DEVELOPING AN ONLINE DIAGNOSTIC ASSESSMENT SYSTEM FOR GRADES 1 TO 6
Developing Diagnostic Assessment is a research and development project being conducted by the Center for Research on Learning and Instruction, University of Szeged with the support of The Social Renewal Operational Program (TÁMOP–3.1.9-08/01-2009-0001).

Project Organization and Management

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Objectives and Context of the Project

At present, national and international assessment programs are utilized on a regular basis to provide comprehensive feedback on the achievement trends of Hungarian students. These assessment programs can signal the need for the introduction of accountability models and system development. In addition, they are useful in facilitating decision-making processes at both the systemic and institutional levels. They are not, however, suitable for tracking the individual development of students, diagnosing learning difficulties and/or identifying causes of failure. In addition to frequent personal feedback, the direct fostering of learning processes and individual student development require different types of information and at levels of accuracy that cannot be provided by currently available assessment methods.

Many of the instructional problems encountered in the schools today can be traced back to the years just preceding or within the very first years of schooling where many students fail to acquire the basic skills necessary for successful learning. In order to remedy this situation, an on-going evaluation system that attends to, measures and tracks the development of individual students must be introduced. Individual
student information must be gathered at a frequency and level of accuracy that would enable it to be compared with normative indicators for the assessment system itself, pre-set scientifically-established standards, and earlier developmental states of the individual. Diagnostic information gleaned through sophisticated data-analysis is fed back to both the students and those in charge of their development and used in the search for solutions to the specific individual developmental challenges identified.

Recognition of the need for accurate individual diagnostic assessment instruments has prompted the launch of an array of R&D programs worldwide. Projects that address individual student needs through direct support of learning and instruction aided by diagnostic measurement systems are presently in effect in many countries. These measurement systems rely on both scientifically elaborated theoretical frameworks and empirically tested standards. Diagnostic assessments must exploit the full range of possibilities that modern information technology offers in order to be ultimately effective. Exploitation of advanced technology ensures that frequency and accuracy concerns are properly addressed. In addition, the efficiency with which modern technology can process and analyze data adds the benefit of access to immediate feedback.

Advancement in the fields of cognitive research and educational evaluation has provided the essential theoretical knowledge necessary for development of new and more sophisticated diagnostic assessment frameworks. Large-scale national and international programs have renewed interest in the psychometric basis of assessment. In addition, the rapid development of information-communication technology has contributed essential innovations needed for computer-based assessment. Despite these huge technological advances, a copious amount of work is still required to utilize and organize these innovations into a workable online diagnostic assessment system.

Supported by The Social Renewal Operational Program, the Developing Diagnostic Assessments research and development project of the Center for Research on Learning and Instruction, University of Szeged, is laying the foundation for a nationwide diagnostic assessment system for the first six grades of primary school.

The project involves

(1) the development of assessment frameworks;
(2) exploration of the possibility of using diagnostic assessments in various fields;
(3) item construction and the development of item banks;
(4) the setting up and piloting of an online assessment system;
(5) extension of assessment to students with special educational needs;
(6) preparation of teachers and educational experts for participation in a variety of assessment processes; and
(7) secondary analysis of data collected in national and international assessment programs.
The objectives of the project are realized through the efforts of a team of interrelated and collaborative working groups formed expressly for the development and execution of the project. The developmental work is achieved through national and international cooperation with the goal of attaining the best expertise and knowledge available to inform the project.

**Seven Work Packages**

The project is organized into seven comprehensive work packages that are then further broken down into smaller units.
Developing frameworks for diagnostic assessment in grades 1–6 in the domains of mathematics, reading and science

Coordinator: Benő Csapó

Coordinators of literacy domains:
Reading: Krisztián Józsa
Mathematics: Csaba Csíkos
Science: Erzsébet Korom

The aim of the work package is to develop scientifically established frameworks for diagnostic assessments and to specify the precise factors to be assessed. Framework development covers (1) reading, (2) mathematics, and (3) science—three domains where early development is known to impact significantly upon later success in a number of areas of learning.

The availability of measurable, operationalized standards (detailed description of the constructs and factors to be assessed) is the essential prerequisite for the construction of the diagnostic items as well as the tests. These standards are also vital for the interpretation of the results as they specify the skills, abilities and levels of achievement needed at given stages of schooling in order for students to be successful and effective in their studies. The frameworks must be based on the most recent scientific knowledge while at the same time be applicable as a guide to item development.

To enhance the analytic power of the diagnostic assessments, framework development is based on a three-dimensional model, reflecting three major goals of education:

1. that the minds of students will be cultivated by the development of specific reasoning skills and general thinking abilities,
2. that students will master the course content prescribed in key disciplines,
3. that students will be able to apply knowledge gained through schooling to a variety of contexts and situations.

Previous research has indicated that schooling often fails to meet these goals. The mastering of course material does not have the desired effect expected in developing the thinking skills of the students. Transfer of knowledge is not automatic, so students are not able to
utilize their knowledge in novel contexts even if they are able to reproduce what they have learnt in the school context. To improve the efficacy of primary education for the above-mentioned three goals, frameworks are required which allow progress in each dimension to be assessed separately.

In devising frameworks suitable to assess these goals, the followings can be utilized: (1) research that reports on the learning and development of cognitive skills and abilities or psychological knowledge that applies to education; (2) awareness of the knowledge and skills necessary for later learning and development coupled with information about societal needs and expectations for how this knowledge will be applied; (3) resources that specify the content knowledge that students are expected to master in the chosen range of disciplines.

The outcome of this work package will be reported in three volumes; one for reading, mathematics and science. The first part of each volume will consist of three chapters detailing the scientific foundation of the framework development. In some cases these chapters will be co-authored by renowned scholars from the international community. The second part of each book will elaborate, in detail, on the factors and content to be measured as determined by national experts in each domain.
Research has shown that if school assessment focuses exclusively on particular domains of knowledge and skill, teachers tend to pay less attention to other, equally important, curricular elements; this results in the distortion of the original educational goals. It is essential that assessment programs consider and actively embrace a wide range of knowledge, skills and abilities. To this end, assessment in the following seven domains will be piloted in this project. The coordinators of these fields are indicated in parentheses.

**English as foreign language** (Marianne Nikolov). In Hungary, just as everywhere else in the world, the beginning of foreign language learning is being shifted to progressively younger ages. In the Hungarian context this phenomenon has been reflected in the growing dominance of English, which is being learned from the age of six by an increasing number of students. This work explores the possibilities of systematic development and monitoring.

**Visual skills** (Andrea Kárpáti). In the 21st century the significance of visual language has become equal to that of verbal expression. The promptness and sophisticated nature of visual judgment has become more important than ever before. Additionally, the relevance of the skills of emotionally loaded visual expression has increased in virtual reality. This work aims to elaborate instruments suitable for monitoring the development of some visual skills.

**Social skills** (Anikó Zsolnai). Previous studies have shown that the social skills and abilities of children might be successfully developed, even on the short run, by use of appropriate methods and sufficient use of teaching and learning aids. The primary objective of this work is to explore the possibilities of diagnostic assessment for social skills and abilities in the age groups of 6–12.

**Civic education** (László Kinyó). Active citizenship, defined as civic participation in the management of personal and public affairs, is considered to be a necessary skill set for the maintenance of modern democratic societies. The needs
of modern society in Hungary warrant a focus on the constituent components of civic education, identification of the internal and external factors influencing the acquisition of civic knowledge in schools and, the development of age-specific instruments by which to measure and assess these factors.

Motivation (Krisztián Józsa). Motivation is essential, not only for learning and the successful development of skills and abilities but for the acquisition of applicable knowledge. The mapping of student motivation combined with diagnostic exploration into motives for learning are necessary in understanding how to foster motivation. The objective of this work is twofold: to locate and adapt the most reliable international instruments for the measurement of motivation and to elaborate and test new instruments for the measurement of motives in reading, writing and counting.

Health literacy and health behavior (Erzsébet Antal and Katalin Barabás). There is a fundamental need for the development of both individual health literacy and health behavior in modern societies. This requires the establishment and maintenance of a health culture, its conceptual knowledge, plus the basic skills which can be successfully applied in health-related situations and activities (context-specific literacy). This work undertakes to develop a theoretical framework upon which to construct and test suitable instruments for the assessment of Health Literacy and Health Behavior.

Learning to learn (Anita Habók). Successful participation in the knowledge-based societies of the 21st century requires that students not only be prepared for a world beyond school but also for lifelong learning. This expectation demands the acquisition of specific learning skills that are applicable outside of and beyond school and into adulthood. This work involves the processing and adaptation of existing international assessment projects, with special attention to the Finnish model, plus the construction and testing of new measurement instruments.
The first complete system of teacher-implemented measurement tools for the diagnostic assessment of skills and abilities for children upon entering school was developed at the University of Szeged in the late 1970s. This system was used for decades by kindergarten teachers, experts and researchers alike. In the early 2000s it was re-evaluated and revised and is presently recommended for the diagnostic assessment of skills and abilities for children when entering school. There is also a second evaluation system that has been in use since 2006; a comprehensive diagnostic assessment for students in grade 4. This system was also constructed by a group led by researchers from the University of Szeged. Following the initial national assessment, this system has been used, since first implemented, for annual national diagnostic surveys in Hungary.

Viewing the above systems as a base, the scope of skills and abilities measurable with these diagnostic tools can be revised and extended as the need for information arises and the technology for how to harvest it becomes available. In addition to the resources currently available, a similar fully comprehensive system of diagnostic assessment for all school grades is required. It is the main objective of this project to fill the gap between the currently available measures of school readiness in grade 1 and measures of lower elementary education in grade 4. This will be
accomplished through the development and construction of a comprehensive, integrated system of diagnostic assessment of skills and abilities for students in grades 1 through 6.

No less than 500 tasks are being constructed for each of the three main domains, reading, mathematics and science—1,500 items as a minimum. These tasks will be incorporated into a battery of structured tests, employed in empirical investigation, and used for testing and the setting of parameters. The task battery will comprise several test variants and be distributed to a nationally representative sample of students numbering in the thousands. Based on the assessment, national diagnostic maps of the measured skills and abilities will be generated to reflect the development of individual components. Subsequently, by drawing on available task items, further test variants may be developed for the purposes of summative assessment.

One of the long-term goals of developing diagnostic assessment instruments is to provide practitioner teachers with a system that would not only inform but foster the planning of their development. For this reason, measurement instruments are arranged into item banks. The development of task and test banks to be used in this way is unprecedented in Hungary and therefore requires meticulous preparation. Since effective student development is based on criterion-referenced evaluation, these future task and test banks must be useable in ways that would enable criterion-referenced analysis of the results.

In the first phase of the project, the items will be presented on a paper test that will be field-tested on nationally representative samples. These initial test results will be used to determine the item parameters. Once the item parameters have been determined the item-banks may be used for large-scale national assessments. The results of these initial paper-based assessments will also set the standard to which the results of future online assessments will be compared.
The widespread use of multimedia devices in schools creates opportunity for multifunctional application. These devices are currently in use in a number of countries for the purpose of student assessment. Due to the many possibilities afforded by computers it is inevitable that electronic assessment will replace traditional paper-and-pencil testing in the foreseeable future. Online assessment promises efficacy and cost effectiveness as there is no need for printing, transportation, coding, and data entry.

An online assessment system based on an open-source platform suitable for measuring knowledge, as well as ability, is presently operating in Luxembourg. The software is known by the acronym TAO, after its original French name (Testing Assisté par Ordinateur). The TAO and its various adaptations have already been used in numerous international assessment programs (e.g., in PISA studies). Further development of the software is on-going internationally.

Computer-based testing, despite its great promise, is still in its infancy worldwide. General testing software can handle a limited number of item types and many tasks normally found in paper-based testing cannot yet be transferred to computers. There is at present a major push in effect worldwide in the area of software development to overcome these limitations. Some recent innovations in computer software development are expected to be tested in this project.

Adaptation of the TAO platform plus the construction and experimental testing of suitable tasks are seen as two main objectives of this project. Task construction is possible in various ways at present, e.g. transfer of certain types of paper-based tasks, application of special task-constructing software or by direct programming of the testing system. All of these possibilities will be tested in the project. An additional feature of this project will be the automatization of additional activities connected to computerized assessment (e.g., data analysis, feedback).

The short history of computer-based assessment shows that technology-based testing does not always equate to results obtained for traditional paper tests. There are three main areas that are seen to be potential contributors to these differences. Firstly, solving problems displayed on the screen requires different cognitive processes from those required when working on paper. Secondly, task types usually associated with paper tests may not always transfer to an electronic medium. Thirdly, the ability of students to demonstrate ability in the assessed skills may be influenced by or
Increasing integration and inclusion of students with special educational needs (SEN) in the Hungarian school system has further highlighted the need for an integrated system of measures in the assessments of jointly educated student groups that would provide comparable results—at least in the area of basic skill development. In response to this need, diagnostic instruments and test banks for the regular evaluation of students with SEN will be developed by using the same principles as those outlined above and integrated into the mainstream measures. Special care, however, must be taken to address the differing requirements that come into play when assessing students with SEN.

Access to appropriate equipment/hardware in the schools is a prerequisite for computer-based assessment. By necessity, this project includes a survey of facilities, IT devices and expertise at the partner schools, as well as the prescription of minimal requirements and conditions necessary for online testing.

**Development of Assessment Instruments for Students with Special Educational Needs**

Coordinator: Éva Molnár
Formerly constructed measures suitable for assessing students with SEN also contain several items that might be utilized or adapted to develop a diagnostic evaluation system. The new framework developed within this present project, however, requires that there be elaboration of new methods of evaluation as well as new tasks. To satisfy these expectations, experts in the education of students with SEN will take an active role as members of the project team.

The extension of the system of diagnostic measures to SEN students requires developmental work in two essential areas. On the one hand, the item pool should be broadened to include items adapted to the special learning difficulties of the children being assessed. These modified tasks would not only allow students with special needs to solve most of the given tasks successfully but it would also facilitate having their achievements show up on unified scales. On the other hand, the benefits of computerized testing allow physically challenged students, who are not be able to participate in paper-based assessment, to solve the tasks by themselves. As part of the project, special technical devices with adaptive functions would need to be developed to enable some SEN students to interact with computers.

**In-service teacher training**

Coordinator: Csaba Csíkos

Practitioners who carry out processes of assessment in their everyday work play an essential role in the modernization of educational evaluation, as is the case when any kind of educational innovation is spread. One of the most important elements of the program is the comprehensive development of educational culture through direct interaction with practitioner teachers: constant training of the participants, systematic collection, analysis and utilization of their remarks, recommendations and feedback and their integration into the development program.

The in-service training of experts working in certain fields as well as of practitioners involved in the program is of high priority for the effectiveness and sustainable development of the online
assessment system. The teachers in the approximately 250 schools involved in the project along with the experts in their fields of research provide professional training aimed at broadening the scope of knowledge of the in-service practitioners according to a three-level system.

(1) On the first level, every teacher in the participating schools will receive an opportunity to gain firsthand experience with the online diagnostic testing system along with access to extensive information on its functioning and usage.

(2) The second level of training will see one representative for each content domain in every institution receive a 30-lesson, in-depth, course on mathematics and research methodology.

(3) On the third level, one teacher from each participating institution will be offered the opportunity to participate in a professional training course that will provide them with special certification upon completion. Beyond the immediate duties connected with diagnostic evaluation, this certificate course would train participants to be able to implement institution-level comprehensive evaluation objectives in the three main literacy domains specified for the project (reading, mathematics and science).

During the project the chance for various types of personal consultation will be available to practitioners. This would be accomplished primarily through the use of information and communication technology devices as opposed to face-to-face in person consultations. Researchers, experts and professional evaluators involved in the program will become familiar with the project goals and objectives through special thematic trainings and small-group workshops led by experts. The wider professional public would be informed about the results of the project as they become available at conferences.
By the end of the 20th century, results of national assessments of competencies and international comparative studies had been built into the culture of Hungarian education and the release of results in their respective publications have become greatly anticipated events among the education-related professions. The results of OECD-PISA, IEA-TIMSS and IEA-PIRLS studies, for example, have enabled individual educational systems to compare their performance with other systems from a variety of perspectives, such as the identification of changes and trends. Moreover, these competence assessment and international comparative studies provide valuable information for the improvement of the Hungarian system of measurement and evaluation. Since publications generally report only summative results, it is important that the complete data for these studies are made available so that researchers working in specialized areas can truly benefit from in-depth analyses of the data. Experts from individual countries are thus able to undertake secondary analyses of the data in an effort to illuminate problems specific to their own regions and circumstances.

The objective of this sub-project is to undertake secondary analyses of a similar kind. Data-bases of Hungarian and international assessments are collected and analyses relevant to the development of the Hungarian educational system will be carried out. This work will include the application of a number of statistical procedures that have not yet been widely applied in Hungary, if at all. These analyses will highlight those aspects of Hungarian student achievement which are satisfactory in relation to their international peers and those which are in need of improvement. Data relevant to problems existing in the Hungarian school system will be extracted and compared to those of countries that suffer much less from these problems. The outcomes of this work will be made available for the professional public.
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