliotherapy programs.

In each institution a 6th grade class was chosen at random and intervention groups were formed by the same method from the students of each selected class. The selection of both the classes and individual students was based on the fact that all students in the participating schools qualified for the multiply disadvantaged status, consequently everyone had an equal opportunity of being chosen. Therefore 8 pupils were chosen from each of the 6th grade classes of the participating schools to attend the respective developmental bibliotherapy or developmental e-Bibliotherapy sessions for six weeks. Those students who did not participate in the developmental sessions were assigned into the control group.

Inspired by the success of the respective bibliotherapy and e-Bibliotherapy sessions carried out within the framework of the TÁMOP-3.3.13-13/1-2013-0001 Eötvös József Program in the first semester of the 2015-2016 academic year titled *The development of pedagogical and professional services within a project network*, in the spring semester,

that is after the completion of the project, we continued the cooperation with four schools previously participating in the respective program.

During these developmental e-Bibliotherapy sessions (Gulyás, 2015a) we observed changes in the participating students' nonverbal communication (Gulyás, Kis-Tóth & Racsko, 2016) and compared the respective data with the results of the analysis of the tablet-based lessons (Gulyás, Nagyné Klujber & Racsko, 2016). Furthermore, we assessed the respective changes related to self-esteem and conflict resolution skills (Gulyás, 2015a,b) and we analysed the reports of the mentors as well (Gulyás, 2016b).

During our experiments focusing on the promotion of digital transformation and the introduction of tablets we explored the attitudes of students, teachers (Herzog & Racsko, 2016) and the parents' (Herzog & Racsko 2015) as well. The results of the research program were summarized in a book (Borbás, Antal, Babiczki, et al 2015).

**The promotion of a digitalized paradigm change in pedagogical culture (2017-2021)**

*The elaboration and renewal of assessment and evaluation procedures, digital development and innovative instruction management schemes regarding the framework system of public education (EFOP-3.2.15-VEKOP-17) (Human Resource Development Operative Program-Promotion of Competitiveness in the Central Hungarian Region Operative Program)*

The research program aims at the development of on-line courses promoting the digital competence of teachers via the elaboration of 30 course materials.

*Methodological development of educational professionals for the prevention of early school leaving (EFOP-3.1.2-16-2016-00001)*

*Introducing the Complex Basic Program in public education institutions<sup>1</sup>*

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<sup>1</sup>While the scope of the Complex Basic Program exceeds the profile of our Department, it is integrally connected to our scholarly activities.

The main objective of the project is the provision of support at the respective school level for the reduction of drop out rates in public education. The prevention-oriented program aims to promote the methodological skills and the adjustment of pedagogical perspectives of teachers along with the development of the respective organisational cultures.

Additional goals include the promotion and strengthening of a methodological culture that facilitates differentiated and personalized approaches in public education institutions.

In the framework of the project several training portfolios have been developed, one of which is the Complex Basic Program. Teachers are encouraged to expand their pedagogical and methodological arsenal facilitating the elaboration of a fair supportive learning environment. The resulting openness will go a long way in compensating the disadvantages of students while promoting their academic success.

Accordingly a school applying the Complex Basic Program is a knowledge intensive learning organisation aiming to achieve improved learning outcomes via the deployment of five subcomponents (1) Logic, (2) Exercise, (3) Art, (4) Digital Culture and (5) Life style counseling,

The Digital culture segment includes a 30 hour training program for in-service teachers. It is delivered in a blended fashion, as 20 hours of actual training based on physical presence is coupled with 10 hours of online preparation in a distance learning framework system utilizing medialized electronic texts.

The training program takes into consideration such unique aspects of the digital side of the Hungarian public education system as the differing device availability profiles and the varying digital literacy of the teachers. The development of online texts prioritised the respective technologies, the collaborative methods, and the promotion of familiarity with online learning communities as these areas are greatly determined by the abovementioned characteristics. The contact-based instruction is aimed to reconcile the components of the competence system and digital literacy with that of pedagogical activities along with demonstrating the options provided by virtual environments.

Consequently, we placed emphasis on the following areas: collaboration options provided by cloud technologies: digital devices supporting learning and teaching: lesson arrangement support application;

applications supporting the learning process— Educational cube, Smart box; visual solutions supporting summary preparation and comprehension: word clouds, conceptual maps, interactive announcement board; knowledge monitoring and evaluation via online methods; presentation preparation in a cloud; and digital options promoting the self-development of teachers.

Additionally, we developed a methodological arsenal promoting the successful implementation of the sub-program via an online closed repository (Tudástár<sup>2</sup>) including assignments developed for extracurricular activities, in-class assignments, educational cubes and a continuously expanded link collection.

Furthermore, we aim at the establishment of a mentored innovative program including a Professional Support System utilizing physical presence based (group observation of classes) and online channels (e-Professional Support System) in promoting implementation at the institutional level.

## **LEGO**

The Eszterházy Károly University has researched and explored the methodology of the integration of the LEGO EDUCATION products into instruction as this approach can increase language and mathematical skills along with achieving a significant improvement in the area of skills required for functioning in the 21st century while offering an enjoyable method for raising academic performance in STEM subjects. Although 60 countries have used such methods, in Hungary the application of the respective methodology is in the beginning stage.

Consequently, we have submitted for accreditation four training programs for in-service teachers in the following areas:

Constructive pedagogical methods supported by LEGO devices in mathematics instruction

LEGO supported Digital narration in education

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<sup>2</sup> Complex Basic Program knowledge repository: <https://tudastar.komplexalapprogram.hu/>

Experience-based instruction supported by LEGO WeDo robots in the lower levels of the elementary school

#### Mobile robots in education

The integration of the LEGO EDUCATION into public education is promoted by the (EFOP-3.2.3–17) *Digital environment in public education* project providing the option of device acquisition and organising the respective training programs for teachers.

The methodology of the LEGO EDUCATION complemented by modern ICT devices results in a complex pedagogical and methodological repertoire supporting experience-based learning via promoting such basic 21st century skills as multilaterality or the parallel development of digital and analog competences.

#### ***EFOP-3.2.15-VEKOP-17-2017-00001 The elaboration, development and renewal of assessment and evaluation procedures, digital developments and innovative instruction management procedures regarding the framework system of public education***

Research aiming at the exploration of the current stage of digital transformation in public education and the higher education arena is indispensable for the the implementation of the National Digital Instruction Strategy (M-DOS).

The project examines pedagogical attitudes toward the use of digital devices and its correlation with other field of pedagogical theory. Furthermore, electronic educational materials for 28 online training programs will be developed, The respective programs can be completed via an online framework system where online mentors help in-service teachers to become more efficient in the virtual space.

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## **The eDia Online Diagnostic Assessment System**

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Technology-based assessment is one of the most rapidly developing domains of educational research and development. Computerized tests, especially assessments delivered online, have a number of advantages over traditional paper-and-pencil tests in a number of respects. They may make the entire assessment process more reliable and more valid, faster, easier, and less expensive. For utilizing the outstanding power of technology-based assessments in the solution of the most crucial problems of mass education, researchers of the Center for Research on Learning and Instruction at the University of Szeged have been developing an online diagnostic assessment system, the eDia. This system can provide students and teachers with precise and frequent feedback in order of supporting personalized learning.

The most serious problems of uniformed school instruction are rooted in the experience that there are large difference between students in several dimensions. Most of the differences cannot be uncovered by the means of traditional methods of educational evaluation, therefore these differences are not correctly recognized, and teaching processes are not adjusted to students' individual developmental level and preparedness. The practical utilization of the system is based on the extended idea of assessment for learning, integrating screening, formative, and diagnostic functions of assessments.

The main aim what the eDia system is designed for is to provide students and teachers with regular diagnostic information in three main domains of education, reading, mathematics and science from the beginning of schooling to the end of the sixth year of primary education. Developmental work is in progress to extend the diagnostic assessments for the kindergarten-school transition, and later on for supporting the work of kindergarten teachers. The eDia platform integrates the entire technology-based assessment process from item development and building item banks to online administration of the tests to data analyses and feedback processes.

The cognitive foundations of the system are defined in the assessment frameworks which are based on a three-dimensional approach at each domain. The frameworks differentiate the psychological-developmental, disciplinary-content and application dimensions of learning. Thus the system offers opportunities to monitor students' development altogether in nine dimensions.

The frameworks have been carefully mapped into item banks containing over a thousand of innovative (multimedia-supported) items in each dimension. The item banks prepared for the three main domains contain altogether over 25 000 assessment items. The item banks have been continuously developed based on the empirical experiences. As the eDia system has been developed at one of leading Hungarian research universities, its technical parameters meet the highest standards. Several servers of the server farm of the university are dedicated for the eDia system, and as the software has been developed and maintained by the information scientist of the university, it applies the most recent innovative solutions.

The online system has been working in an experimental mode in over 1 000 partner schools (almost in a third of the Hungarian primary schools) for several years since its first pilot (over hundred thousand students have already been assessed) and is ready to offer its utilization for the entire system of primary schools in Hungary (for assessing almost half million students). At present, the standard mode of operation is that the system offers three assessments for the participating classes, at the beginning, at the middle and at the end of a school year. A testing session is usually 20-45 minutes, depending on the depth of the assessment (number of dimensions, details). A complex diagnostic assessment takes usually three hours. Based on the diagnostic information, teachers may design and carry out personalized intervention, and the impact of their activities can be seen from the next assessment.

The main motivation for schools to use the eDia is the sophisticated feedback based on valid, reliable, high-quality online tests. Students receive immediate feedback when have completed the tests, and teachers receive high-quality visualized data about their students and class compared to the achievements of the entire school, school district and country means. Teachers may apply for access to the item banks and can compile their own test customized to their actual teaching practice and assess their students any time. The developmental project which resulted in the eDia system

included a substantial teacher education component. Over three hundreds of teachers have been trained for becoming item writer, furthermore several accredited in-service teacher training programs (from 30 hours up to two years) are offered for the practicing teachers related the development and utilization of the eDia system.

The feedback data can be seen by the students and teachers have access to the contextualized data of their students. The results of the assessments have continuously been analyzed and published both in books and in academic journals (see the list of selected publications) and in journals read by the teachers.

Beyond its main function (to support personalizing and individualizing education), the eDia platform has been used for assessments in a number of domains (test were developed for the assessment of e.g. school readiness, writing skills, musical abilities, English as a second language, health literacy, financial literacy, visual skills, civic competencies, combinatorial reasoning, inductive reasoning, problem solving, learning to learn, ICT literacy, creativity, social skills, motivation, collaborative problem solving) from pre-school to higher education in Hungary and in a number of other countries.

Several experiments for further utilization of the assessment system is in progress, among others developing online intervention methods (e.g., online games) and connecting them to the assessments, implementation of mastery learning models, and supporting teachers' innovative teaching practices and research work.

For further information see the eDia web site: <http://edia.hu/>

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