

Designing a System of Training and Methodology Support for Training Construction Industry Specialists in the Conditions of Digital Economy

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Abstract. The paper presents a concept for designing an information system that provides organisation and support of the educational process. The core of the concept is the individual approach to the formation of students' educational trajectory. The individual approach is formed automatically on the basis of previous learning results and supposes complexity of the syllabus-grounded educational material, including as well a list of references depending on the factual level of assimilation of the instructional material. The information system concept involves storage and demonstration of course materials as well as third-party data from electronic databases of scientific, reference or educational sources. The system is able to predict the results of current, interim and final assessment in an automated fashion, depending on current results, in order to create additional recommendations for mastering the material and potential grade improvement. The designed system is capable of generating reports on learning outcomes in an automated mode. Such information system is a tool for the realisation of a hybrid form of education.

1 Introduction

The modern national and global educational process is undergoing digital transformation at all its levels [1, 2]. The digital educational environment is developing intensively: educational platforms and electronic educational resources are being developed; mass-scale open online courses are being formed; distance learning technologies are being actively applied. The scholars engaged in pedagogical research pay attention to the fact of active modernisation of educational systems, when classical pedagogical models are transformed into hybrid or distance formats, and educational organisations – into digital universities [3, 4].

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The comprehensive integration of digital technologies into all spheres of modern man's life requires every specialist to be proficient in working with new digital technologies. This is particularly important for future professionals engaged in project development and design since their activities involve the use of software tools that are continually upgraded and have many competitors on the market.

The educational process organisation for such specialists should be connected with actualisation of their independence and subjective approach to professional activity as well as formation of individual educational trajectory involving development of competencies not only in the construction sphere, but also in IT [5, 6, 7]. To ensure this process, an updated stock of assessment tools, reference and methodological materials is needed, not only in the construction domain, but also those connected with digital technologies. All this is possible only on the condition of availability of specialised information systems capable of keeping information up-to-date and providing access to necessary resources (including educational ones). Thus, *the aim of the study* is the development of a concept of an information system capable of organising and supporting due training of construction industry specialists in a real-time mode.

The hypothesis of the study voices that the use of an information system providing due organisational and methodological conditions for the formation of individual educational routes will increase the efficiency and quality of the educational process.

The theoretical significance of the research lies in identification of key objects and their links in case of automated development of an individual educational trajectory based on student's personal achievements. The obtained results are a basis for the development of educational information systems capable of organising and supporting the educational process in the best way.

The practical significance of the research lies in the use of the obtained results by the specialists of training/methodology services at educational institutions towards creating individual educational trajectories for the students in an automated fashion. In addition, the results can serve as a basis for scholars' research as well as analytical or project work in the sphere of pedagogy.

2 Objects and Methods

The object of the study is the educational process, which includes:

- the learning process during which a student learns didactic units, undergoes current, interim and final control, uses reference materials, etc;
- the academic support process during which training plans are drawn up and reference materials are generated;
- the organisation process during which syllabi, schedules of training sessions as well as timetables for current, interim or final assessment are drawn up.

The following *methods* were used to explore the research object:

1. *The structural method* that allows for identification of key qualitative and quantitative characteristics of the object under investigation. Such characteristics include all objects and subjects of the educational process. The scholars note in their works that the selected objects can be used as input parameters of process simulation models [8], as elements of project documentation [5, 9] or those contributing to the design and development process for software products used subsequently at educational organisations [].

2. *The method of analysis* that makes it possible to derive some patterns (or rules) based on the results of applying the structural method. In addition, the method of analysis was applied at the design phase, after the realisation of a complex of tasks enabling a researcher to produce a finalised result. The operational management of a project is

organised this way. When analysing a number of contemporary works connected with software products, the team of authors presenting this article found that the method of analysis proved to be a key tool [3, 10, 11].

3 Results

The use of the structuring method made it possible to highlight the following objects of the educational process, with the characteristics listed below:

1. The student undergoing a certain type of education (specialist degree programme, bachelor degree programme, master degree programme, postgraduate research course or further vocational training). The type of education influences the material to be studied by a student. The level of student's knowledge is also important: initial (i.e. at the beginning of any academic course), current (i.e. while mastering the academic discipline competences) and final (i.e. by the end of learning of the academic discipline).
2. The teacher, who monitors the students' learning process and shapes the didactic content of the academic discipline on the basis of some adopted standards.
3. The specialist of the training and methodology service who monitors the teacher's work and the latter's compliance with the curriculum (syllabi). However, the content of the discipline is beyond the domain of this specialist. Such specialists organise the teaching load, compile training schedules and reports on the educational process and engage in other organisational work.

The results of the undertaken analysis served as a basis for the authors team for the development of a concept for a system supposed to provide educational and methodological support of the training process. Such a system is based on the following aspects:

The first aspect. Organisation and support of non-linear learning. The system automatically selects an educational trajectory individually for every student within the same academic discipline. This can include, for instance, elementary, standard and advanced level. Depending on the level, the workload intended for each didactic unit is extended, the material presentation level changes as well as the scope of supplementary material. The assimilation of every new unit is conditioned by the previous unit assimilation results.

The second aspect. Individualised support in reference sources. In addition to the recommended literature for everyone, the system should select sources on an individual basis (depending on the learner's current results). For instance, when mastering a didactic unit at the elementary level, one needs literature that should explain the material using simple language (e.g. in the form of pictures, diagrams, comic strips). Some material should be stored within the system, while additional sources should be recommended through direct reference to external resources (e.g. electronic databases of scientific literature, e-reference systems at libraries or publishing centres).

The third aspect. Individual recommendations for current, intermediate and final assessment. The didactic units assimilation results serve as a basis for compiling a list of literature or areas to be mastered by a student as a supplementary material in order to get a proper assessment mark. It means that during the academic course the system monitors the learning units assimilation level and simultaneously maintains the progress monitoring. Based on these results, the system should make predictions on final control results. In order to improve the learner's performance, the system should select additional literature on an individual basis to allow for higher grades. It can also recommend certain sections of a discipline for special consideration, for a student to pay attention to, when preparing for final assessment.

The fourth aspect. The possibility of practice-oriented approach in learning. In this case, didactic units can be split into competencies to be mastered successively. For

instance, having failed to obtain a satisfactory knowledge on traffic flow formation after being delivered a study course, a student cannot proceed to exploring simulation models for traffic flows.

The fifth aspect. The possibility to generate reports based on different criteria – for a teacher or for training/methodology services, not only for monitoring the learning outcomes, but also for further improvement of the educational programme.

The sixth aspect. The system should act as a tool enabling student – teacher communication in a convenient way.

The seventh aspect. The system is an instrument for storage and automated generation of documents aimed to support the educational process.

4 Discussion

The realisation of the educational process with the use of digital technologies extends the capabilities of all its participants, meets the learners' modern needs, increases motivation for cognitive activity, promotes optimisation of pedagogical work and educational activities [2, 11, 13]. The scholars note in their works that the use of information technologies in the educational process is characterised by the holistic unity of motivational, cognitive, and activity-based components [12, 14]. The creation of individual educational trajectories for every student based on one's current progress (or other factors) makes it possible to set up a digital class [7, 15, 16]. The design of the discussed system within the framework of the undertaken research meets the current requirements and the development of pedagogical science.

The researchers, in their works on digitalisation of the educational process, form an interrelated set of methodological, target-oriented, substantive, processual and reflective components [6, 12, 17]. The educational process model realised with the help of the designed information system encompasses all the above components.

It should be noted that most of modern researchers' scholarly works are aimed at individualisation of learning [5, 9, 10]. This means that not only academic disciplines, but also their content, should be varied. Every student is unique and has his/her own "learning pace". This gives rise for a need in a universal tool allowing for individual selection of training materials based on objective indicators. The designed system allows this problem to be solved in an automated way.

5 Conclusion

The modern educational process implies the use of different forms of learning based on application of information technologies and systems. The training of a competent specialist requires that the content of any academic discipline should meet the practice-oriented needs. All materials used in practice should be up-to-date and meet the market requirements of a relevant economic sector. All this can be accomplished in case of availability of a specialised information system. The present study results have engendered a concept making it possible to implement such a system that meets all the requirements of the modern society and the country's economy.

The obtained results are adequate to the given subject area and provide a basis for designing a due information system. This is substantiated by the use of a number of general scientific methods stated in the relevant section. In addition, the obtained results can be used in research and development dealing with improvement of the educational process and unification of similar-profile methodological materials of different educational institutions.

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