

Students' Development of Information-seeking Skills in a Computer-aided Quest

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Abstract — In this paper, we describe the role of the game experience in the development of information-seeking skills among students. Participants searched for relevant scientific articles and information in a competition to answer questions. The quiz was developed using “Beaver’s”¹ Engine, which is usually used to organize outdoor games such as “Dozor”². We used the game concept to organize a quiz. The students’ feedback shows the development of many skills.

Keywords — *Information search; gamification; student assessment*

I. INTRODUCTION

Information using is fundamental for education. It requires searching, processing and the transmission of information. Although libraries were used previously in the education process, the Internet now gives us new opportunities and contains much information that we use every day. All these requirements are included in information literacy.

The concept of information literacy was introduced by Paul Zurkowski in 1974. According to [1] “information literacy is a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information”. Information literacy overlaps significantly with information technology skills, but is broader. It develops lifelong learning through abilities that may use technology but which are ultimately unobstructed by them.

It is widely accepted that information literacy is vital in an information-technology century. As it follows from the description, information literacy also manifests itself in an ability to produce information seeking, which has become essential today because of the continuous growth of information [2]. In the age of information technology, the focus of information seeking has shifted to the Internet. Effective Internet searching requires special skills. Search engines such as Google and Yandex have arranged search competitions to highlight these skills. In this article, we describe applying gamification techniques to improve student’s information-seeking skills. As a base, the “Dozor”

[3] game was used with altered rules. Students played the quiz and competed with each other.

II. LITERATURE REVIEW

Information seeking is one of the skills that all students should have, especially after completing a master's-level science program. Students should be able to find the necessary information through research. Most people have limited search literacy and do not know how to use search engines effectively [4], [5].

Vakkari [6] and Niu [7] investigated information-seeking behavior and other aspects of information seeking. These researchers described only a few models of information seeking, noting that “due to the complex nature of information searching, it is impossible to control all necessary factors in natural research settings” [7].

In a paper [8] described an assessment of information literacy skills provided at the California State University. The assessment strategy included three phases. After the assessment, they found that students started their research using computers. They also observed decreasing usage of print resources, and fewer requests at the reference desk in the library. They concluded that the best way to judge competence may be to trace students’ actions when searching for information. However, the paper is a work in progress and they need to clarify the concept of information competence when addressing the “fuzziness” of information competence standards.

In another paper, [9] described an information literacy program that was integrated into the curriculum for nursing students. Students completed surveys before and after completing a program to assess their skills in applying information literacy. It was found that students, who completed a program, were more skilled at using of the library catalogue to locate resources. In this way, the program to develop information literacy showed its effectiveness.

The article [5] analyses the information-seeking tasks among students in high school biology classes. The students were asked to conduct a real-time information-searching task; in addition, some participants were included in semi-structured interviews. The results showed that 59% of the information sources were Internet-based. Students used the

¹ <http://beavengine.ru>

² <http://www.dzzzr.ru>

Internet because of easier access compared to a library. The most popular strategy when searching the Internet was a keyword search. The researchers also provided a literature review that discussed works that highlighted the lack of information seeking and critical evaluation skills.

Gamification can increase students' interest in performing information-seeking tasks. Thus, it was applied at the University of Huddersfield, which implemented a "Lemontree" system that "tries to make using library resources less stressful as well as injecting an element of fun into library activities" [10]. It also, it adds social elements to library use, such as sharing comments on Facebook. The system received positive feedback from users and increased the engagement of those who used the system.

Although gamification is not a new term, it does not have an exact definition. Burke [11] described it as "the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals". Seaborn [12] conducted a survey on gamification to clarify the terminology and the concept. According to it, gamification consists of two main aspects: non-entertainment purposes and gaining some inspiration from games. Both of them exist in our approach. The term "gamification" showed a sharp increase on Google Trends in the second half of 2010 and has become increasingly popular. Research has indicated that gamification promotes increased student motivation and engagement [13].

Many attempts have been made to enhance search literacy by using gamification elements in different ways. In a paper, [14] presented a web-searching framework to perform interactive search tasks. The framework included such game design elements as user points, levels, sounds, badges, and leaderboards. The users, who tested the framework, noted that the framework is "user-friendly and capable of increasing users' motivation." Cheong et al. [15] implemented the Quick Quiz system – a tool for quizzes that embed in an instructional strategy - with time limits to answer questions, multiple-choice questions, and voluntary participation without assessment. After the quiz, the results were summarized and an instructor discussed the answers given to increase interest in the topic being debated. Students earn points for each correct answer, and the faster the answer was given, the more points for the task were received. About 60% of students who participated noted that the approach increased effectiveness of their learning and productivity.

As can be seen, many attempts have been made to improve information literacy in general and information-seeking skills in particular. Different approaches have been taken, including searching for information while completing a project, curriculum integrated programs, applying gamification techniques in routine actions and so on. In the present study, we organized a special quiz to improve the information-seeking skills of master's students. This quiz was modeled on the game known as Dozor, an outdoor game prevalent in Russia and Western Europe, which is based on the concept of a puzzle hunt. One example of a puzzle hunt is the game hosted by the Massachusetts Institute of Technology. In this game, teams tried to find special codes at certain places, solve puzzles and complete other tasks in a limited amount of time

[16]. The quiz we organized aimed not only to improve information-seeking skills, but also to develop teamwork skills and improve language skills in scenarios in which students searched for articles written in foreign languages.

The rest of this paper is structured as follows. Section 2 describes some works that aimed to increase students' information literacy. Section 3 introduces the quiz principles, tasks features, and provides examples of the task questions. Section 4 describes the quiz process among master's students. Finally, section 5 provides the conclusion.

III. GAME PRINCIPLES AND ENGINE USE

We took some principles from the Dozor game, such as time limits for questions, clues, and a game engine. The game used a special engine that distributed tasks, calculated points, tracked statistics, and provided communication with the organizers. We used Beaver's Engine for the quiz because it is a free engine with features to develop several types of games, has good reviews, and simple deployment. The engine has a simple interface, but is not very user-friendly. The system allows one to input an answer in an open form, but without white spaces. Only teams could play the game. Thus, students had to create teams rather than participate individually.

The quiz questions were created in an original form. Players had to use web-search engines, such as scholar.google.com to solve tasks. Each task had attributes such as:

- Task complexity
- Set of clues available in a given time
- Number of attempts to give an answer

Due to the differing complexity of the tasks, the number of points for each task varied. Similarly, different amounts of time were allowed for solving easy and complex tasks. All these factors forced students to choose a strategy. They could solve many simple tasks, or they could solve a few of complex tasks. The number of clues used, incorrect answers and the time taken to solve a task were taken into account at the end of the quiz.

Below are examples of the tasks. In the first question, we asked students to type only the first author's surname because of engine limitations, and specified that the answer could not contain white spaces. The first search instructions were the following:

- "Enter the surname of the first author of a work, published in 1927, who had a major influence on the development of mathematical models for the spread of disease and is still relevant in many epidemic situations" (Answer: Kermack).

Another search was as follows:

- "Enter the name of the district in a city in Britain where John Snow found the reason for the cholera outbreak" (Answer: Soho).

As mentioned previously, the tasks had different levels of complexity. The following is an example of a difficult question:

- Task: “If you have some problems with our quiz, don’t be upset. You are not the first to have trouble finding information. For example, in 2013, some secondary students had the same problem, so they had some tasks to solve this. No, you must not complete all this test, just Assignment 2. So, to which one would you go? P.S. When you go, just remember that you have a lot of money and 48 euros for lunch is not expensive” (Answer: Bord’Eau).
- Clue: “Assignment 2: Imagine that you have won one million euros and have decided to take your parents out for a very fancy dinner in Amsterdam. Because you now have plenty of money, only the best will do. You decide to go to the restaurant with the most Michelin stars. To which restaurant would you go?”

To answer the questions, students needed to find relevant articles and at least skim the texts. For simpler tasks in the quiz, the answers could be found directly in the articles; for more difficult tasks, students had to follow references to other articles. Figure 1 presents an example of a form to send an answer to a task. After the quiz, participants received a table with the quiz results, which included the number of clues used, the time it took to solve tasks, the total time taken and the points. The results and tasks were then discussed.

IV. GAME PRINCIPLES APPLIED TO MASTER’S STUDENTS IN COMPUTATIONAL SCIENCE

Ten master’s students participated in two quizzes during the course of the master’s program “Urban Supercomputing” at the ITMO University [17]. They were aware of the quiz rules and limitations. They received instructions about how to register on the system and create a team. The first quiz involved tasks based only on articles that students had read before the quiz. They chose some interesting articles related to their research and presented these articles to their classmates. In this way, the first quiz measured the attention of their colleagues. This quiz contained 20 tasks of varying complexity and lasted an hour.

The tasks in the second quiz were not related to articles students had read but instead to their fields of study. There were only seven tasks, but some were more complex and intricate than were others. For this reason, more time was allocated for the second quiz, and students were divided into teams consisting of two members.

Finally, the quiz revealed students’ abilities to find information and work together, as well as some flaws in the quiz. One such flaw was related to a problem at the beginning of the quiz process.

The students encountered difficulties with the system that delivered the quiz, and there were some questions about how to use it. The main issue involved students’ reluctance to read the instructions, which indicated the necessity for a trial quiz in advance of the real quiz.

Another flaw was connected to the assessment system. The engine has an embedded assessment system; however, because of differing task difficulties and the random order of tasks, the assessment might not be fair. For example, if one team were to be given only the simplest tasks and solves them in a short time, they would receive more points than would another team that solved only a few difficult tasks during the quiz. This complication led us to provide a reassessment so that teams received more points for solving complicated problems.

Fig. 1. Answer input form.

After the quiz, we asked students to complete an opinion survey about it. The responses indicated that only one student had played a game that incorporated similar concepts. The second quiz, which was related not to articles students had read but to their fields of study, was more exciting for the students, and we received very positive feedback from them. They suggested increasing the number of questions at the easy and medium levels.

We also asked students which skills were useful for the quiz. They noted the following skills and qualities::

- Savvy
- Erudition
- Data processing
- Information seeking
- Understanding texts
- Article searching

After the quiz providing few steps clarified which we should keep next time to provide a quiz:

1. Creating tasks that are designed for the target audience (master’s students in this case).

2. Providing a trial quiz for test tasks (only the organizers would be involved).
3. Adjusting and correcting tasks according to the results of the trial quiz.
4. Trial quiz to introduce the logic behind the quiz (the anticipated participants involved).
5. Obtaining the quiz results.
6. Posting the quiz results. Correcting tasks according to difficulties that arose during the quiz. Individual recommendations for participants.

The fourth point was omitted in present example, but this was necessary to avoid wasting time on providing explanations during the game.

V. CONCLUSION AND FUTURE WORK

Information-seeking skills have become vital in a modern world that is full of information. It is difficult to remember all the necessary knowledge, and technology can help us find the required information quickly. In this paper, we discussed an information-seeking quiz designed to improve students' skills that are important in the age of information technology. We organized a Dozor-based quiz using Beaver's Engine. During the quiz, we encountered some problems that indicated the necessity of providing a trial before introducing the main game. The engine that we used requires some modifications to meet our needs. The feedback from students after the quiz helped to identify shortcomings. The students made useful comments and provided suggestions about the quiz.

Finally, the students were delighted to take part in this quiz. Nevertheless, we want to improve the quiz and use it for other subjects too. We started to develop our own system for providing such quizzes. The system is developed using the ASP.NET and was deployed in our local network for testing. In the current version of the system, the quiz starts at a certain moment and has a time limit. After the quiz, players can view a table showing the results and the task statistics, which could be useful for organizers. Each task may contain some of the following features:

- Clues
- Possibility of refusing the task
- Time limitation
- Limits to the number of attempts to answer

In future, we will improve the system by taking steps such as implementing new features and adjusting user interfaces. We also, we want to measure the effects of a quiz on information-searching skills in a specific topic by providing a series of quizzes.

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