Approaches to Personalisation in an Electronic Course: a Practical Experience *

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Abstract

At the present stage of the educational system development, it is relevant to create optimal conditions for the implementation of personality-oriented learning, taking into account individual requests and needs of students. Accordingly, the authors reveal the features of personalisation; note that a personalised educational path is one of the approaches. The purpose of the article is to describe and analyse a practical experience in creating and testing an electronic course for first-year bachelor students with the possibility of personalised learning. As a result, a general approach to a personalised educational path design in an electronic course is described; several options for personalised learning are highlighted. The research showed that an "average learner's" path was the most popular among students. A positive transfer of an "average learner" to the "successful learner" could be reached by personalised motivation, focused teacher support, and student interaction. A conscious choice of a personal educational path facilitates the development of particular competencies. Not all students consciously approach the choice of a personal educational path – they do not correlate their expectations or knowledge and neglect the core opportunities of e-learning - supplementary materials, co-working, or peer support.

Keywords: *personalised educational path, personalisation, electronic course, student, competencies, educational opportunities.*

1 Introduction

The widespread use of digital technologies, the global trends towards the implementation of automation, intellectualisation, and robotisation of all spheres of human activity have a huge impact on the labour market, generating new forms of work and new professions, changing the demands of employers. To respond quickly to the challenges and demands of the digital economy and the emerging knowledge society, higher education institutions will have to systematically adapt to changing socio-economic conditions, learn to offer new, innovative educational solutions in response to the challenges of the future.

Firstly, the ability to manage projects and processes is important, since the basic logic of the world of the future is project logic. Secondly, the ability to work in a mode of high uncertainty and a quick change of conditions is significant, since the world is full of uncertainties and dynamism. A

person should make decisions quickly and respond to changing working conditions. Thirdly, creative abilities are demanded, because creative, non-standard solutions help to solve problems. Together with that comes systemic thinking – the ability to identify complex systems and work with them, supported by the programming of IT – solutions, management of complex automated complexes, and work with artificial intelligence. Finally, multilingualism and multiculturalism, the ability to work with teams, groups, and individuals give grounds for productive communication. Moreover, interdisciplinary communication skills help to transfer practices from one industry to another, to communicate with specialists from different industries.

In Russia, as a part of the global education foresight , not only trends in the education of the future were presented, but strategies for the educational activities of universities in different areas were also defined [Russia 2025: Resetting the Talent Balance, 2017]: changes in the organisation of educational activities, assessment of results, development of motivation, individualisation of education, etc. Among the most important trends in the education of the future are individualisation and personalisation. This means the transition to a personalised educational path based on the open educational resources (MOOC platforms, etc.) and appropriate approaches to assessing learning outcomes. Generalised models of competencies should form a single basis for individual forms of learning, allowing them to learn throughout life. The main result of training will be a student's competence profile obtained both in educational and extracurricular activities. The formation of competency maps for specific areas of training and profession (educational and career paths), which should become a model for students in compiling their educational paths, becomes relevant.

The digital educational environment has a range of features and capabilities, such as interactivity, mobility, multimedia, communication, automation (including the use of artificial intelligence technologies), which allow implementing the real practice of modern professional training for future specialists, focusing on prospective changes and digitalisation of professional activity. With the help of new educational tools - digital tools, on the one hand, and, on the other, active forms, methods, teaching technologies used by teachers in the digital environment, the role of a student is changing. Through formal and informal educational, self-education, cognitive, and research activities, the formation of a learning position takes place. The changes in the roles and forms of learners' activities are determined not only by new technological capabilities but also by the transformation of goals, values, and objectives of professional training.

Transformation of the professional training objectives is considered from the perspective of social demand, as well as from the perspective of a student's demand (reference points for personalisation of education, personal and professional development in the digital environment). Within the framework of professional training, a student's active position as a future specialist should become the main on the path of continuous professional and personal development, the search for personal meanings, values, and interests through independent activity in the digital educational environment.

The purpose of this paper is to describe an ongoing experimental work of designing an electronic course based on the ideas of personalisation, information redundancy, variability, project-based learning, and reflection [Kulikova & Yakovleva, 2020].

In the study, we hypothesise that the ability to choose variable personalised paths within an e-course contributes to the development of students' active cognitive position and important competences – digital competences, strategies of interaction with information (search, extract, re-code), learning autonomy, initiative, and self-organisation.

To concretise the hypothesis, we formulated several research questions. What are the most popular students' strategies of choosing personalised paths within an e-course? Does any chosen path has a positive impact on the development of a student's competencies? Are students ready for a conscious personal choice of learning paths?

2 Experimental work in designing an electronic course with personalised educational paths

2.1 Personalisation as an educational trend: literature review

Personalisation has become a widely discussed trend in education (see in [Fitzgerald et al., 2018], [Căprioară & Frunză, 2013]). The central idea of personalisation is the personal interests and needs of a particular learner. Sanjabi and Montazer showed that a learning style could become the starting point for personalisation [Sanjabi & Montazer, 2020]. "Personalisation in education is user centred and tailored to suit users' information needs and existing information behaviour" [Shen, 2018]. Kremneva et al. propose that personalisation of education could be reached "through the practice of designing related personal and collective image of the future, the formation of each student repertoire of personal educational routes based on collective educational strategy" [Kremneva et al., 2020]. Bentley and Miller underlined that personalised learning approach strengthens learner engagement and, consequently, improves learning outcomes [Bentley & Miller, 2004]. Sorokoumova et al. suggest that personalised educational process "takes into account dominant special abilities of students, allowing to realise student potential" [Sorokoumova et al., 2020]. Gerasimova et al. propose to understand personalisation as "the creation of an educational environment focused on individual needs and the disclosure of individual capabilities, and providing the most effective learning" [Gerasimova et al., 2020].

The digital environment becomes the catalyst for personalised learning. Thus, Romero et al. suggested using an intelligent system to support self-regulated learning as an important aspect of personalisation [Romero et al., 2019]. By analysing e-portfolios and measuring student progress in learning, intellectual technologies generated and proposed learning paths that enabled the highest learning achievements.

2.2 Features of an electronic course for personalised learning

The Chair of Digital Education of the Herzen University for two years has carried out experimental work concerning personalised learning approaches. The work was done within an electronic course "Information Culture of a Personality" for the first-year bachelor students of Pedagogical education (profile "Computer science and information technology in education").

The main ideas of the designed course are student active learning position, reflection, consciousness, and responsibly in learning. The course is based on the idea of variability, in particular the use of variative tasks. Thanks to the variation of the developed tasks, each student has an opportunity to choose an educational path in learning, the opportunity to study following personal aspirations to achieve significant goals and objectives.

The course "Information Culture of a Personality" included 9 lectures and 17 practical classes. During the experimental work, the course was implemented within a blended learning paradigm. The lectures were based on the interdisciplinary ideas of computer science, pedagogy, psychology, and sociology. The key objectives of the lectures were to form the idea of the transforming society under the influence of digitalisation, to describe the features of the 21st-century information culture. Together with that, students familiarised with the main concepts of this specific subject area systematised new requirements for specialists demanded by the digital society, developed their ICT competencies and skills to effectively solve educational and professional tasks in the digital environment.

During the lectures, active teaching methods were used, encouraging students to active mental and practical activities. Therefore, students were offered several types of lectures. A lecture-problem began with posing a problem or problematic issue, which needed to be solved in the process of presenting the topic. A lecture-visualisation was based on various visual forms of presentation and perception of information - audio, video, diagrams, tables, models, and mind maps). A lecture-discussion included various questions and mini-discussions to exchange opinions, and, as a result, the answers received were taken into account in the presentation of the material. A lecture-error was

offered at the final stage of training, for during the lecture, students had to find meaningful errors and at the end of the lecture, these errors were reviewed and analysed.

As a part of the practical work, in each class, students were offered three types of tasks - in-class assignments (selected and performed during each practical class); invariant and variative assignments (selected and performed as part of the autonomous work). A matrix of tasks is presented in Table 1.

Table 1: Matrix of tasks - general view

Activities	Levels of tasks	In-class assignments	Autonomous work:Invariant assignments	Autonomous work:Variative assignments
Practical classes	Basic			
Practical classes	Intermediate			
Practical classes	Advanced			

The e-learning course was realised with LMS Moodle. For the effective completion of assignments, students were offered methodological recommendations and criteria for evaluating work. Since all tasks according to the degree of difficulty were distributed across three levels, differentiation could be traced in the descriptive nature of methodological recommendations and assessment criteria. So, for the basic level (yellow path), step-by-step activity algorithms, strict assessment criteria, and their detailed description, including work assessment parameters, were proposed. At the intermediate level, (green path) descriptive methodological recommendations and general assessment criteria were offered. At the advanced level (blue path) merely methodological recommendations were given, and the assessment system was flexible (peer and self-management, peer evaluation, and self-assessment).

In the process of studying the course, students carried out a research project. Each student could choose a research topic that was relevant and significant for him/her (within the subject area of the course). During the training, through a series of variable tasks, it was necessary to study and analyse the research problem, structure the material and draw up a multimedia resource that reflected the purpose and objectives of the study, the progress of work, the main content of the topic and the results of the study. Presentation and defense of the developed projects took place at the final practical class.

Every assignment had three levels of difficulty that a student could choose - basic, intermediate, and advanced (three "paths": Yellow, blue, and green). Variative tasks in contrast to invariant were based on interdisciplinary ideas. These tasks expanded the knowledge of students and allowed going beyond the basic educational content. For the entire course, students were offered 153 tasks each student selected and completed 51 tasks.

Before completing an assignment, each student had to justify his/her choice: formulate personally significant goals and objectives, personal interest, characterise the need to perform this particular assignment. As an indicative basis for choosing the degree of difficulty of the tasks, students were offered a table (Table 2).

2.3 Materials and methods

In the study, we used several research methods: methods of modelling and designing an electronic course; mathematical methods for calculating the number of views for different types of digital content and summarising the points received for practical work; statistical methods - cluster analysis

Table 2: The orienting basis for tasks selection : The orienting basis for tasks selection

The orienting basis for selecting tasks	Basic level	Intermediate level	Advanced level
Degree of autonomy	+	++	+++
Difficulty	+	++	+++
Research, creativity	+	++	+++
ICT tools choice	+/-	++	+++

performed with "Statistica 10" software package.

3 Analysis of the experimental work results

At the initial stage of the study, the course materials were selected, a series of variable tasks was developed, and variations in the choice of forms methods, and approaches for implementing educational activities were proposed. As a result, a model of an electronic course "Information Culture of a Personality" was designed and implemented with individualised educational paths for students (Figure 1). In the model of the electronic course, the conditions of the educational process were specially designed, allowing to adapt the content to the interests, characteristics, and needs of each student and to implement a personality-oriented learning approach.

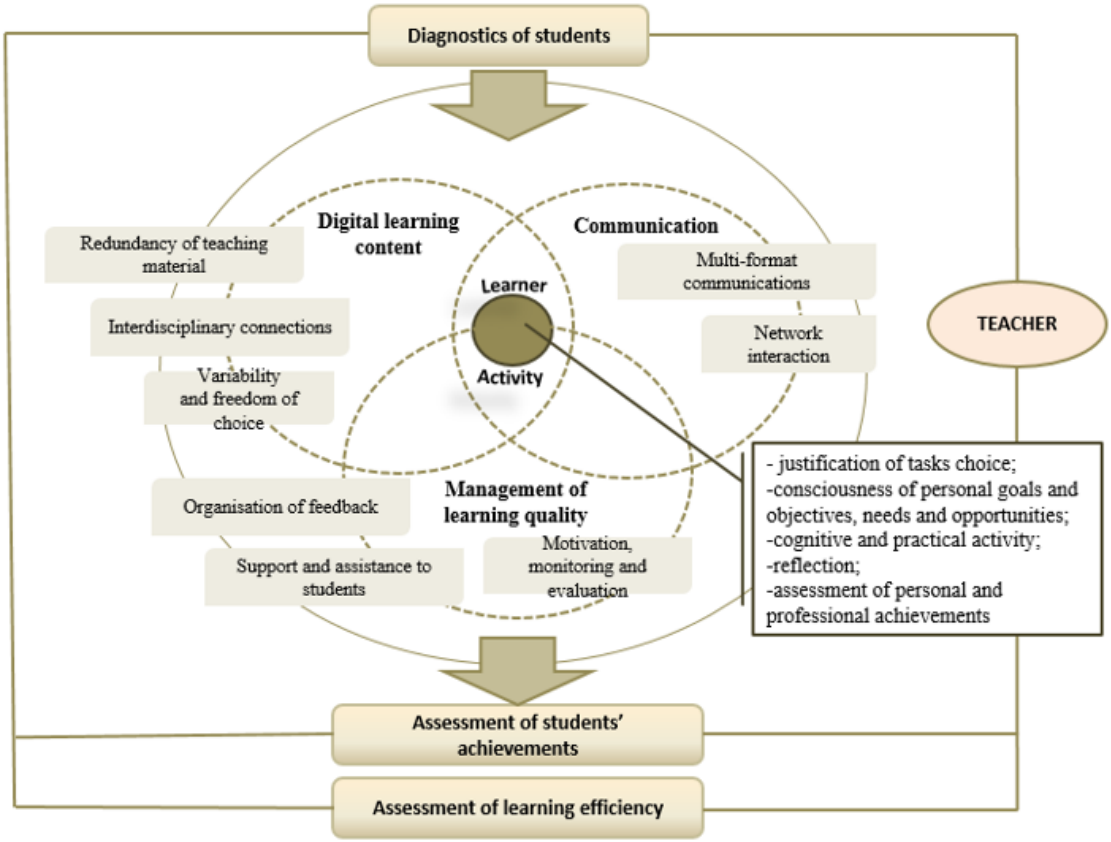

Figure 1: Model of an electronic course with individualised learning paths. Source: own work

At the second stage of the experimental work, a study of a focus group within the developed electronic course was conducted. During the spring semester of the 2020 year, 20 students undertook the course, and during the 2021 year – 18 students. During the first year, the analysis of students' activity in the electronic course revealed several strategies for choosing tasks [Kulikova & Yakovleva, 2020]:

1. Constant selection of advanced tasks and their performance at a high level - highly motivated students with outstanding academic achievements within the educational program (2020: 2 students; 2021: 3);
2. Preferential selection of advanced tasks and their performance at a high level (2 students; 3);
3. Variable selection of intermediate and advanced tasks and their implementation at the sufficient average level (2020: 13 students; 2021: 18);
4. Constant selection of basic and intermediate tasks and their performance at the minimum passing score - low-motivated students with poor academic achievements within the educational program (2020: 3 students; 2021: 2).
5. Gradual approach - one more strategy was detected during the second your – when learners started with basic tasks and then gradually switched to intermediate and advanced (2 students).

LMS Moodle Herzen provides tools to generate reports on student activities in the digital educational environment. These reports allow creating structured and filtered information about student activities on the e-course, reducing time for teachers to analyse the educational process in a digital environment. The data was downloaded from the Moodle system, as well as from electronic grade books maintained by the teachers.

A comparative analysis of students' activities concerning their actions during the study was carried out. The focus was on the number of views of certain information resources, participation in the course, and received points for practical tasks. Since the number of views of the resources was approximately the same for 2020 and 2021, the participation of students on the forum was also analysed. In 2020, two students chose the advanced level of tasks and showed the greatest participation in the forum (58% of all responses). In 2021, the situation changed, in the forum, there were practically equal indicators, both among students who chose the advanced level and among students who chose the basic level. The highest indicator is for the advanced-level student (27% of all responses on the forum), and the second indicator is for a basic-level student (19% of all responses).

Analysis of the answers on the forum allows us to identify students' interest in studying the course. In 2020, the forum aroused the greatest interest among advanced-level students, while in 2021 the forum was interesting to almost all students of different levels. However, in 2021 there were fewer responses to the forum than in 2020. Perhaps next year the course teachers will be able to improve the situation and achieve the highest participation rates in the forum. A recommendation for achieving this goal may be the formulation of a problematic question from a teacher who will characterise the importance of the offered topics.

The second most important resource viewed is the assignment template. Students often refer to this template to correctly formulate completed assignments for the chosen level. The template describes the sequence of actions by which it is necessary to structure your answer to the completed practical task.

The least viewed information resources of the course are supplementary resources in practical task 3 "Query language (search operators)" (1 student referred in 2020, 8 students - in 2021) and "Metasearch system" (1 student referred in 2020, 7 students - in 2021). On the one hand, the 2020 activity report suggests that students are rarely interested in supplementary resources (only 1 student looked at both resources). On the other hand, in 2021, it was enough for students to open a resource once and use it. Such analysis identifies digital resources that may be worth paying attention to during lectures or making them more attractive to students (e.g., with gamification).

The most viewed information resource is the forum in practical task 7 (Foreign language information resources). A new forum is created every year. In 2020, it was viewed 211 times, and in 2021 - 217.

The analysis of students' activity showed that the number of the course dropout at the very beginning of the course is 23% both in 2020 and in 2021. These students start the course steadily, attend the first lecture, and then stop completing assignments. This shows that interest in the course is waning and there is a need to improve it to reduce the risk of dropping out early in the course. In addition, the analysis at the very beginning of the course contributes to the timely identification of students who are at risk.

With the help of the Moodle "Event Log" tool, the actions of users for the considered period were uploaded, and then the number of views of all resources of the course was calculated for each student. Including, the received points for practical tasks were calculated from the electronic grade book. Students were designated by variables with values - Var1-Var8 (for this analysis, those students were selected who regularly attended classes, completed all assignments, and completed the course). The obtained data on the activities of students for 2021 are presented in Table 3.

Table 3: Data on student activity in 2021. Source: Own work

	Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8
Number of views	204	282	302	534	148	342	422	298
Obtained scores	117	128	82	149	111	128	149	149

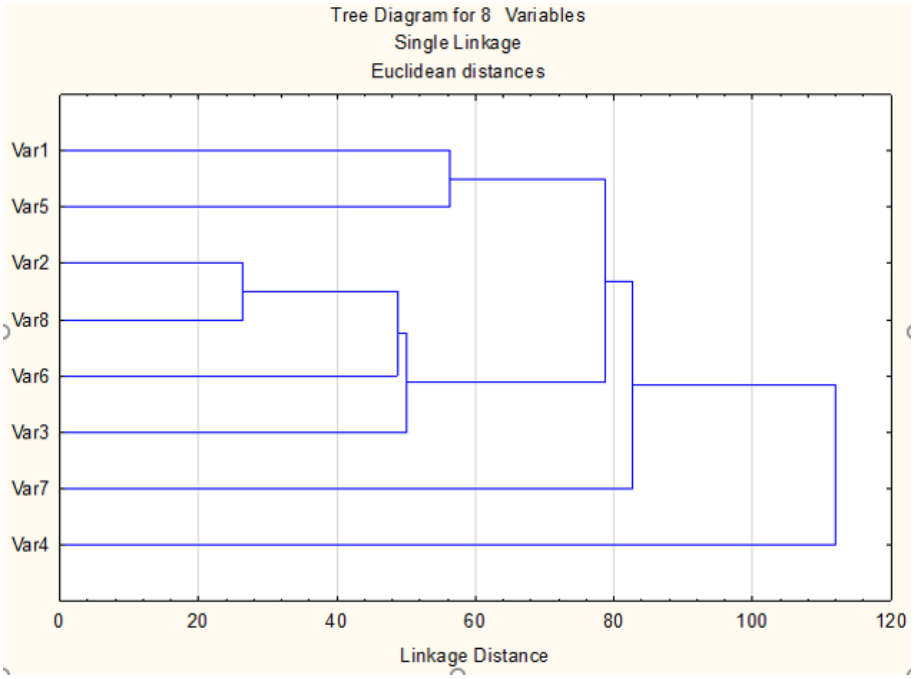

Figure 2: Cluster analysis of educational data (2021) Source: own work

The figure shows that the values Var1 and Var5 merge into one group. These students are the only ones who initially chose the basic level and complete the minimum tasks necessary to complete the course. All others chose the advanced or advanced level and this analysis of the data shows that there are strong groups that choose the easiest option to complete the training.

With the cluster analysis of the results on the activities of students in 2020, Table 4 was also compiled.

Table 4: Data on student activity in 2020. Source: Own work

	Var1	Var2	Var3	Var4	Var5	Var6	Var7	Var8
Number of views	66	46	43	79	199	43	135	81
Obtained scores	112	124	125	75	146	114	104	116

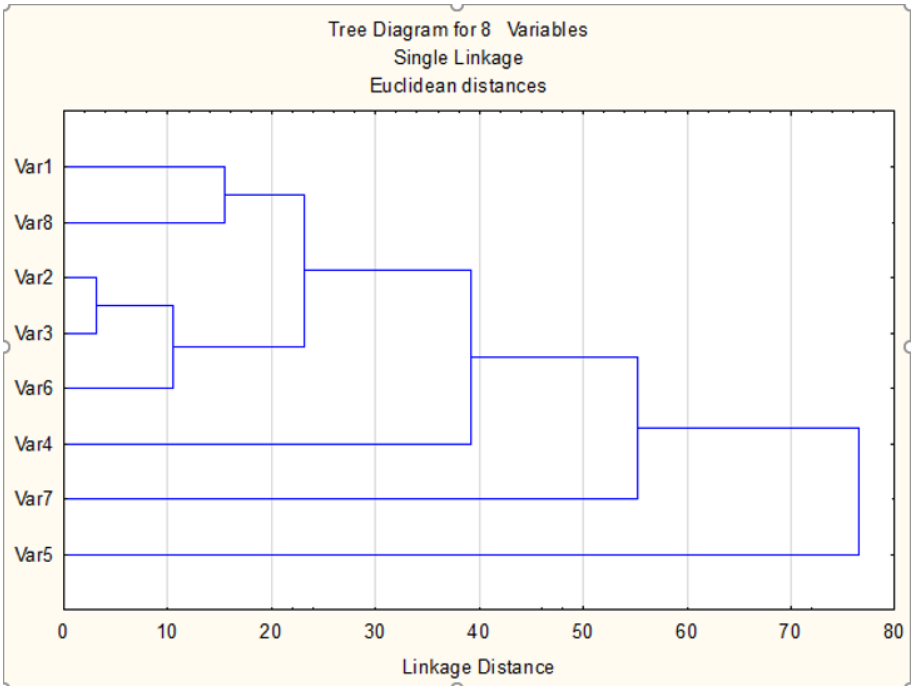

Figure 3: Cluster analysis of educational data (2020). Source: own work

Based on the results of 2020, it was impossible to unambiguously single out the groups, since students implicitly chose the level of education. Because of this, the situation looks as follows: Var2 and Var3 chose a predominantly high level; therefore, they were combined into one group, while the rest were distributed evenly, but it was not possible to identify a clear pattern.

Since students have the opportunity to move between levels, at the beginning of the course they perform different tasks from each level. Students choose which level suits them, and closer to the middle of the course they stop at the same level. In 2021, thus, the number of those who chose the high level increased from 2 to 5. The distribution by levels allows organising the choice of a personal educational path.

How do students themselves evaluate the course with the possibilities of individualised learning paths? Students listed among the most difficult tasks for understanding the work connected with making digests, bibliographic lists, and electronic library systems (this is objectively confirmed by the analysis of the extracted data described earlier). The simplest tasks were those related to visualisation (infographics and mind maps). However, this may be a subjective perception of easiness - after all, behind the simple and attractive interface of these digital tools is a more complex task - the synthesis of information and planning activities. Most students (77%) noted that they lacked examples and samples of completed tasks, mainly in the format of videos or other multimedia materials. Students

named the addition of tasks for self-control of the theoretical part (for example, tests based on lecture materials) as well as a reduction in the number of task variations as wishes for improving the course.

According to the results of the experimental work, we can describe general rules for designing an individualised educational path for students in the framework of an electronic course:

- identification of personal meanings, positions, goals, and values (determination of personal qualities that can affect the development of competencies);
- consciousness and understanding of personal needs, requests, and opportunities;
- freedom and consciousness of choice in the created educational environment (choice of content, means, methods, forms of activity, measures of help and support from the teacher and peers);
- the planned and gradual building of an individualised educational path for mastering the content of the course;
- diagnosis (self-monitoring and self-assessment, the reflection of educational activities; tracking the dynamics of self-development; awareness of personal and professional results of activities to further increase the effectiveness of training).

Depending on the chosen educational path, there are several options for personalised ways of mastering the course content:

- motivated "successful learners" choose advanced tasks with active research and creative activity. This way of mastering the course particularly contributes to the development of innovative thinking and creativity;
- less motivated "average learners" mostly start with the basic level of tasks and might gradually move forward to the intermediate and advanced tasks. The highest risks of this group are associated with reduced working capacity and insufficient willingness to work independently and proactively, with weakly expressed motives and activity goals. However, a personal path gives such learners a chance to develop reflection and learning autonomy.
- unmotivated "weak learners" are the riskiest participants of the course, and they need the special attention of a teacher. Their paths reflect the minimal sufficient level of mastering the content. However, with teachers' and peers' help and support, this path still contributes to the development of basic information strategies and self-management. Finally, we can systematise the benefits of the designed electronic course:
- activity and adaptability of students' educational and cognitive activity due to the free choice of forms, methods, and tools, awareness and meaningfulness of choice;
- students' self-activity and self-organisation;
- the objectivity of monitoring and evaluating the results of each student (tracking with an electronic progress grade book the chosen educational path, with timely corrections of numerous parameters);
- flexible opportunities for the implementation of scientific and creative activities, self-development, and self-realisation.

4 Discussion

The analysis of the results showed that the most difficult for students were such activities as work with electronic libraries and foreign language resources. At the same time, this block of tasks is associated with important competencies of the 21st century. These competencies are reflected as fundamental in the majority of competency frameworks for citizens in general as well as for representatives of specific professions (for example, teachers). In the Europass initiative, we see a category of "information processing". In the Russian Federal State Educational Standards of "Pedagogical Education", such ideas are presented in the corresponding category of "systemic and critical thinking". Thus, Yessekeshova et al. investigated approaches to critical thinking development through systemic structuring and studying information [Yessekeshova et al., 2020].

In the Digital Competence Framework for Educators – DigCompEdu, the category of "digital resources" appears [Redecker, 2017]. It is associated with identifying, assessing, and selecting digital resources for teaching and learning. The study of Guillén-Gámez et al. proposed several groups of characteristics associated with digital resources in the educational context: digital skills, digital ethics, digital flow, anxiety towards ICT, quality of ICT resources, intention to use ICT, and ICT integration [Guillén-Gámez et al., 2021]. So, we can conclude that it is important for a learner not only to be able to find a relevant resource with ICT tools but also to evaluate ethical aspects of the content and further use of the information.

The report "Future Work Skills 2020", published in 2011 by the Institute for the Future in Palo Alto (USA) presented a map of professional skills of the future [Future Work Skills Summary Map, 2011]. The map also highlighted information competencies - transdisciplinarity, project thinking, literacy in the new media environment, cognitive loading management, intercultural competence, virtual collaboration, computational thinking, innovative adaptive thinking, and social intelligence. In our study, students developed most of the listed skills through the offered assignments and in the conditions of a conscious choice of the task's measure of difficulty. In this perspective, Meng, Jia, and Zhang proposed the "SMART key elements model" for facilitating high-order thinking skills: situated learning, mastery learning, adaptive learning, reflective learning, and thinking tools [Meng et al., 2020].

In the study "Competence Foresight 2030" (Skolkovo), a list of "over-professional skills and abilities" was presented [Atlas of Emerging Jobs, 2015]. This list contains competencies of an informational nature - systemic thinking, programming of IT solutions, project management, and readiness to work in the mode of high uncertainty and a quick change of conditions. Gerasimova et al (2020) proved that personalised learning approaches are effective when teaching students to work with digital technologies. The authors propose such indicators of personalisation as "awareness of choice, determination of characteristic factors of the educational model, gradation of the task system" [Gerasimova et al., 2020].

Conclusion

Summing up, let us refer to the main research questions.

What are the most popular students' strategies of choosing personalised paths within an e-course? The two-year experimental work showed that most students variably selected intermediate and advanced tasks and performed them at a sufficient average level. This means that so-called "average learners" form the core of all learners. Consequently, several important factors could influence a positive transfer of "average learners" to "successful learners": motivation to study the course (personal interest, awareness of the importance of the content for future personal and professional development); attractiveness of content (design, modernity, and interactivity); teacher support (through the analysis of the students' digital footprint, identification of the risks of drop out); student interaction (examples of success, mutual support, and peer assessment).

Does any chosen path has a positive impact on the development of a student's competencies?

If a student consciously chooses a personal educational path, then, in any case, he/she will develop important competencies. However, the higher the level of tasks is set, the greater the range of these competencies appear.

Are students ready for a conscious personal choice of learning paths? The particular study showed that not all students consciously approach the choice of a personal educational path. For example, they choose advanced tasks but do not refer to supplementary materials. In addition, they do not always correlate their expectations and knowledge: choosing either too simple tasks or too difficult. Self-diagnosis at the beginning of the course, as well as additional recommendations of the tutor based on it, can help solve this contradiction.

In educational practices, it is important to develop new models of electronic courses, with variable ways of mastering the content. That will allow solving a wide range of tasks related to the development of professional competencies and advanced skills of the 21st century, and the development of a student's personal potential in the aspects of self-realisation.

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