ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

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INSTRUCTIONAL DESIGN OF SMART TECHNOLOGY USE IN TEACHER DIGITAL EDUCATIONAL ENVIRONMENT

G. B. Sarzhanova[1], R. S. Bobesh[2], G. Zh. Smagulova[3]
Karaganda Buketov University, Karaganda, Kazakhstan.
E-mail: [1]galiya008@mail.ru; [2]solnyshk@mail.ru; [3]smagulova_gulya@mail.ru

A. Turkel
Dokuz Eylül University, Izmir, Turkey.
E-mail: ali.turkel@deu.edu.tr

N. B. Serikbayeva
Semey State University named after Shakarim, Semey, Kazakhstan.
E-mail: nurgul.sgpi@mail.ru

Abstract. *Introduction.* According to the provisions mentioned in Digital Kazakhstan Programme and Digital Teacher national project, the teacher today is regarded not just as an active user of the novel digital and smart technologies, but as the creator and transmitter of the authors' digital educational content. The modern teacher is supposed both to adapt to and perform the professional activity within the digital setting of the educational institution and be able to design his/her own digital educational environment to transfer the educational content and organise effective "educator-learner" educational interaction. This situation brings us to the issue of the necessity for the teacher to be aware and master the potential possibilities provided by the smart technologies in realisation of the educational activity in terms of online and mixed learning; this, in its turn, conditions the search for the solutions for the effective instructional design of smart technology application in a teacher digital educational environment.

Aim. The present study *aims* to substantiate the instructional design of the implementation model of smart technologies when designing teacher personal digital educational environment (on the example of the authors' Smart Assistant software as a means of optimising teacher activities and organising an online and mixed educational process).

Methodology and research methods. The following categories of research methods were used to reach the goal set: 1) theoretical: cybernetics method, generalisation, analogy, abstraction, visualisation, modelling, and classification; 2) empirical: surveys and interviews techniques, as well as mathematical and statistical data analysis approaches.

During the experimental part of the study an online questionnaire survey on "Implementation of smart technologies in designing a teacher personal digital educational environment in the conditions of distance learning at a university" was conducted among 201 teachers of Karaganda Buketov University

(Republic of Kazakhstan) and Dokuz Eylul University (Turkey) from 12 December 2022 to 30 April 2023. The aim of the experiment was to identify problems with the adaptation and implementation of smart technologies in designing a digital educational environment. For this purpose, the respondents answered fifteen questions and made suggestions for improving the university digital educational environment.

Results and scientific novelty. The article substantiates the design of smart technology implementation in a teacher digital educational environment as a means of optimising his/her activity in organising online and mixed learning process (on the example of the authors' software Smart Assistant), and identifies the problems with the adaptation and implementation of professional activities in the context of a digital educational environment. The characteristic features of the problems of teachers' adaptation in a digital educational environment and the difficulties of smart technologies implementation in their professional activity are defined.

Practical significance. The Smart Assistant software product was developed as a means of optimising the teacher's activities in organising an online and mixed educational process.

Keywords: instructional design, digital educational environment of the university, digital competence of the teacher, smart technologies, teacher personal educational environment.

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ПЕДАГОГИЧЕСКИЙ ДИЗАЙН ПРИМЕНЕНИЯ СМАРТ-ТЕХНОЛОГИЙ В ЦИФРОВОЙ ОБРАЗОВАТЕЛЬНОЙ СРЕДЕ ПЕДАГОГА

Г. Б. Саржанова[1], Р. С. Бобеш[2], Г. Ж. Смагулова[3]
Карагандинский университет имени академика Е. А. Букетова, Караганда, Казахстан.
E-mail: [1]galiya008@mail.ru; [2]solnyshk@mail.ru; [3]smagulovag@mail.ru

А. Туркель
Университет Докуз Эйлюль, Измир, Турция.
E-mail: ali.turkel@deu.edu.tr

Н. Б. Серикбаева
Семипалатинский государственный университет имени Шакарима, Семей, Казахстан.
E-mail: nurgul.sgpi@mail.ru

Аннотация. *Введение.* Согласно положениям, приведенным в программе «Цифровой Казахстан» и нацпроекте «Цифровой учитель», реализуемых в Казахстане, педагог сегодня рассматривается не только в качестве активного пользователя последних цифровых и смарт-технологий, но и как создатель и транслятор авторского цифрового образовательного контента. Современный педагог должен как адаптироваться и осуществлять профессиональную деятельность в цифровой среде образовательного учреждения, так и уметь проектировать собственную цифровую

образовательную среду для передачи образовательного контента и организации эффективного образовательного взаимодействия «педагог – ученик». Сложившаяся ситуация подводит нас к вопросу о необходимости овладения учителем возможностями, предоставляемыми смарт-технологиями в реализации образовательной деятельности в условиях онлайн- и смешанного обучения, что, в свою очередь, обуславливает поиск решений по эффективному проектированию применения смарт-технологий в цифровой образовательной среде учителя.

Цель заключается в обосновании педагогического дизайна модели имплементации смарт-технологий при проектировании персональной цифровой образовательной среды педагогов (на примере разработки авторского программного обеспечения Smart Assistant как средства оптимизации деятельности педагога по организации онлайн- и смешанного образовательного процесса).

Методология, методы и методика. Для достижения цели исследования нами были применены следующие группы методов исследования:

теоретические: кибернетический метод, метод обобщения, метод аналогии, метод абстрагирования, метод визуализации, метод моделирования, метод классификации;

эмпирические: методы анкетирования и интервьюирования; методы математической и статистической обработки данных.

В ходе экспериментальной части исследования был проведен анкетный онлайн-опрос на тему «Внедрение смарт-технологий в дизайне в персональной цифровой образовательной среде преподавателя в условиях дистанционного обучения в вузе» среди 201 преподавателя Карагандинского университета имени академика Е. А. Букетова (Республика Казахстан) и Университета Докуз Эйлюль (Турция) в период с 12 декабря 2022 года по 30 апреля 2023 года. Цель эксперимента заключалась в выявлении проблем адаптации преподавателей при осуществлении профессиональной деятельности в контексте цифровой образовательной среды и применении ими смарт-технологий в профессиональной деятельности. Для этого респондентам было предложно ответить на 15 вопросов и внести предложения-рекомендации в совершенствование цифровой образовательной среды вуза.

Результаты и научная новизна. В статье изучен и обоснован педагогический дизайн имплементации смарт-технологий при проектировании персональной цифровой образовательной среды педагогов, представлены результаты разработки авторского программного обеспечения Smart Assistant как средства оптимизации деятельности педагога по организации онлайн- и смешанного образовательного процесса, а также выявляются проблемы преподавателей вуза при адаптации и осуществлении профессиональной деятельности в контексте цифровой образовательной среды. Определены характерные черты проблем адаптации педагогов в цифровой образовательной среде и сложности применения смарт-технологий в профессиональной деятельности.

Практическая значимость. Был разработан программный продукт Smart Assistant как средство оптимизации деятельности учителя при организации онлайн- и смешанного образовательного процесса.

Ключевые слова: педагогический дизайн, цифровая образовательная среда университета, цифровая образовательная среда педагога, смарт-технологии, персональная образовательная среда педагога.

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DISEÑO PEDAGÓGICO PARA LA APLICACIÓN DE TECNOLOGÍAS INTELIGENTES EN EL ÁMBITO EDUCATIVO DIGITAL DEL DOCENTE

G. B. Sarzhánova[1], R. S. Bobesh[2], G. Zh. Smágulova[3]
Universidad de Karagandá E. A. Buketov, Karagandá, Kazajstán.
E-mail: [1]galiya008@mail.ru; [2]solnyshk@mail.ru; [3]smagulovag@mail.ru

A. Turkel
Universidad Dokuz Eylül, Esmirna, Turquía.
E-mail: ali.turkel@deu.edu.tr

N. B. Serikbáeva
Universidad Estatal Shakarim de Semey, Kazajstán.
E-mail: nurgul.sgpi@mail.ru

Abstracto. *Introducción.* De acuerdo a las disposiciones del programa "Kazajstán Digital" y del proyecto nacional "Profesor Digital", implementados en Kazajstán, en la actualidad se considera al docente no sólo como un usuario activo de las últimas tecnologías digitales e inteligentes, sino también como un creador y emisor de contenidos educativos digitales originales. Un docente moderno debe adaptarse y realizar actividades profesionales en el entorno digital al interior de la institución educativa, y ser capaz de diseñar su propio entorno educativo digital para transmitir contenidos educativos y organizar la interacción educativa efectiva "profesor-alumno". La situación actual nos lleva a la cuestión de la necesidad de que los docentes dominen las oportunidades que brindan las tecnologías inteligentes en la implementación de actividades educativas en condiciones de aprendizaje en línea y/o combinada, lo que a su vez, determina la búsqueda de soluciones para el diseño efectivo del uso de tecnologías inteligentes en el ámbito educativo digital del docente.

Objetivo. El objetivo del estudio consiste en fundamentar el diseño pedagógico de un modelo para la implementación de tecnologías inteligentes al diseñar un entorno educativo digital personal para los docentes (utilizando como modelo el desarrollo de software de autoría Smart Assistant como mecanismo para optimizar las actividades del docente en la organización del proceso educativo en línea y mixto).

Metodología, métodos y procesos de investigación. Para lograr el objetivo del estudio, se han utilizado los siguientes grupos de métodos de investigación:

1) teórico: método cibernético, método de generalización, método de analogía, método de abstracción, método de visualización, método de modelado, método de clasificación.

2) empírico: métodos de interrogatorio y entrevista; métodos de procesamiento de datos matemáticos y estadísticos.

En el transcurso de la parte experimental del estudio, se llevó a cabo un cuestionario en línea sobre el tema "Implementación de tecnologías inteligentes para el diseño de un entorno educativo digital personal del docente en el contexto de la educación a distancia en la universidad", donde participan 201 docentes de la Universidad de Karagandá E. A. Buketov (República de Kazajstán) y de la Universidad Dokuz Eylül (Turquía), realizándose la encuesta entre el 12 de diciembre de 2022 al 30 de abril de 2023. El propósito del experimento fue identificar los problemas de adaptación de los docentes al realizar actividades profesionales en el contexto de un entorno educativo digital y el uso de tecnologías inteligentes en las actividades profesionales. Para ello, se pidió a los encuestados que respondieran 15 preguntas e hicieran sugerencias y recomendaciones para mejorar el entorno educativo digital de la universidad.

Resultados y novedad científica. En el artículo se han examinado y fundamentado el diseño pedagógico para la implementación de tecnologías inteligentes al momento de crear un entorno educativo digital personal para los docentes; así como también, se han presentado los resultados del desarrollo del software Smart Assistant del autor como un medio para optimizar las actividades del docente en la organización en línea y semipresencial del proceso educativo, y también, identificando los problemas

de los docentes universitarios en la adaptación y realización de actividades profesionales en el contexto del entorno educativo digital. Se identifican los rasgos característicos de los problemas de adaptación de los docentes al entorno educativo digital y las dificultades de utilizar tecnologías inteligentes en las actividades profesionales.

Significado práctico. El producto de software Smart Assistant fue desarrollado como un medio para optimizar las actividades del docente al organizar el proceso educativo en línea y semipresencial.

Palabras claves: diseño pedagógico, entorno educativo digital de la universidad, ámbito educativo digital del docente, tecnologías inteligentes, entorno educativo personal del docente.

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Introduction

Within the realisation of the President's Address to the people of Kazakhstan titled "Unity of the people and systemic reforms – a solid foundation for the prosperity of the country", the Digital Kazakhstan Programme and the Digital Teacher national project are implemented[1]. According to the basic statements of the abovementioned documents, the teacher now is regarded not just an active user of the novel digital and smart technologies, but the creator and transmitter of the authors' digital educational content. The modern teacher is supposed not only to adapt to and perform the professional activity within the digital setting of the educational institution but also be able to design his/her own digital educational environment to transfer the educational content and organise effective "educator-learner" educational interaction. This brings us to the issue of the necessity for the teacher to be aware master and the opportunities provided by the smart technologies in realisation of the educational activity in terms of online and mixed learning. This conditions the search for the solutions for the effective design of smart technologies application in a teacher's digital educational environment.

The need for this research on the territory of the Republic of Kazakhstan is conditioned by the changes provoked by the digital technology application, increasing requirements for the list of teachers' competencies, which are not limited with ICT competencies and supplemented by digital technology.

There is no doubt that the teachers' digital competencies are not only a factor contributing to the expansion of educational opportunities, but also a kind of resource that determines the education development and transformation, in particular, and

[1] The next address of the president of the Republic of Kazakhstan K. Tokayev "Unity of the people and systemic reforms – a solid foundation for the prosperity of the country" [Internet]. 2022 Mar 16 [cited 2023 Jul 19]. Available from: http://www.gov.kz/memleket/entities/kyzylorda-karmakshy/press/article/details/5768?lang=en&ysclid=lngy9fhdrl180399386

the entire system as a whole. The core content of these competencies, the practical implementation of the algorithms for mastering and continuous improvement of these competencies is at the stage of study and research by the pedagogical and scientific community. Active digitalisation of education in quantitative and qualitative terms is hampered by the insufficient number of teachers, who have special mastery of pedagogical design, namely, those who have practical skills in designing and implementing modern ICT in the educational context.

The concept of "instructional design" is a relatively new concept in pedagogical science. It was initially introduced into the pedagogical terminology during the early 1940s by R. Ganzhe[1]. Triggered by significant technological advancements during the periods of industrialisation and post-industrialisation, information-communication and computer technologies have indeed become integral components of human existence. They are indisputably regarded as essential components of instructional design. Consequently, the creation of educational online resources serves as a pedagogical technology. This technology amalgamates two distinct types: instructional design technology, which focuses on formulating methodological theories for specific subject areas; and web design technologies, which concentrate on digital implementation of these methodological theories within the online domain. This amalgamation has solidified its position in academia under the term "instructional design".

The purpose of the present research is to substantiate the instructional design of the implementation model of smart technologies when designing teacher personal digital educational environment (on the example of our software Smart Assistant as a means of optimising the teacher activity in organising an online and mixed educational process). Our Smart Assistant software product is presented as a result of the scientific and theoretical substantiation and development of a model of instructional design of smart technology implementation into a teacher personal digital educational environment.

In this regard, we posed a research question: "Is it possible to create such a smart tool that would simultaneously and completely combine the capabilities of various existing software products (shells), test programs, interactive online class platforms? Moreover, allowing teachers to optimise his/her activities in the organisation of the educational and cognitive process in online and blended learning conditions, regardless of the conditions of its implementation, educational goals, content of the academic subjects, forms and types of organisation of students' educational activities". To resolve this issue, a study was conducted, the purpose of which was to scientifically substantiate the model for the implementation of smart technologies in the design of a teacher personal digital educational environment, to study the issue of teachers' readiness to use smart technologies in professional activities, to develop and test our software product Smart Assistant based on survey results, as well as to assess internal and external factors influencing the development of this software product.

[1] Gagné R. M. The conditions of learning. Holt, Reinhart & Winston: New York; 1965. 308 p.

The limitations of this article are that in modern conditions there is no common understanding of the concept of a teacher digital educational environment, and along with it there are no uniform requirements for its design. In this case, targeted work is required to systematise theoretical knowledge and organise experimental work, under which it is possible to design a teacher digital educational environment using instructional design technology. When studying the issue of adaptation of teachers in performing their professional activities in the context of the digital educational environment, a survey was made among 201 teachers of the Faculty of Foreign Languages of Karaganda Buketov University (Republic of Kazakhstan) and Dokuz Eylul University (Turkey), which represents a sufficient reference sample. Moreover, a limitation in this study is also presented with the set of specific multimedia programs, software, and smart equipment, which formed the basis for the development of our software product named Smart Assistant.

Literature Review

The education system in Kazakhstan confronts several challenges, one of which involves the disparity between the caliber of digital educational settings and the requisites of diverse sectors within the job market. These sectors require professionals adept in digital skills and capable of excelling in a rapidly evolving range of professions. According to G. Z. Smagulova et al., it is worth acknowledging that a considerable proportion of contemporary Kazakhstani students and school pupils express discontent with the digital facilities within schools and higher education [1]. A distinct request from the younger generation for a shift from conventional methods of structuring the educational process to digital and hybrid models has taken shape.

The professional orientation of higher education determines the mechanisms and format of the educational content transfer and acquisition. The educational environment acquires a great importance in the processes of the future specialist's development, as it is the space in which students' universal and professional competencies development take place.

From the point of view of the effectiveness of the learning process, the educational environment should be considered as a factor, condition and a tool of student's education and development, and a subject to teacher design and modelling as well as psychological and pedagogical considerations. With the formation and development of a digital smart society and the accompanying concept of smart education, the changes in the educational environment in digital and non-digital patterns have been clearly observed. In addition, with the rapid development of smart technologies, the importance of creating a smart digital educational environment is becoming increasingly important in the field of education, and this trend is becoming more and more pronounced.

The invention of artificial intelligence and its wide spread implementation in all the spheres of human life has led to the transition from "e-learning" paradigm to the smart education. E-learning at the beginning of the 21st century was applied as an innovative and informative technology of distance learning, but now it has turned

into a "smart" technology, which is dynamically reconfigurable and intellectually enriching technology that uses "smart" technologies and digital tools.

S. Munawar et al. believe that "the information and communication technology are developing quickly to improve the productivity of the country economically for forming a digital solution which is provided with any software or hardware system application" [2].

V. P. Tikhomirov notes: "The concept of 'smart' is a new paradigm of society development, behind which is the future of its development. It implies a comprehensive modernisation of all educational processes, methods and technologies and brings new technologies into the educational industry, allowing for new organisation of content development, delivery and actualisation" [3].

G. Z. Smagulova et al. state that the currently existing regulatory, policy documents, developed and adopted state concepts and projects establishing priority directions for Kazakhstani system of education, the actively implemented digitalisation of educational organisations, the availability of personal computers among students and teachers, expanding the digital educational environment functions and urgent demand for qualified specialists, actualise the problem of training a teacher who is ready for the multifunctional use of the potential of digital technologies and who implements the technology of instructional design in designing his/her digital educational environment [1].

Creating a personal educational environment for a teacher can solve a number of problems of distance learning. Since the key task of all educational systems is to prepare people with a wide range of skills and competencies, it is highly important for the education today to provide the favourable conditions to improve the teacher's mastery of digital technologies through his/her digital space. The analysis of scientific and pedagogical literature allowed us to draw a number of important conclusions:

- Today, the digital competence of teachers in Kazakhstan is at the stage of formation, and the implementation of the digital educational environment of the teacher will have a positive effect on the education process.

- A range of problems preventing teachers from carrying out distance learning has been identified. The main problems of distance learning realisation include: an increase in the burden on teachers and students, an unsatisfactory level of organisation of the educational process using distance technologies, formalisation of education, and the lack of face-to-face interaction between teachers and students.

Initially, instructional design was pedagogical design and learning design. As a bridging discipline, it is also the study of researching and improving methods for development, presentation and assessment of educational instruction and learning practices by continuously incorporating findings from other disciplines (such as cognitive psychology).

I. A. Takushevich shares Merrill's viewpoint and states that in its classical form, instructional design can be defined as the development of the "most effective, rational, and comfortable teaching methods, techniques, and systems available in the field of professional educational practice" [4, p. 4].

E. Chernobai et al. summarise that methodologists operate various terms referring to instructional design, including:

– "instructional design" – development of didactic materials;
– "learning design" – development of educational process;
– "learning environment design" – development of educational environment;
– "learning activities design" – development of learning activity of students [5].

As we can see, instructional design approach to organising the learning process is considered by most Kazakhstani and foreign scientists as a systematic and methodical approach. It has been prevalent among scholars and practitioners for more than a century. In recent years, several models have been developed to understand the learning process and to create learning materials.

T. V. Aslamova highlights that the instructional design model essence involves adaptability, a wealth of sources, a wide array of multimedia elements (such as audio, video, and graphics), and the capacity to conform to the audience level and requirements swiftly and effortlessly [6].

A number of scientists and methodologists analysed the essence and the structure of instructional design, various theories and its role in teaching certain subjects. Depending on the purpose of instructional design and the content of its design, characterised by flexibility, accessibility, versatility and the possibility in the learning environment one can create such models as ADDIE, SMART, SAM and ALD. Yet, most widely used model is ADDIE (Analysis, Design, Development, Implementation, Evaluation) (Fig. 1).

The instructional design in designing a teacher personal digital educational environment is directly related to the development of modern digital information and communication technologies. Increasingly, the term "smart" can be found in the pedagogical methodological literature. N. V. Dneprovskaya et al. give a fairly broad concept of "smart", which allows us to fix it in the methodological apparatus of education [7].

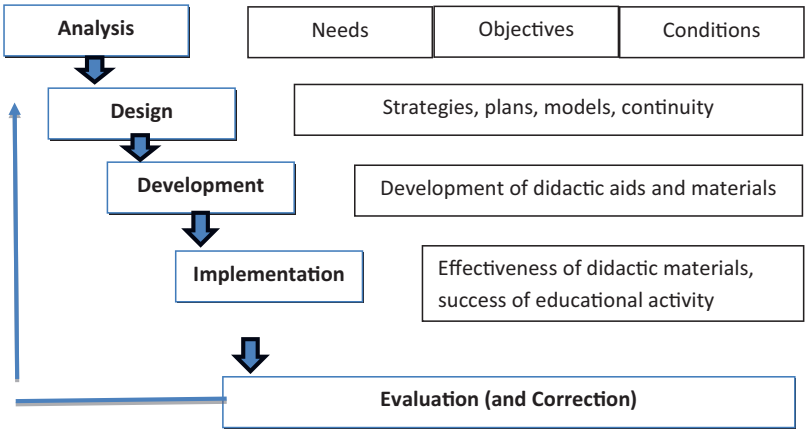

Fig. 1. Instructional design as a technology

N. V. Dneprovskaya et al. believe that "smart" characterises a system or procedure attribute that becomes evident through its engagement with the surroundings. This attribute empowers the system and/or procedure to:

• swiftly react to shifts in the external surroundings;
• adjust to evolving circumstances;
• autonomously progress and self-regulate [7].

A. A. Aletdinova and A. A. Melnichenko scrutinised different methods of grasping the notion of intelligent education and they outlined the subsequent domains:

- "Smart" is seen as an educational, intellectual environment;
- "Smart" is regarded as a combination of educational institutions and faculty (with which it is difficult to agree; rather, it should be considered as a kind of infrastructure for education, in this case at a university);
- "Smart" as a new kind, a new approach to education that allows us to achieve either better results or more effective ways;
- "Smart" as a personality formation within the enhanced by developing his/her new smart competencies [8].

A. A. Aletdinova and A. A. Melnichenko also note that smart technologies enable the creation of educational products that facilitate personalised and interactive learning experiences for various user groups [8].

One should note that in the context of this research the term "smart" should be regarded in the meaning of "clever, intelligent" or "using digital technology" rather than as an acronym derived from Management (SMART: Specific, Measurable, Assignable, Realistic, Time-relevant). Here, the acronym "SMART" should be seen as a phenomenon consisting of five key concepts: 1) "Self-directed"; 2) "Motivated"; 3) "Adapted"; 4) "Resource enriched"; 5) "Technology-embedded".

A prominent contemporary trend in social advancement involves the development, integration, and operation of smart technologies across diverse domains. These technologies bring about substantial changes not only in technological processes but also in social dynamics. This has led to the emergence of discussions about the formation of a smart society as a distinct form of public organisation.

T. V. Belenko and I. F. Issayev note that notion of a smart teacher represents a novel dimension in teaching, where the amalgamation of technologic tools, services, and internet resources among learners results in transformative interactions among participants. This gives rise to novel outcomes – social, economic, and other benefits – aimed at enhancing education [9]. The ongoing evolution of the education system suggests that smart education is progressively supplanting traditional classrooms and limited-scenario e-learning, acting as a supplementary tool. The concept of smart education is geared towards delivering the utmost quality of education, enabling graduates, particularly those from colleges and universities, not only to excel in rapidly evolving professional landscapes but also to adapt to an innovative society.

In accordance with the point of view of J.-M. Liang et al., the necessity for implementing smart technology arises from the digitalisation of domestic education,

necessitating modern tools and targeted resources to cater to the educational ecosystem stakeholders: educators, students, and parents [10]. At the same time, P. Youhasan et al. say that smart technologies go beyond mere instrumental support for instructional activities, encompassing online tools and services, which facilitate the creation of personalised digital educational environments for both teachers and students. These environments facilitate the design of individual learning paths [11].

Furthermore, it is important to highlight that contemporary undergraduate and graduate educational programmes allocate more time to extracurricular work. Consequently, the potential of smart tools and smart services grows, offering avenues for remote support systems, the supervision of university students' endeavors, the distribution and dissemination of digital educational content, and the cultivation of competencies pertinent to 21st-century specialists. Such perspectives are articulated by both Kazakhstani and foreign authors including A. V. Solovov [12], S. A. Konovalova, N. I. Kashina [13], I. Lyapina [14], N. Ignatieva, I. Zhdankina [15], M. S. Chvanova [16], Ş. Ţălu [17], M. Kalantzis, B. Cope [18], P. L. Davidson [19], P. García-Tudela [20], J. O. Connelly, P. Miller [21], J. M. Spector [22].

The study of the essence and evaluation of digital competencies and digital competence of teachers is presented in the works of Kazakhstani authors A. B. Barlybaev [23], A. A. Sharipbaev [24], I. S. Mukhametzhanov [25].

The active introduction of smart technologies in all spheres of society, the focus on the digitalisation of the economy necessitates the transformation of the education system, the development of digital pedagogy. In these realities, the digital competencies of teachers are not only a factor contributing to the expansion of educational opportunities, but also a kind of resource that determines the development and transformation of the educational procedure sand the entire system as a whole [11].

The analysis of recognised international approaches in the realm of assessing teacher digital skills reveals the following:

The area that has evolved within research pertains to comprehending, delineating, and organising teacher digital proficiencies. This highlights the broadening scope of their tasks, alterations in training prerequisites, and shifts in the circumstances for professional advancement.

Owing to the swift evolution of the digital landscape, the suggested standardisations for teachers' professional digital skills are not all-encompassing and necessitate ongoing investigation and establishment.

This provokes the issue of putting forward the research related to the identification and description of professional competencies that would reflect the content of what the educators perform within the potential of digital educational setting, the development of new teaching aids by teachers; develop national solutions to ensure the digital competence of teachers, make additions to the register of professional competencies of a teacher.

An examination of the practices in countries actively embracing smart technologies indicates that the integration of the smart education concept contributes to the education of highly skilled professionals, thereby fostering swift

economic progress. As a result, nations championing smart education principles, such as Korea and Singapore, have significantly advanced in their technological evolution. The Republic of Korea, which embraced the smart education concept, successfully cultivated an industrialised economy and a distinct innovation framework by consistently investing in human resource development. Over the past 6 years, it has consistently held the top position in Bloomberg's ranking of the most innovative countries. As of 2019, Singapore occupies the 6th position in this ranking, trailing behind only Germany, Finland, Switzerland, and Israel in terms of developmental progress (Bloomberg 2019 Innovation index).

The current generation of young students belongs to the generation Y and Z and requires a new format of professional training, novel approaches to learning, and teachers of a new formation. Within the context of education digital transformation, the instructional process transit into an educational environment. This transition, as Mironenko E. S. states, guarantees accessible and uninterrupted education to cater to the learning requirements of the population, while also fostering an increase in intellectual capital. Consequently, the digitalisation of education necessitates the establishment of a digital educational context [26].

S. V. Tarasov & I. A. Bayeva in their work point out that upon examining publications addressing educational environments, it becomes apparent that experts from diverse fields describe its functional purpose and structural elements differently [27]. Philosophically, there is a call for "constructing a fresh educational context, a multi-dimensional realm that aligns with the needs of young individuals and responds to the current cultural trends and dynamics".

From a psychological perspective, there is a rationale to formulate, craft, and apply the educational context as a factor, condition, and tool for shaping the educational process within both general and higher education institutions. Kazakhstani and foreign psychologists V. I. Panov, V. V. Rubtsov; V. A. Yasvin, E. Afari, H. J. Walberg emphasise in their works the need to design the educational environment [28–32].

Now we witness a reconsideration of the function of computer technology within the educational system, prompted by the swift advancements in Internet capabilities. Upon scrutinising these technological advancements, it becomes apparent that the term "computer technology", which has encompassed information technology essence for the past decades, is progressively being supplanted by concepts such as "electronic technology" and "digital technology". Therefore, in the current phase of educational development, it is prudent to discuss the evolution of a digital educational environment.

The significance of this digital educational environment, within the context of society digitalisation and educational modernisation, is justified by scholars S. V. Tarasov and A. E. Maron, as they note that "in the era of rapid changes in all spheres of people's life, the issues of updating the content and quality of education as the ability of the education system to ensure the achievement of the goals of the individual, society and the state deserve special attention. The solution to this problem is possible by modeling the educational environment, the backbone

component of which will be the formation of a fundamentally new system of continuous education" [27, 33].

G. O. Tazhigulova et al. support A. Khutorskoy, who considers educational environment to be natural or artificially created socio-cultural environment of a person, including various types of means and content of education, capable of ensuring a productive activity of the student [34].

During the examination of both national and international scholarly works, various methods for elucidating the meaning of the term "digital educational environment" were explored. After comparing the aforementioned perspectives concerning the interpretation of the "digital educational environment", it can be inferred that researchers concur on the notion of it as a system encompassing an array of information, digital and educational resources, alongside the technologies to apply them, ensuring the efficient absorption of educational materials by students. This holds true regardless of their geographical location and tailored to their abilities and preferences.

In Kazakhstani educational practice, the presence of an electronic information and educational setting stands as a prerequisite for the implementation of higher education programmes within an educational institution. It should provide access to curricula, course outlines, discipline work plans (modules), practical activities, electronic library system publications, and digital educational resources as outlined in the course syllabi. Additionally, it should facilitate the tracking of the educational process, interim assessment results, and mastery of the primary educational curriculum. This encompasses conducting various classes, evaluating learning outcomes, with e-learning and distance learning technologies being utilised.

The digital environment also involves forming an electronic portfolio for each student, comprising the storage of his/her work, evaluations, and appraisals from any participants within the educational process. S. A. Asanov, G. V. Akimenko, E. V. Shirinkina, B. Gros, M. Batoon, L. Morales and J. Figueroa establish interaction among the participants of educational process, may it be synchronous or asynchronous via the Internet [35–38].

Methodology, Materials and Methods

The methodology of the research relies on the principles of systemic analysis, cybernetics, educational psychology and didactics. The following categories of research methods were used to reach the goal set:

theoretical: cybernetics method, generalisation, analogy, abstraction, visualisation, modelling, and classification;

empirical: surveys and interviews techniques, as well as mathematical and statistical data analysis approaches.

The experimental part of the research consists of three main stages: preliminary research (survey), instructional design of teacher digital educational environment (development of Smart Assistant digital tool), assessment of the developed Smart Assistant digital tool.

To help teachers in the implementation of distance and blended learning formats, it was necessary, first of all, to determine the readiness of the teachers to work in an online format, and then, after analysing the needs of the respondents, identifying their initial level of digital competence, to study the possibilities of the existing software products and platforms in order to develop a unified, universal, multifunctional, adaptable digital platform that would be accessible to all teachers, regardless of the disciplines taught, access mode, goals and content of training.

The first part of the study an online questionnaire survey on "Implementation of smart technologies in designing a teacher personal digital educational environment in conditions of distance learning at a university" was conducted among 201 teachers of Karaganda Buketov University (Republic of Kazakhstan) and Dokuz Eylul University (Turkey) from 12 December 2022 to 30 April 2023. The aim of the experiment was to identify problems with the adaptation and implementation of smart technologies in designing a digital educational environment. For this purpose, the respondents answered fifteen questions and made suggestions for improving the university digital educational environment.

Results

At the initial stage of the survey, the total number and age of survey participants were analysed in order to objectively represent the number of working teachers and break them down into conditional age groups (Table 1).

Table 1

Distribution of survey participants by age

University	Age of the teachers					
	Total number of participants	< 25	25–34 years old	35–49 years old	50–59 years old	> 60
Karaganda Buketov University	126	18	39	59	9	1
Dokuz Eylul University	75	13	20	37	5	-

Based on the data obtained, the percentage of responding teachers at two universities by age was presented (Table 2).

Table 2

Distribution of teaching staff of educational institutions by age in percentage

University	Age of the teachers					
	Total number of participants	< 25	25–34 years old	35–49 years old	50–59 years old	> 60
Karaganda Buketov University	126 (100%)	14,3%	31%	46,8%	7,1%	0,8%
Dokuz Eylul University	75 (100%)	17,3%	26,7%	49,3%	6,7%	0%

Analysing the distribution of teaching staff of educational institutions by age in percentage, we can conclude that the predominant group (on average about 48%) are the teachers aged 35–49 years, about 29% are the teachers aged 25–34 years, a little more 30% are the young specialists under 25 years of age, less than 1% are the teachers over 60 years of age.

The survey results showed that 71% of the teachers are familiar with the concepts of "smart education" and "smart technologies", 9% have no idea about these concepts, and 20% found it difficult to answer this question.

The largest part of the respondents (47%), answering the question about the essence of the concept of "smart education", considers "smart education" to be an educational environment, and 20% of the respondents treat it as an educational network, 17% understand "smart education" as a guided learning process, 16% found it difficult to answer this question.

Also, 63% of the respondents considered the format of formal and informal learning to be the structure of the concept of "smart learning", 8% of the teachers believed that the structure of the concept includes only informal learning, 6%, on the contrary, believe it refers to formal learning only, and 23% found it difficult to answer.

The teachers' answers to the question about the identity of the concepts "smart technologies" and "digital technologies" showed that the largest proportion of the respondents (44%) believe that they are not one and the same thing, 24% consider them synonymous, and 32% doubt in their answers.

Moreover, 65% of the teachers identified "smart education" as an instructional model, and 23% as a supplementary teaching tool, 12% found it difficult to answer.

In addition, 84% of the teachers surveyed use elements of smart education in their teaching activities this or that way, while 16% of the teachers do not use them at all.

The next question shed light on what the teachers think smart education in digital educational environment is (Fig. 2).

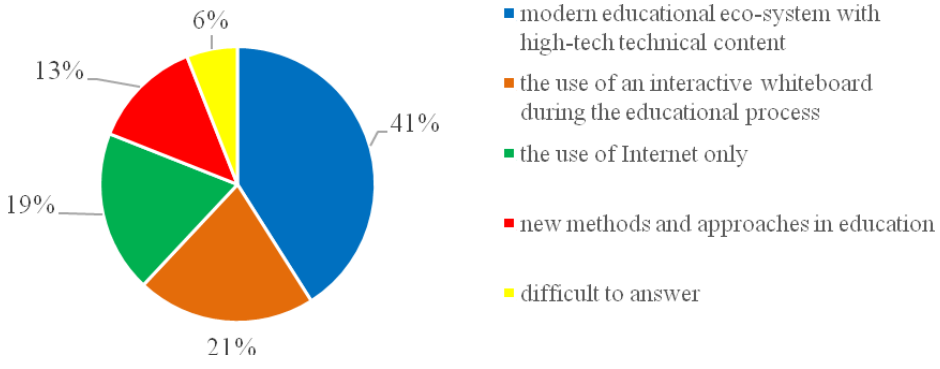

Fig. 2. Respondents' ideas of the concept of smart education in the digital educational environment of a university

When asked whether they are participants in "smart learning," 58% of the respondents gave a positive answer, 14% gave a negative answer, and 28% were not sure in their responses.

However, about 68% of the region's pedagogical community surveyed supports the use of smart technologies and digital tools in the educational process, 18% were against it, and 14% found it difficult to answer.

The use of smart technologies and digital tools by teachers to organise students' independent work was supported by 73%, automation of checking homework by 61%, and as a mechanism for assessing and monitoring students' educational achievements by 46%.

The teachers identified the main difficulties of using smart technologies in their teaching activities as technical difficulties (31%) and organisational difficulties (22%).

A number of studies on the current state of teacher's digital competences indicate their level of readiness to apply smart technologies in their professional activities. Our study is no exception. Thus, the results of our survey of teachers show that the most of them (68%) are at the basic level, 29% of the respondents show a digital competence of the "digital use" type, and only 3% of the respondents are at the "digital transformation" level. The pattern of data obtained is explained by the need for methodological support for teachers to work in the digital environment, the lack of digital competence and the belief of the teacher community in the poor quality of existing educational materials.

The examination of outcomes derived from the experimental phase of the research (questionnaire-based) demonstrated that incorporating smart technologies into the instructional design of the teacher individual digital educational environment yields beneficial outcomes for structuring the educational process. Concurrently, it enhances the efficiency of both the teacher and the students. Thus, according to the data, slightly more than half of the respondents (52.1%) stated that they did not experience any particular difficulties associated with the organisation of the educational process. At the same time, 43.8% of the survey participants rated their level of adaptation to new conditions as satisfactory, and only 4.2% expressed insufficient or complete unpreparedness for the implementation of smart technologies in the organisation and conducting classes in their disciplines (Fig. 3).

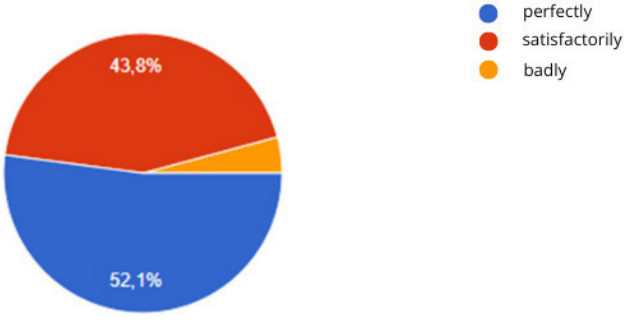

Fig. 3. Adaptation of the respondents to the conditions of distance learning

Studying the issue of teachers' motivation whilst usage of smart technologies to design their own digital educational environment, we noticed that the respondents expressed an ambiguous answer. Most of the respondents (45.8%) noted an increase in their motivation in organising and conducting training sessions remotely. At the same time, 39.6% of the teachers did not particularly notice the difference and answered that their level of motivation remained at the same level. Of particular interest was the answer of the remaining respondents (14.6%), who answered that their level of motivation had decreased.

We believe that the answers of the survey participants, whose level of motivation showed a negative trend, can be explained by the social and age characteristics of the personalities of teachers. It is no secret that most of the teachers aged 45+ are representatives of the "old school", who do not have enough experience in the application of modern information and communication technologies, all the more so they are forced to conduct educational activities in a distance format (Fig. 4).

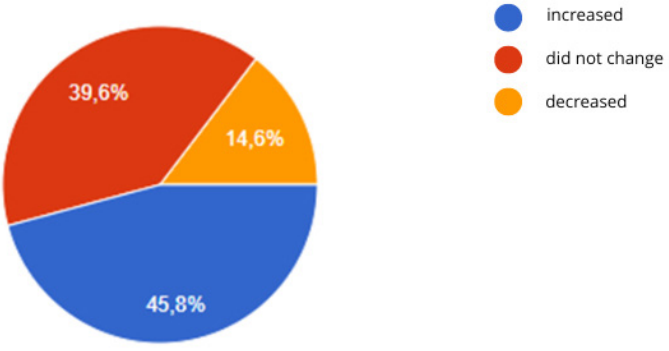

Fig. 4. The level of motivation of the respondents

Earlier in the article, we noted that the current generation of students belongs to the so-called generation Y and Z. With the development of telecommunication networks and computer technologies, modern young people skillfully operate with a huge flow of incoming information using various gadgets. Teachers, in turn, should keep up with the times and keep pace with those they teach. According to the data obtained on how teachers use the digital space and how it affects the educational process, we found that novel technologies and gadgets application directly contributes to the educational and learners' cognitive activity. The educator finds it easy and convenient to render the educational material in the digital space: 97.9% of the respondents actively use personal computers and laptops for distance learning, 62.5% limit themselves to mobile phones, and 12.5% of the survey participants noted a tablet in the form of the main working device for conducting classes at a distance (Fig. 5).

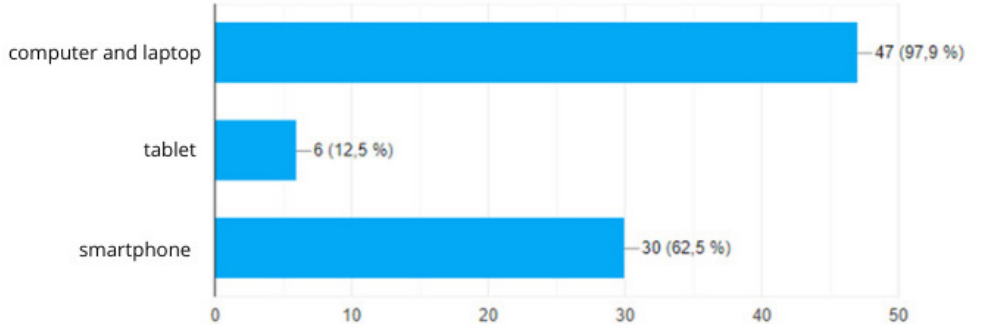

Fig. 5. Preferences of teachers in smart tools use

With the development of digital technologies, it is vital for teachers to develop digital competence as an integral part of professional competence. This is explained by the fact that the use of smart technologies makes it possible to intensify the educational and cognitive activity of students, and teachers to meet the educational needs of students. At the same time, only one application of computer technology and access to the Internet is not enough to improve the academic performance of students. Teachers should be trained to effectively integrate digital technologies into the learning process and to complement and modify existing teaching methods. It follows that digital technologies increase the level of professional training of a teacher.

As practice shows, the attitude of teachers to smart technologies is a key factor in the successful implementation of technologies in education. Meanwhile, teachers do not always have a positive attitude towards smart technologies, sometimes showing a negative attitude towards their existence and purpose. The most frequent obstacles to mastering smart technologies by teachers are: lack of time; lack of access to these technologies; lack or shortage of resources; lack of experience and lack of support from the university.

Thus, a survey conducted at the Karaganda Buketov University among the faculty of the Faculty of Foreign Languages, showed that 45.9% of the respondents note the poor quality of the Internet connection at the university, 37.5% of the respondents complain about regular technical failures, 27.1% did not encounter problems, 2.1 % complain about the inability to download the application or the necessary material, the same number of the interviewed (2.1%) complain that there are computers in the classrooms, but there are no speakers, the remaining 2.1% of the respondents complain that browsers are not updated, the Word program does not work correctly, and its counterpart is inconvenient to use (Fig. 6).

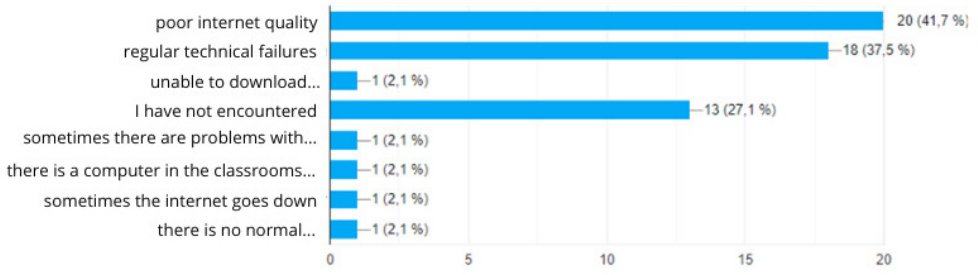

Fig. 6. The most frequent barriers to mastering smart technologies by teachers

We believe that the introduction of digital technologies in any educational institution requires a high degree of organisation, as well as a long planning process involving many different specialists, and since any implementation is inherently laborious and time-consuming process with various stages, it is necessary to focus on ways to support the effective implementation of technology in education [39].

Firstly, it is necessary to provide the educational institution with the necessary equipment and Internet connection, and, secondly, to provide appropriate training for teachers to use digital technologies.

The digital educational environment is not only an interaction between a student and a teacher, but also an opportunity to improve one's professionalism. Thanks to smart technologies, teachers have the opportunity to attend various online courses, trainings, seminars, conferences, while saving material resources and time. In the personal digital educational environment of a teacher, professional growth is seen as a continuous process, and this is its andragogical value. The existence of a personal digital educational environment for a teacher is the implementation of the concept of "education for all" and "education through life for life".

Summing up the results of the survey conducted using Yandex forms, we can conclude that the teaching community is systematically changing its attitude towards smart technologies, smart education, and artificial intelligence technologies in a positive direction. We associate these changes primarily with the comprehensive digitalisation of the education system of the Republic of Kazakhstan, providing participants in the educational process with access to a single digital educational space, as well as with the elimination of "professional deficits" of teachers through programmes for continuous professional development of teachers.

At the same time, analysing the results of the survey, it can be noted that problems of an organisational and technical nature remain. In addition, the trend of aging teaching staff continues, which also creates difficulties in incorporating smart technologies into educational practices.

Discussion

The preliminary survey as a stage of the study helped us identify the main range of problems associated with the design of a teacher digital educational environment. In particular, we determined the readiness of teachers to carry out professional activities in the context of the digital educational environment of the university, studied their educational needs, determined the level of digital competence, and, accordingly, determined the necessary functionality, which was subsequently reflected in the design of our software product Smart Assistant.

Therefore, following an analysis of the essence of the "instructional design" and "digital educational environment" concepts mentioned before in Literature Review section, along with identifying the ADDIE instructional design model as fundamental for crafting a personalised digital educational environment for educators, the groundwork for developing the original Smart Assistant model was initiated. The model presented by us consists of 3 main stages:

- the design stage of the teacher's activity (organisation, storage, transfer of educational content, taking into account the set learning goals);
- the stage of performing the teacher's tasks (providing interactive assistance during the educational process);
- the analytical stage of the teacher's activity (Fig. 7).

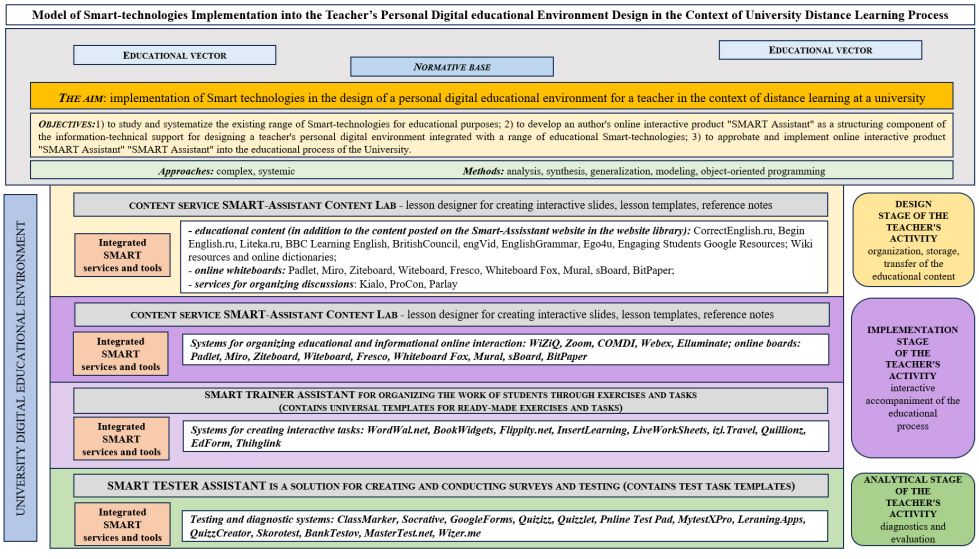

Fig. 7. The model of smart technology implementation into the teacher's personal digital educational environment design in the context of university distance learning process

The instructional design model for designing a teacher personal educational environment using smart technologies has been developed in accordance with the identified stages of a teacher professional activity – design, implementation, analysing, which allow optimising the interaction among individuals engaged in the educational procedure, organising and broadening the range of their educational and cognitive activities through the implementation the software product Smart Assistant in his/her professional activity and concretisation and systematisation of the existing range of smart tools and products.

The software product Smart Assistant acts as an organising and structuring component of information and technical support for designing a teacher personal digital environment, optimising his/her activities to enhance educational and cognitive activities and educational interaction between the members of the learning environment, retention and conveyance of digital educational materials, diagnostics, correction, evaluation and control of educational achievements of students in the conditions of distance learning at the main stages of its activity.

The fulfillment of instructional and technological design standards for the software product is guaranteed by assembling a research project team with specific expertise and skills, followed by essential Beta testing and potential adjustments if they are needed.

While designing the proposed model, the variety of smart tools and services is integrated into complexes according to the identified stages of the teacher's activity within his/her professional routine.

The model puts forward the idea that the possibilities of using existing online educational tools and services and the developed interactive system Smart Assistant are integrated, leading to the streamlining of the teacher's tasks in orchestrating educational sessions and facilitating interaction among the participants within the learning environment.

The model is built according to the selected stages of the teacher's activity. The main function is to organise the users' mutual work by applying the templates presented on the website.

The interactive system contains subsections, each of which contains specialised content (ready-made templates for organising a particular educational activity) and allow the teacher to plan and organise his/her work through a set of ready-made solutions at all stages of his/her activity when planning, compiling an outline of a lesson, compiling exercises, tasks and tests (Fig. 8).

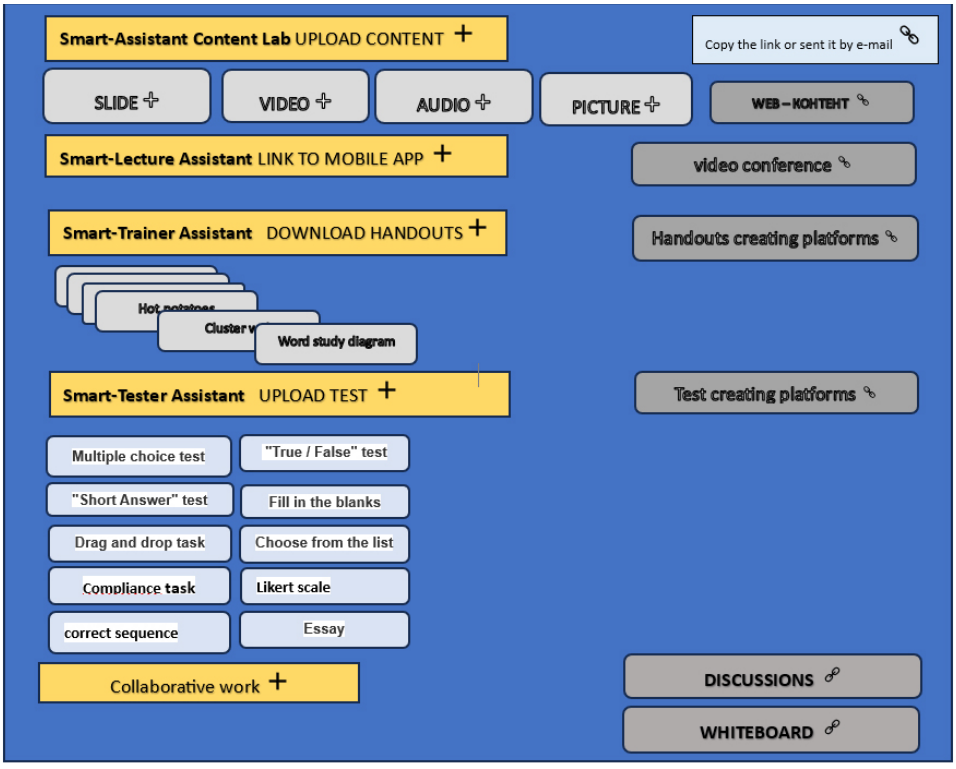

Fig. 8. Schematic representation of the structural components of the interactive complex Smart Assistant

Thus, the structural components of the interactive system Smart Assistant include:

• content service Smart Assistant Content Lab – a lesson designer for creating interactive slides, lessons, reference notes (accompanied by ready-made presentation templates to present and organise educational material);

• Smart Lecture Assistant – a mobile application used for gathering systematising data while conducting a lecture session online (it facilitates the work of a teacher in collecting data about present users, the time of watching a lecture in online video conferencing systems, such as Zoom);

• Smart Trainer Assistant for organising the work of students through exercises and tasks (contains universal templates for ready-made exercises and tasks) (Fig. 9).

NAME _____ CLASS _____ DATE _____

Graphic Organizer

How-to Essay

Activity	Steps	Equipment
	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.
	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.
	1. 2. 3. 4. 5.	1. 2. 3. 4. 5.

NAME _____ CLASS _____ DATE _____

Graphic Organizer

Rank Order Chart

Topic: _____

Rank	Item	Explanation
1		
2		
3		
4		
5		
6		
7		
8		

Fig. 9. Handouts templates in Smart Trainer Assistant

• Smart Tester Assistant – a solution for creating and conducting surveys and testing which contains test templates. Smart Tester Assistant is maximally adapted to the educational needs and needs of any teacher, goals and content of the training course. In this section, the teacher is offered a number of templates for creating test questions (see Fig. 10).

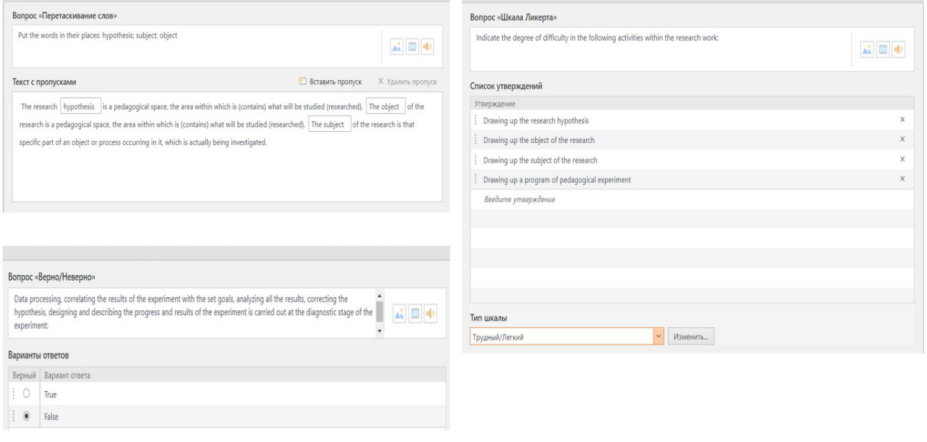

Fig. 10. Test templates in Smart Tester Assistant

In general, the complex allows us to combine learning resources, including PDF, Google and PowerPoint files, to create an active educational session, supplement learning content with interactive tests, games and tasks, and adjust the pace of the learning session.

Smart services and digital toolkit integrated into the model includes the following online services and reflects the system of smart services, including:

1) Educational content (in addition to the Smart Assistant in the website library): CorrectEnglish.ru, Begin English.ru, Liteka.ru, BBC Learning English, British Council, engVid, EnglishGrammar, Ego4u, Engaging Students Google Resources; Wiki resources and online dictionaries;

2) Systems for organising educational and informational online interaction: WiZiQ, Zoom, COMDI, Webex, Elluminate; online boards: Padlet, Miro, Ziteboard, Witeboard, Fresco, Whiteboard Fox, Mural, sBoard, BitPaper; services for organising discussions in Kialo, ProCon, Parlay;

3) Presentation creation services: Mentimeter, GoogleSlides, Prezi, Emaze, Powtoon, Photobubble, Canva, Pictochart, Genially;

4) Systems for creating interactive tasks: WordWal.net, BookWidgets, Flippity.net, InsertLearning, LiveWorkSheets, izi.Travel, Quillionz, EdForm, Thihglink;

5) Testing and diagnostic systems: ClassMarker, Socrative, GoogleForms, Quizizz, Quizzlet, Pnline Test Pad, MytestXPro, LeraningApps, QuizzCreator, Skorotest, BankTestov, MasterTest.net, Wizer.me;

External resources (communities, online resources like wikis, dictionaries, encyclopedias, and more are employed to broaden, enhance, and complement students' knowledge and skills. Documents related to educational process management are shared on the Smart Assistant platform. Collaborative efforts (especially during challenges) and individual learning trajectories are facilitated through cloud services, serving as supplementary sources of information.

As we have previously mentioned, the instructional design of digital educational environment of teachers based on the implementation smart technologies go through three main stages: planning (organisation), realisation (procedural), and assessment. The problems of implemetation of smart technologies and their integration into the digital educational environment of teachers can be found in each of these three stages. The attempt to find better solutions to these problems pushed us to the idea of creating a contemporary, multifunctional, adjustable, understandable digital instuctional tool that would unite the best educational practices in optimising a teacher professional activity – Smart Assistant digital tool. The results of SWOT-analysis the general characteristics of Smart Assistant are displayed below (Fig. 11).

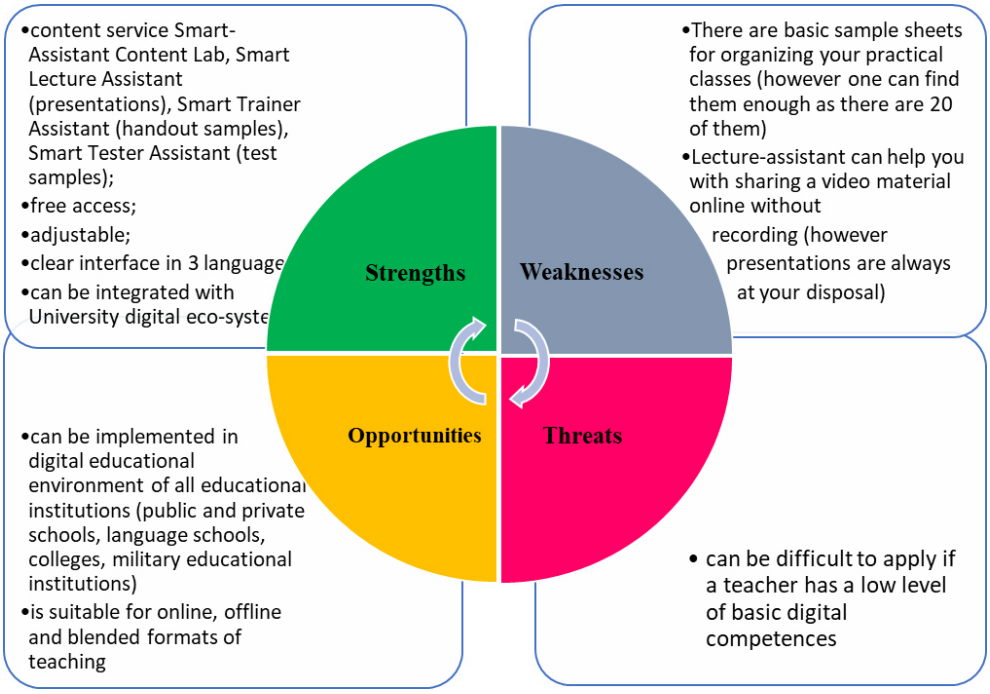

Fig. 11. SWOT-analysis of Smart Assistant digital tool developed by the research group

A comprehensive strategy in utilising smart tools proposes that the interactive suite Smart Assistant does not eliminate but rather complements and involves the utilisation of already existing smart technologies by using the didactic potential of the latter in organising forms of activity and participants' interaction in the educational process in the conditions of distance learning. The implementation of this approach consists in combining the possibilities of using existing online educational tools and services (search engines; organisers; publishing tools: blogs, file hosting, etc.; communication tools: social networks and specialised services; cooperation services: cloud document editors; learning platforms: LMS, MEP platforms, video hosting).

Adopting a systematic perspective, a digital individualised learning setting is perceived as an organised and technological system, comprised of structural elements that encompass an array of technical tools and supportive mechanisms: modern technologies (including smart technologies), methods, tools, resources, environmental subjects.

Thus, the results of the preliminary survey, the results of SWOT and the content analysis of the pedagogical design of the automated software product Smart Assistant implemented in the digital environment of the Karaganda Buketov University

confirm the scientific hypotheses of scientists, experts and practitioners involved in the active implementation of smart technologies in the digital educational space, and also expand and complement existing research on the problems of developing a teacher digital competence.

Conclusion

The Digital Kazakhstan Programme and the Digital National Project are being implemented to realise the Address of the President of Kazakhstan to the national unity and institutional reforms – a solid foundation for the country's prosperity. According to the principal provisions of the Address, teachers are not considered to be active users of modern digital and smart technologies only; they are creators and transmitters of the teacher's personal digital educational content. Consequently, it raises the issue that the teachers need to be friends with smart technologies and be aware of the possibilities they offer to carry out educational activities within the online and blended learning formats. This is a condition for seeking solutions for the teachers to implement smart technologies in digital educational environment.

There is no doubt that the teachers' digital competencies are not only a factor contributing to the expansion of educational opportunities, but also a kind of resource that determines the education development and transformation, in particular, and the entire system as a whole. The core content of these competencies, the practical implementation of the algorithms for mastering and continuous improvement of these competencies is at the stage of study and research by the pedagogical and scientific community. Active digitalisation of education in quantitative and qualitative terms is hampered by the insufficient number of teachers, who have special mastery of pedagogical design, namely, those who have practical skills in designing and implementing modern ICT in the educational context.

The formation and development of a new quality of teachers' professional competencies, drawing up his/her "individual educational trajectory", and launching the "lifelong learning" concept will make it possible to adequately eliminate the emerging "professional deficits" of the teaching community.

Summarising the results of theoretical and experimental work, we can draw the following conclusions:

1. For the successful implementation of new digital realities in the global, the community launched the "lifelong learning" concept, which allows us to maintain a person's skill level throughout his/her life.

2. Under the influence of smart technologies, an open, rapidly transforming educational environment "smart education" is being built, in which the organisation of learning process radically changes and access to fundamentally new cognitive tools is provided, allowing each student to receive his/her individual learning trajectory.

3. As part of the comprehensive implementation of the national project "Digital Teacher" and the various programmes included in it, high-tech developments are penetrating the educational environment and updating the material and technical

base of educational organisations. This contributes to the implementation of new instructional designs of generative and transformative educational activity.

4. Designing a smart digital educational environment changes the role of the teacher, turning him/her into a digital mentor. At the same time, as research results show, teachers have "professional deficits", the successful elimination of which is seen in the Smart Assistant software developed by the authors. This allows teachers to form and develop new aspects of professional competencies, ultimately leading to the growth of professional competence in general.

5. The developed Smart Assistant software product, in contrast to similar tools and platforms existing today, has a number of advantages, including unlimited access for users, a convenient and easy tool to understand interface in three languages, an integrated and systematic approach to organising the functionality of the software, the capability to integrate the product with the digital educational environment of the university (the ability to function within the university website, AIS "Platon"), a variety of tools for organising educational and cognitive activity of students, regardless of the class type.

6. The use of smart technologies in the instructional design of the digital educational environment helps to increase the level of motivation, efficiency, has a favourable effect on the interaction between the teacher and the student, helps to establish communication and collaboration, and provides new opportunities for professional self-development and self-education.

This study is a logical continuation in the series of research devoted to the problem of implementation of smart technologies in contemporary educational eco-system in general, and the development of professional activity of a teacher in particular.

To conclude, the instructional design of the digital educational environment should be carried out to support the professional growth of teachers, and to provide learners with a personal learning experience and access to cutting-edge educational resources. By investing in the most valuable and important teachers, we will be able to ensure the quality of education and the economic growth of the state.

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Information about the authors:

Galiya B. Sarzhanova – PhD, Head of the Department of Theory and Practice of Foreign Language Training, Faculty of Foreign Languages, Karaganda Buketov University; ORCID 0000-0002-3461-8963, Scopus Author ID 57189506923; Karaganda, Kazakhstan. E-mail: galiya008@mail.ru

Roza S. Bobesh – PhD Student, Department of Theory and Methods of Foreign Language Training, Faculty of Foreign Languages, Karaganda Buketov University; ORCID 0009-0009-9788-3666; Karaganda, Kazakhstan. E-mail: solnyshk@mail.ru

Gulnur Zh. Smagulova – PhD, Senior Teacher, Department of Theory and Methods of Foreign Language Training, Faculty of Foreign Languages, Karaganda Buketov University; ORCID 0000-0002-3343-2518; Karaganda, Kazakhstan. E-mail: smagulova_gulya@mail.ru

Ali Turkel – PhD, Associate Professor, Department of Turkish Training, Buca Faculty of Education, Dokuz Eylül University; ORCID 0000-0003-4743-8766; Izmir, Turkey. E-mail: ali.turkel@deu.edu.tr

Nurgul B. Serikbayeva – PhD, Senior Lecturer, Department of Pedagogy and Psychology, Semey State University named after Shakarim; ORCID 0000-0002-7490-7639; Semey, Kazakhstan. E-mail: nurgul.sgpi@mail.ru

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The authors have read and approved the final manuscript.

Информация об авторах:

Саржанова Галия Байжумаевна – PhD, заведующая кафедрой теории и методики иноязычной подготовки факультета иностранных языков Карагандинского университета имени академика Е. А. Букетова; ORCID 0000-0002-3461-8963, Scopus Author ID 57189506923; Караганда, Казахстан. E-mail: galiya008@mail.ru

Бобеш Роза Сабиткызы – аспирант кафедры теории и методики иноязычной подготовки факультета иностранных языков Карагандинского университета имени академика Е. А. Букетова; ORCID 0009-0009-9788-3666; Караганда, Казахстан. E-mail: solnyshk@mail.ru

Смагулова Гульнур Жумартовна – PhD, старший преподаватель кафедры теории и методики иноязычной подготовки факультета иностранных языков Карагандинского университета имени академика Е. А. Букетова; ORCID 0000-0002-3343-2518; Караганда, Казахстан. E-mail: smagulova_gulya@mail.ru

Туркель Али – PhD, доцент кафедры преподавания турецкого языка педагогического факультета Бука Университета Докуз Эйлюль; ORCID 0000-0003-4743-8766; Измир, Турция. E-mail: ali.turkel@deu.edu.tr

Серикбаева Нургуль Бейсембековна – PhD, старший преподаватель кафедры педагогики и психологии Семипалатинского государственного университета имени Шакарима; ORCID 0000-0002-7490-7639; Семей, Казахстан. E-mail: nurgul.sgpi@mail.ru

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Información sobre los autores:

Galia Bayzhumáeva Sarzhánova: PhD, Jefe del Departamento de Teoría y Métodos de Enseñanza de Lenguas Extranjeras, Facultad de Lenguas Extranjeras, Universidad de Karagandá E. A. Buketov; ORCID 0000-0002-3461-8963, Scopus Author ID 57189506923; Karagandá, Kazajstán. Correo electrónico: galiya008@mail.ru

Rosa Sabítkizi Bobesh: Estudiante de doctorado del Departamento de Teoría y Métodos de Enseñanza de Lenguas Extranjeras de la Facultad de Lenguas Extranjeras de la Universidad de Karagandá E. A. Buketov; ORCID 0009-0009-9788-3666; Karagandá, Kazajstán. Correo electrónico: solnyshk@mail.ru

Gulnur Zhumártovna Smágulova: PhD, profesora titular del Departamento de Teoría y Métodos de Enseñanza de Lenguas Extranjeras de la Facultad de Lenguas Extranjeras de la Universidad de Karagandá E. A. Buketov; ORCID 0000-0002-3343-2518; Karagandá, Kazajstán. Correo electrónico: smagulova_gulya@mail.ru

Alí Turkel: PhD, Profesor Asociado, Departamento de Enseñanza de lengua Turca, Facultad de Educación, Buka, Universidad Dokuz Eylül; ORCID 0000-0003-4743-8766; Esmirna, Turquía. Correo electrónico: ali.turkel@deu.edu.tr

Nurgul Beysembékovna Serikbáeva: PhD, profesora titular del Departamento de Pedagogía y Psicología de la Universidad Estatal Shakarim de Semey; ORCID 0000-0002-7490-7639; Semey, Kazajstán. Correo electrónico: nurgul.sgpi@mail.ru

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