UNIVERSITY OF SZEGED
DOCTORAL SCHOOL OF EDUCATION

Digital Technologies in Education

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The overall framework for the training programme

IT is a general subject area in public education which is tied to multimedia applications. Educational research in the field in the 1960s and 1970s dealt with learning computer programming and only targeted a narrow expert audience. With the emergence of digital technologies in mass education in the early 1980s, large-scale studies began to examine the educational use of computer devices, various digital technologies and the Internet. In recent years, research has also focused on the pedagogical applications of artificial intelligence. Assessing these findings and capitalizing on this technology, the training programme prepares PhD students for innovative developmental work aimed at optimising the educational application of digital technologies. Additionally, it enables them to exploit the potential of these tools and new analytical repertoires (e.g., pattern-recognition algorithms) to address previously unanswered research questions concerning the quality of knowledge.

The training programme encompasses five major problem areas linked to teaching digital technologies: (1) the development of digital literacy and opportunities for its enhancement; (2) the effective integration of digital technologies into education; (3) the development of students with special educational needs (SEN) through digital tools; (4) personalised education (smart education); and (5) technology-based competence assessment, with research examining the possibilities for logfile analysis and computer game-based development.

The theoretical preparation involves discussion of the new demands set by the knowledge-based society and their solutions as well as issues in Sociology and the philosophy of science. It provides an introduction to methodologies used in the fields of technology, Educational Psychology and Aesthetics to study multimedia devices. It also presents the nodes in the nearly three-decade history of educational IT and technology-based assessment and development that are of interest from the perspective of Educational Science. Furthermore, it offers an international overview of digital technology-assisted teaching and learning, as well as the educational applications of the Internet and artificial intelligence.

A key part of the practical side of the training programme involves familiarisation with and analysis of state-of-the-art instructional and assessment systems (e.g. the eDia online assessment system) and development systems (e.g. the eLea online development platform), as well as new hardware and digital technology environments. In their practical work with IT devices, PhD students receive an overview of theoretical and practical issues in designing software for educational assessment and development in parallel with fuller practical experience. They also survey innovative item and test development options and analytical possibilities for collected data (responses and log data).

Given the characteristic features of the field, PhD students benefit from the

participation of international guest lecturers and experts in the training and from the opportunity to collaborate with their international peers. In addition, the courses offer PhD students the chance to gain experience with the educational application of e- learning technologies in their own training.

Main areas of research

Research currently conducted in the field can be grouped into five major topic areas:

1. The development of digital literacy and opportunities for its enhancement

We offer our PhD students research topics in competence testing and educational theory alike. In the area of competence testing, we study the constituents of IT competence, the development of the skills and competences necessary in digital technology-assisted educational and real-life environments, personality traits that help or hinder computer-assisted learning, competence development through devices (e.g. developing spatial cognition, visual memory and psychomotor coordination) and artificial intelligence literacy.

Among questions of educational theory, we develop a theoretical framework for pedagogic models of digital technology-assisted teaching and learning. Specifically, we examine digital technologies characteristic of particular cultures and subcultures, pedagogic procedures and their links to traditional teaching methods, and features of cultural environments. We thus focus on the effect of gender, age and cultural milieu on learning performance in a digital technological environment, including domestic and international IT competence testing and school case studies. Whenever possible, we involve our PhD students in domestic and international competence testing, thus providing an opportunity to conduct comparative analyses between various cultures. They are familiarised with the problems of compiling international tests and exercises and the role of digital procedures in data processing and analysis, and they participate in data collection.

2. Integrating digital technologies into education (assessment, development, efficacy, materials development, competence development, development of skills and competences, distance learning, etc.)

This topic area includes the design of digital development programs to improve the quality of school knowledge and impact studies as well as the design of second- and third-generation tests and development programs, analyses of curricula and teaching materials, and the study of the general use of IT culture and its educational consequences. Researchers in this area are currently concentrating on the interdisciplinary, integrative role of digital technologies, specifically studying digital technology-assisted teaching methods and instruments that can be used to evaluate instruction in different subject areas, to simultaneously make it more effective and to develop IT competence. Designing e-learning applications, developing educational methods and instruments particularly effective in electronic environments and studying electronic forms of distance study also fall within this topic area.

Didactic problems that research tackles in this topic area include the study of effective technology-supported methods and the monitoring of effective integration of digital technologies into education through school experiments and assessments within the areas of competence development, learning, teaching and assessment. Within this topic area, we wish to provide an opportunity to use action research to develop IT teaching tools and teaching environments in communities of disadvantaged learners and in forms

of teaching in which digital technology may serve as an adequate means of development. We also provide space within this topic area for researching feedback mechanisms, as well as effective forms of visualisation and response.

3. Special educational needs (SEN) students and applications of digital technology

This includes studies on the technology use habits, attitudes and competence development patterns specific to different age groups and biological sexes. These studies also analyse development programs and digital teaching materials designed for different groups, as well as the selection of IT entertainment available commercially and on the Internet. A key topic area in the field is the design and testing of special education applications, with the potential applications of rapidly developing and individually tailored adaptive IT as therapeutic tools being virtually endless. SEN students include socio-economically disadvantaged young people who fall behind in school, a situation which experience shows can be compensated for with technology-supported methods and development programmes.

4. Exploring research questions related to the impact and implementation of personalised online adaptive testing

This topic area includes the transformation of previous, traditional and computer-based linear testing and development systems into online adaptive ones and impact studies of their operation. It also encompasses adapting and improving existing examples of online assessment and testing environments and designing competence tests and development systems based on new teaching models and technical solutions. In close cooperation with other training programmes, new opportunities are made possible for the design, measurement and parameterisation of adaptive testing and development systems that make wide use of technological options. This involves research questions tied to the introduction of adaptive testing, e.g. the impact of position and comparing the functioning of adaptive systems of various structures (number of adaptive steps, applied algorithm, optimising initial and final testing criteria, studying item-based and subtest-based adaptive testing, and conditions for the dissemination of online adaptive testing in Hungary).

Our doctoral programme provides researchers who have a degree in sociology, education, psychology or IT and an interest in the field with opportunities to cooperate in this topic area, in the hope that they will engage in IT research and development in specialised areas of teaching that represent a gap in Hungary. We see facilitating the development of IT applications that provide equal opportunity for socio-economically disadvantaged students and of related teaching methods as well as studying instructional processes aided by digital devices aimed at improving dysfunctions as key areas of need.

5. Technology-based assessment and computer game-based development of competences; the adaptation and application of new options and methods for logfile analyses

The cognitive revolution in psychology and the development of new understandings of knowledge in a rapidly changing knowledge society in the 21st century which thus requires constant learning – including real-world options to assess and develop areas also measured with traditional instruments, the measurability of new constructs, and the transferability of more motivating tests matched to the individual's competence level – have made it possible to determine what is worth assessing and developing in particular stages of development and how. The shift from traditional testing techniques to technology-based testing, however, has not only created opportunities for researchers; it has also posed problems and challenges. This has resulted in the development of new-

generation educational assessment technologies, which may even produce significant changes in educational assessment in the short term. This topic area involves the implementation of these technologies in a range of competence areas.

In cooperation with other training programmes, this topic area includes research on assessing competences that cannot be measured with traditional data collection techniques (e.g. collaborative problem-solving and interactive dynamic problem-solving), as well as on designing training programmes to develop relevant competences based on online computer games and on conducting impact studies. It also involves studies on new options in technology-based testing (e.g. logfile analyses with new-generation statistical methods, learning analytics, educational data mining and big data, as well as exploring and evaluating the opportunities provided by artificial intelligence).