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WebQuest as a Factor of Teaching Teamwork

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ABSTRACT

An educational WebQuest can and should be used in teaching teamwork to students. Readiness for social interaction and implementation of one's role in a team is a fundamentally important personal and professional quality (i.e., a subsystem of social and professional competency) in the modern world. The organization of group work of students is a mechanism for the development of both teamwork skills and personal experience of this work. The digital transformation of the educational environment creates favorable conditions for the development of competences as well as personal and professional qualities of students, including the willingness to work in a team: in the digital educational environment, it is possible to organize information interaction between students. An educational WebQuest as a competency-based learning technology stimulates both individual and group activities of students, which can be managed by students themselves. The authors have substantiated that version control in performing WebQuest tasks is an effective mechanism for obtaining primary information, which makes it possible to assess students' readiness to work in a team. A method of processing the primary information reflecting the actions (and their results) during the students' teamwork is proposed in this connection. The research involves a pedagogical experiment performed at Kuban State Technological University (Krasnodar, Russia), including the university-based regional school technology park. The analysis of the factual data shows the high efficiency of using WebQuests for organizing teamwork of both junior university students and school students involved in studying at the technology park. The theoretical significance of the research results is that they can contribute to further scientific understanding of such a problem as the development of students' readiness for social interaction and realization of their role in the team, the practical significance lies in the fact that the research results can be a basis for the design of pedagogical technologies aimed at developing the specified personal and professional quality in students.

Keywords: WebQuest, Teaching, Teamwork

INTRODUCTION

Nowadays there is no need to prove that the readiness to work in a team (more precisely, the individuals' readiness for social interaction and the realization of their roles in a team) is an extremely significant personal and professional quality that should be formed at all levels of the system of continuous education, including the system of higher education, as well as additional education for school students. Indeed, in any sphere of human

activity, the tasks are so complex and voluminous that their solution is possible only by effective teams, and not by individuals. Researchers have shown "support to the value of teams to organizational effectiveness" (Tohidi, 2011) and "the value of teamwork" (Schmutz et al. 2019). It is recommended to organizations that they "train team members to understand their roles in their teams and what is being expected of each team" (Obiekwe et al. 2021). Education is to prepare students for work in organizations, following its mission of the harmonization of human activity and society. Therefore, the formation of students' readiness for social interaction and the implementation of their roles in the team is an important social and pedagogical task. The success of a student in a team is a criterion for the formation of an appropriate personal and professional quality in the student.

The digital transformation of the educational environment creates favorable conditions for the development of students' competenc(i)es and personal and professional qualities (including the willingness to work in a team). In the context of such transformation, conditions appear for the application of competence-oriented teaching methods, one of which is an educational WebQuest – "one of the modern interactive educational technologies based on the Internet" (Sanina et al. 2019).

An educational WebQuest can be used both in the individual work of the student and in teamwork. The authors of this article consider the performance of an educational WebQuest in many respects similar to project performance, which makes it possible and expedient to control versions when executing a WebQuest. In other words, the team performance of a WebQuest in a digital educational environment also needs version control (and related digital tools, i.e. version control systems), as well as the implementation of a network project. In the same way, the logic of interaction of students in the team execution of an educational WebQuest is no different from the logic of network interaction in the implementation of a project. Although an educational WebQuest is an obviously promising technology, its potential for forming students' readiness to work in a team is still not fully used; the most important reason is the insufficient development of the theoretical, methodological and technological prerequisites for its application. The research problem is to increase the effectiveness of teaching teamwork in a digital educational environment. The research problem is the question: how to use the WebQuest so that the teamwork of students is successful? A detail of the study is the question: how should one organize, accompany and methodically ensure the network interaction of students during team work on a WebQuest? The purpose of the study is to develop primary mathematical models for the use of an educational WebQuest in the teamwork of students. The most important task of the study is to identify the criteria for using the educational WebQuest in the teamwork of students. The object of the study is the network interaction of students during teamwork on a WebQuest, the subject of the study is the effectiveness of the educational WebQuest in a digital educational environment.

METHODS

The methods applied for the purposes of this research are the analysis of scientific literature and best practices in supporting team learning, modeling, methods of qualimetry, method of expert assessments, methods of probability theory and mathematical statistics, methods of set theory, methods of infometry, and pedagogical experiment.

The methodological foundations of the research are as follows: the systematic approach, which considers the digital educational environment as a set of conditions for the implementation of information educational technologies, including an educational WebQuest; the competence-based approach, which considers the willingness to work in a team and other competences of students as a factor in the success of their educational activities; the activity-based approach, which considers the teamwork of students as the most important mechanism for the formation of their readiness for social interaction and the realization of their role in the team; the qualimetric approach, which declares the need for multi-criteria diagnostic assessment of the students' teamwork; the sociological approach, which considers the team as a social system and a competitive personality ready to work in a team as a social resource for an innovative economy (or human capital); the probabilistic and statistical approach, which considers the work of a student in a team as a probabilistic process, and the diagnostic assessment of teamwork as a statistical measurement); the process approach, which considers teamwork on a WebQuest task as a set of students' actions and the control of performance results as a component of pedagogical monitoring.

RESULTS AND DISCUSSION

From the point of view of the authors of this article, the version control should be a a mandatory component of pedagogical monitoring while performing an educational WebQuest by a team in the digital educational environment. It should be stressed that pedagogical monitoring itself is an information mechanism for accompanying the educational activities of students. Moreover, all versions of the results of the WebQuest performance (both current and previous ones) should be publicly available to all team members.

The primary mathematical model of the version of the intermediate results of the WebQuest project is a tuple $\varpi = <F\ Z\ L>$, where F is the set of files or modules that reflect the intermediate results (portions of information), Z is the set of pieces of information stored in files or modules, L is the set of all kinds of connections between them (first of all, correspondence links, as well as semantic links between pieces of information). It is obvious that $Z = \bigcup_{i=1}^{f} \mathrm{Zi}$, $f = card(F)$, where f is the number of files or modules, *card* is the cardinality of the set (its cardinal number, i.e., the number of elements in it), Zi is the set of pieces of information in one file or module, U is the union of sets symbol.

The mathematical model of information reflecting the current state of the WebQuest project (its process and intermediate results) is as follows:

$Z = PUCUDUQUR$. Here P is a set of pieces of information reflecting the introduction and statement of the problem, C is a set of pieces of information reflecting the conclusions, discussion and evaluation of the results of the WebQuest, D is a set of URLs (websites or their pages) addressed to while completing an educational WebQuest, Q is a set of pieces of information found on websites and selected for further processing, R is a set of pieces of information reflecting the results of the project.

The phase distance (the degree of difference) between two versions of the results of the project (including the educational WebQuest) is $\varepsilon = card(F^{//} - F^{/}) + card(L//\text{-}L^{/}) + card(Z^{//} - Z^{/})$. Here $F^{/}$ is the set of files or modules in the previous version, $F^{//}$ is the set of files or modules in the current version, $L^{/}$ is the set of information links in the previous version, $L^{//}$ is the set of information links in the current version, $Z^{/}$ is the set of pieces of information in the previous version, $Z^{//}$ is the set of files or modules in the current version. Note that versions may differ even with similar information content: the distribution of information across files or modules may be different.

Imagine a model of teamwork when performing an educational WebQuest. Let S be the set of learners performing network interaction, then their number is $s = card(S)$. If the set of actions performed by the i-th student is Ai, then the total set of actions performed by the team is $A = \bigcup_{i=1}^{s} \text{Ai}$; respectively, the total number of actions on the part of the i-th student $\alpha_i = card(A_i)$, on the part of the team as a whole $\alpha_i = card(A_i)$. The digital information environment makes it possible to automatically record transactions, keep records of sessions of educational and information interaction. Digital educational environments are no exception.

At the same time, the actions of students (especially their results, the impact on the state of the project) can be different. Ideally, the student's actions should be aimed at introducing new information elements into the current version that will bring it closer to the finished information product. If multiple learners submit the same information item, then the learner with the earliest timestamp is given priority.

If the i-th student sent a set of pieces of information hi, then the total set of pieces of information sent by students will be $H = \bigcup_{i=1}^{s} hi$. Ideally, $H - Z = \text{Ø}$, where Ø is the symbol of the empty set. At the same time, there are practically no such situations; there is extra work to be done. If modifications are made to the current version of the project that are incorrect, then it is necessary to correct the situation. Correcting the situation is either to return to the previous version, or to replace the wrong modification with the correct one. If the probability that the i-th student will be able to do this (both recognize the mistake and justify his or her position, i.e. explain with reason) equals p_i, then the probability that the student cannot do this equals p_i. According to the probability of independent events theorem, the probability that no member of the team can do this will be $\prod_{i=1}^{s} (1 - pi)$, therefore, the probability that at least one of the team members will be able to detect and correct will be $\rho = 1 - \prod_{i=1}^{s} (1 - pi)$.

As it can be observed, in team interaction a student cannot work better (but can work worse) than the level of formation of competences required

to solve problems allows. Obviously, the student's results of solving the problems when working in a team do not make it possible to directly assess the extent to which the student successfully carries out social interaction and realizes his or her role in the team. If the student solves a certain problem at the quality level $K^{/}$ during individual work and at the level $K^{//}$ during team interaction, then the realization of the student's cognitive potential during teamwork is $\eta = \frac{K^{//}}{K^{/}}$. A more complete estimate of the specified parameter is $\eta = \frac{\sum_{i=1}^{m} K_i^{//}}{\sum_{i=1}^{m} K_i^{/}}$. Here m is the number of different tasks solved by students, respectively, in team and individual work, $K_i^{/}$ is the level of solving the i-th task in individual work, $K_i^{//}$ is the level of solving a task, similar in structure, volume and difficulty, in teamwork.

If we are talking not just about teamwork, but about network interaction (i.e., the interaction of team members through the digital environment), then the success of such interaction depends not only on the student's competenc(i)es (required to solve problems) and the student's readiness for social interaction (willingness to work in a team), but also on the student's information competency. A WebQuest is, first of all, information technology, therefore, in order to work on an educational WebQuest, a student must have information competency, at least to find the necessary information on websites (Shaposhnikova et al. 2021, Shaposhnikova et al. 2022).

In this case, the criteria for the work of the student in the team execution of the WebQuest are as follows. The first criterion is the realization of cognitive potential in teamwork. The second criterion is the number of student actions associated with the correction of the work of other team members. The third criterion is the number of student actions associated with the formation of new files or project modules. The fourth criterion (the most important one!) is the number of pieces of information that the student has contributed to the project, thereby bringing it closer to the final version.

We will consider the implementation of the educational WebQuest using the example of the network project "Spiritual unity of mankind (using the example of the semantic unity of proverbs and sayings)". The most important pieces of information (information units of the project) are proverbs and sayings of different peoples that are similar in meaning, the project module is an information repository of proverbs and sayings that are similar in meaning (i.e. proverbs and sayings combined into a semantic group); accordingly, affiliation links reflect which website this or that proverb (saying) was taken from. The main possible mistake of students is to incorrectly attribute the proverb to one or another semantic group. The reverse error is not attributing a suitable proverb to the corresponding semantic group. As an example, let us take the Jewish proverb "In a house where there are many owners, the guest remains hungry", which a student mistakenly attributed to the semantic group "A long-staying guest is a disaster", while it should be attributed to the semantic group "The destructiveness of a large number of guiding factors" (including such proverbs as "Too many cooks spoil the broth").

To complete a WebQuest project on the specified topic, least a basic level of intercultural competency, especially intercultural susceptibility, is required

(in addition to information competency and readiness for social interaction). To assess it, the student (not when working in a team) is given the task: to divide the proposed set of proverbs into several semantic groups (in the semantic group there should be proverbs similar in meaning); the number of semantic groups is from three to five, the number of proverbs in a semantic group is from three to ten.

Team performance of WebQuest projects can be used both in teaching university students and high school students in a technology park – such as the Regional School Technopark of Kuban State Technological University (while training in the field of linguistics). The sample includes 2083 undergraduate students (of which 986 enrolled in 2018 and 1097 enrolled in 2019) and 37 high school students. The implementation of projects for all the students was evaluated on a 100-point linear scale. High school students formed 5 teams, and the results of the WebQuest project were as follows: 72, 85, 96, 77 and 80 points. Undergraduate students formed 210 teams, and the results of the WebQuest project were as follows: 11 teams – up to 40 points, 49 teams – from 40 to 55 points, 68 teams – from 55 to 70 points, 59 teams – from 70 to 85 points, 23 teams – over 85 points. As it can be observed, the engineering university and the technology park (as a university-based institution of additional education for secondary and high school students) have much work to do to strengthen the continuity between general and higher education.

CONCLUSION

The educational WebQuest is definitely not the only pedagogical technology that can be used to teach students teamwork. But it is obvious that it is the digital transformation of the educational environment that creates all the conditions for teaching students teamwork: firstly, there is the possibility of online interaction, and secondly, there is the possibility of version control (results of work, including the work on the WebQuest task). Prospects for the study include the development of information and probabilistic models of students' teamwork on WebQuest tasks.

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