Assessment of E-Portfolio in Higher Education

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Abstract—The e-portfolio development and introduction are based on the fact that the reflective practice of its creation allows students to document and track learning, develop a coherent picture of experience, and improve self-understanding. The study took place at Lomonosov Moscow State University (Russia); an assessment tool to design and develop electronic portfolios in the higher education system has been developed and tested in the study. A survey focused on the value of an electronic portfolio, which was positively assessed by the respondents, was conducted. The students participating in the study developed e-portfolios that described their reflections on the learning process and backed the arguments made with proof. The assessment showed that 60% of students should improve their cooperation skills while skills related to conceptualization and implementation, critical thinking and decision-making, assessment and modification, meta-cognition and progress should be developed in 44%, 33%, 52%, and 64% of students, respectively. The research results confirm that e-portfolios provide an appropriate platform for integrative learning that allows students to visualize the relationship between various concepts learned throughout the course and beyond.

Keywords—Assessment; integrative learning; e-portfolio; self-regulated learning; formal and non-formal learning.

1 Introduction

In the 21st century, global society is changing rapidly, and the development of information and communication technologies (ICTs) makes the world more integrated and accelerates the process of communication. The interpenetration of cultures due to the global dissemination of information through the world media is taking place. International business is dominated by transnational corporations whose employees,
specialists and managers work in different countries of the world [1]. As a result, this has changed the way of living and student learning styles, which today require the creation of a network to learn without borders [2].

At the same time, cognitive skills are the most important learning and teaching skills in the 21st century [3]. Therefore, according to research, most educators have focused on the use of ICTs to improve cognitive skills [4,5]; the technology can be applied to improve critical thinking, problem solving and creative thinking skills [6].

However, before the digital revolution triggered the transformation of education, a number of educators used physical portfolios to create collections of student works in order to assess or document their abilities. In a number of fields, such as design, fine art or photography, portfolios are used to document personal development and showcase work. The proliferation of digital technologies replaced physical portfolios with digital ones and increased the capabilities, functions and portability of collections [7]. Various scientific sources provide a number of different approaches to defining a portfolio; but generally, researchers describe it as “purposeful generalization and reflection of work, effort and progress.” In the most general form, an e-portfolio is a digital adaptation of the paper portfolio [8]. Thus, these are “web-based collections of learning artifacts generated by students (documents, multimedia projects, speeches, images, etc.) and related reflections focused on learning and growth” [9]. A modern e-portfolio is a platform that can be used to compile, organize, and develop a digital presentation; it can be updated and adapted for different purposes and audiences. As noted above, various electronic media and links to external sources can be used to store an electronic portfolio; for example, an electronic portfolio can be stored on computer hard drives, USB flash drives, smartphones, iPods, CDs, commercial websites, educational websites, or any combination thereof [7]. E-portfolios provide benefits in a number of disciplines, not just in visually-oriented ones such as studio art. For example, business programs appreciate reflection and self-regulatory aspects of learning while a portfolio provides an opportunity to represent personal and professional growth outside traditional academic systems [10]. An e-portfolio is shared with teachers, fellow students, or potential employers and clients in accordance with the goals set.

Academically, e-portfolios are mainly focused on meta-cognition and goal setting, that is, the awareness of one's learning and development of skills, the ability to assess strengths and weaknesses, and reflect on personal progress. The latter is developed by adding new artifacts and analyzing old ones when compiling an e-portfolio. In this case, artifacts are defined as long-term records of achievement that can be demonstrated to potential employers as evidence of skill development or to the teacher as evidence that the student has succeeded in the course [11]. Personal and professional growth records allow students to analyze learning and specify short-term and long-term goals [12]. The e-portfolio also provides academic advice and feedback due to interactivity (e-portfolios are accessible to students and advisors at any time; thus, advisors can monitor student progress in real-time); progress tracking (there is usually a list of grades to track student progress, but portfolios fully describe student activities in the learning environment and beyond); planning (portfolios allow teachers to provide detailed recommendations to help students achieve goals, determine the resources to improve academic performance); portability (students can take their portfolios with them from year to year or from university to university; teachers can use the portfolio to get acquainted with
the student) [13]. In the academic environment, electronic portfolios are usually categorized into three types: showcase portfolio, which highlights major achievements; learning portfolio that demonstrates a learning process with a focus on feedback; assessment portfolio, which is used to assess the competency of students on specific standards or topics [9].

The institutional use of electronic portfolios is to enable the academic administration to demonstrate compliance with the accreditation requirements or academic standards. Academic administration can use the portfolio to assess student strengths and weaknesses to subsequently make changes to the curriculum. This is a centralized source of information that can be accessed to assess academic performance and course effectiveness [11]. In terms of career development, students can use portfolios to demonstrate potential employers their abilities and skills that cannot be done through the academic certificate (diploma) [14]. In addition, e-portfolios are a great way for students to demonstrate the learning pathways or skills they achieve by pursuing related goals or competencies in different subject areas [15]. E-portfolios are flexible and adaptable; thus, they can be updated and incorporated into professional networking platforms as a job search tool or for promotion [16]. Today’s companies are increasingly willing to accept e-portfolios to evaluate job candidates [17].

E-portfolios have a number of advantages over traditional portfolios, including accessibility, ease of duplication and storage, constant updating, and the possibility to add hyperlinks, audio and video data that provide a more dynamic presentation of the content [18]. In addition, students get more opportunities for reflection due to increased potential for connections between different types of media, standards, and artifacts, as well as increased knowledge of technology applications [19]. E-portfolios are a well-established practice in higher education that helps students develop critical thinking and problem-solving skills [20]. E-portfolios are included into the list of the eleven high-impact practices that have the greatest effect on student learning, understanding, and engagement [7]. According to research, students who have skills to work in an ever-changing environment have developed self-regulated learning strategies. A digital learning environment lacks organization and control that are commonly found in traditional classrooms. The lack of a formal structure makes self-regulated learning strategies an important educational component [21] (Figure 1).

![Diagram](http://www.i-jet.org)

**Fig. 1.** The development of self-regulated learning skills through the e-portfolio creation

Note: Own development based on [9]
It was proved that students who are not motivated to learn have difficulty learning and developing learning skills. E-portfolio documents achievements and success in the learning process, which allows students to easily analyze them [22]. This can contribute to the motivation of students to continue their learning and invest time and effort in it; keep their interest in the use of the e-portfolio for professional purposes: help students set learning objectives and define them in the short and long term, which is a key strategy for effective lifelong learning [23]. It is no wonder that in the digital era when technology is having an increasing effect on education all over the world, electronic portfolios in higher education programs are gradually replacing traditional papers [24].

Clearly, e-portfolios have disadvantages along with their positive aspects. Although researchers agree that an e-portfolio is a great assessment, learning, and employment tool [22], it is unlikely that the portfolio will be fully utilized unless students invest their effort in it. The major problem is student self-motivation which is considered the key to the adoption of new technologies and an integral part of self-regulated learning. When students do not have enough knowledge to compile a portfolio, it may be incomplete or inconsistent; therefore, it cannot contribute to their educational or professional activities. The key point is setting standards; thus, if there are no portfolio artifact standards, there are inconsistencies and gaps [25]. It is also important to focus on the time-frame; the sooner students begin to create a portfolio, the more complete it will be. Technologies are certainly important. Students and the academic staff should be trained to create, evaluate and use e-portfolios [26]. While e-portfolios can provide students with benefits, their effectiveness is limited unless they are properly implemented [27]. The e-portfolio creation is a complex process that requires training for both teachers and students [28]. In order to fully benefit from an e-portfolio, the platform it is hosted on must have some key features and capabilities. Users should be able to sign in, make changes, upload content, and update profile information quickly and easily. The platform should allow the user to define how others can view the portfolio and provide user feedback. Ideally, users should be able to create a lifelong profile that they can complete from any educational level throughout their professional career [29].

The foreign experience of introducing e-portfolios seems to be interesting. For example, at Harvard Graduate School of Education, which introduced a course based on the cognitive learning model, students were asked to create real work products, which they displayed in their professional e-portfolios as part of learning-oriented assessment [30]. The research proved that portfolio creation helps students learn more about themselves and build strong mental models through reflection. E-portfolios were filled with weekly reflections on the course materials read and discussions on the results of the meetings held while working on the project. Students tried to solve technical difficulties or questions related to the e-portfolio content on their own or discuss them with their peers. The strategy reflects the high Individualism vs. collectivism (IDV) index developed by Hofstede. At the end of the course, after the portfolio assessment, students were given recommendations to improve the effectiveness of their learning [11]. At the Complutense University of Madrid, e-portfolios are used as a learning and reflection tool to prepare students for their practical activities. Students compile their e-portfolios and upload assignments weekly to receive constructive feedback from both their peers and the teacher. At the end of the term, students transform their course portfolios into career portfolios by adding resumes, mission statement, and selecting those artifacts that best
demonstrate their academic and professional experience [11]. At Sookmyung Women's University (Seoul, South Korea), an e-portfolio is used as a tool for reflection on learning and professional development, as well as assessment. Students can create a product, process, or demo portfolio [31] based on their professional goals; they choose artifacts and write reflections on them in accordance with the overall goals of the portfolio. Artifacts are the product of various projects presented throughout the course improved after receiving feedback from the teacher and allowing students to assess their own progress.

Modern Russian education should consider the individual needs of students, assess not only their knowledge, but also academic achievements, develop competency in various fields of activity, encourage teamwork and creativity, as well as provide insights into professional career prospects [32]. As a result, the modernization of Russian education creates new requirements for teacher competencies and the ability to use technologies for reliable assessment of student learning outcomes. The ePortfolio technology has been implemented in the Russian education system for 10 years; however, in Russian higher education, there is no single approach to the use of the technology. Thus, it is often referred to as a means of collecting and arranging information rather than a knowledge development mechanism. The purpose of the study is to develop an approach to assessing e-portfolios describing formal and non-formal learning outcomes based on the cognitive approach. The data collected in the study were used for self-assessment, peer and teacher assessment.

2 Methods

2.1 Sample formation

The study involved 35 students at Lomonosov Moscow State University (Russia) (63% of women and 37% of men). The average age of the study participants is 19.6 years. There were 3 educational specialists (work experience of at least 10 years) involved in the study. The research sample was formed on a voluntary basis by sending out email invitations.

2.2 Study design

At the first stage, student attitude towards electronic portfolios, as well as internal factors that can motivate learners to successfully create and use a portfolio were studied based on the quantitative approach in order to clarify student views on the value and importance of an e-portfolio, as well as their own results and efforts. A survey which asked students to think about the future use of the electronic portfolio was conducted. The question was as follows: “I believe that an e-portfolio can contribute to my professional activities and career and will help me study and work better.” The target question was assessed on a 5-point Likert scale [33]:

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Paper—Assessment of E-Portfolio in Higher Education
The second stage of the research was conducted in accordance with the key e-portfolio goals based on two components: learning and demonstration. During the experiment, students collected evidence of their work and reflected on the path to take to ensure lifelong learning and skills development. Electronic portfolios facilitate the job admission process and contribute to career development. When creating portfolios, students relied on literature, publicly available alumni profiles on social media, published job advertisements and the described requirements, and personal experience to list important lifelong learning skills.

The experiment was conducted on the Open-Source Portfolio (OSP) platform configured in accordance with the research objectives; thus, the focus from the subject area and disciplines was shifted to the context of learning, employment and external activities in order to highlight the current trend of the importance of learning beyond the formal higher education. This approach is more flexible as it involves students with different qualifications and work experience. The electronic document can include both experience and skills acquired within the educational program and beyond.

The major portfolio assessment criteria were determined in cooperation with the educational specialists; it was decided to make 6 criteria (meta-cognition and progress; critical thinking and decision-making; creativity and innovation; conceptualization and implementation; cooperation and teamwork; assessment and modification).

2.3 Ethical issues

Participation in the study took place on a voluntary basis and anonymously. Students were assigned individual numbers. Their personal data and the assessment of electronic portfolios were not disclosed.

3 Results

The survey results did not contain a negative answer; there were only 7% of students gave a neutral answer. Half of the respondents "absolutely agreed" while the "rather yes" and "yes" options were chosen by 43% of respondents (Figure 2).
Next, the participants created their electronic portfolios including formal and non-formal learning outcomes (Figure 3, Figure 4).

Note: Based on [34,35].
During the first week of the experiment, the students created portfolios based on the initial advice on technical and methodological issues. They were asked to include artifacts that demonstrate their achievements in the three types of education:

- **Formal education** - The students accumulated results obtained in a hierarchically structured, systematic, chronologically distributed education system. Any educational outcomes achieved in an organized and structured learning environment (from primary to higher education), including assessments that allow students to enter the next stage of their studies, could be considered.

- **Non-formal education** - The students accumulated results achieved outside the formal learning environment; they tried to cover the widest range of knowledge and activities such as individual and personal research on a subject or interests using books, libraries, the Internet or other sources.

- **Informal education** - The students were asked to accumulate educational outcomes as a result of daily activities related to work, family or leisure, that is, artifacts based on daily experience.

Next, the average level of reflection for each student was calculated on the following 6 categories:

- Meta-cognition and progress
- Critical thinking and decision-making
- Creativity and innovation
- Conceptualization and implementation
- Cooperation and teamwork
- Assessment and modification.
The results are described as a hexagonal diagram (Figure 5). It identifies the categories in which the student portfolio scored well and the areas that require further improvement. These areas can be improved based on teacher recommendations.

**Fig. 5.** An example of a hexagonal diagram evaluating student electronic portfolio (Student 11)

Note: Own development

Additionally, the average assessment of the group electronic portfolio was calculated by each category (Fig. 6).

**Fig. 6.** Hexagonal diagram of the e-portfolio assessment of the experimental group

Note: Own development
In addition to the aggregate average assessment by category, the areas of student interest to create an e-portfolio were highlighted. The results showed that 21 students (60%) required increasing cooperation skills. It was also noted that skills related to conceptualization and implementation, critical thinking and decision-making, assessment and modification, meta-cognition and progress should be developed in 44%, 33%, 52%, and 64% of students, respectively.

Further, the students were given assignments aimed at stimulating critical thinking, the need for a creative approach and the ability to respond quickly in a changing environment. There were small groups of 5 students to improve teamwork skills and the ability to delegate responsibilities and authorities. At the same time, the educational specialists gave a coaching session to teach students to compile a portfolio. After three weeks devoted to completing the assignment and updating the portfolio, the assessors noted the following changes: cooperation skills should be improved in 58% students; conceptualization and implementation - 41%; critical thinking and decision-making - 31%; assessment and modification - 51%; meta-cognition and progress - 61%.

4 Discussion

The advantages of an e-portfolio as an assessment tool are based on the fact that it encourages lifelong learning by making it possible to collect, monitor and study student experiences [36]. E-portfolio helps teachers and students improve meta-cognition, convey the true concept or new information and use data analysis [37]. Students can use multimedia artifacts, including video and audio content, to make their portfolios more interesting. In addition, e-portfolios are more practical compared to the traditional ones as they are stored on flash or virtual drives and do not require a lot of space [38].

There are various assessment types that can be effectively based on the use of an e-portfolio. This is a formative assessment tool; it is believed that an e-portfolio is more effective than standardized assessment tests given the numerous and complex aspects of learning. E-portfolios are also used to establish professional performance and competency standards that can be found in government licensing programs. Importantly, e-portfolios can be self-assessed [39], which allows students to analyze their development and identify strengths and weaknesses. Studies focused on student perception show that learners recognize the benefits of e-portfolio as a learning tool [40]. It was found that 85% of survey participants noted that e-portfolios had encouraged them to study [41], and 90% of participants recognized the benefits of e-portfolios for their career prospects; at the same time, students who used an e-portfolio demonstrated an increase in their meta-cognitive skills, as well as stronger motivation and self-esteem compared to those who did not use it.

E-Portfolios have been found to stimulate and support meta-cognition and reflection on learning [40]. The results of a quantitative study of ICT readiness of students, which influences their views on the use of e-portfolios to improve cognitive skills, are of interest. The analysis of students’ views on the use of e-portfolios demonstrated positive results; students mainly aimed (1) to learn by creating the portfolio, (2) to improve creativity and (3) problem-solving skills, (4) to enhance critical thinking and (5)
increase the reliability of the assessment [18]. The study of factors affecting student motivation and attitude towards e-portfolios found that perceived usefulness and relevance are the two cognitive and contextual factors that most influence motivation while autonomy encourages students to put effort in portfolios [40]. Students who lacked motivation had a negative portfolio score. At the same time, a negative e-portfolio assessment was often associated with poor student learning strategies [42]. This conclusion is consistent with the findings of studies [43], in which participants considered an e-portfolio as a useful tool that encourages learning activity and motivation, as well as satisfaction with competencies and results obtained [44].

According to research, it is also important to provide technical support to students and teachers as it can significantly affect student motivation and their perception of e-portfolios [26,45]. Student comfort when using the e-portfolio technology is also an important aspect of motivation. Intrinsic motivation is the key to the acceptance of new technologies, and self-efficacy (competency) is a prerequisite for motivation [43]. It is noted that problems with the IT infrastructure and the system used to create an e-portfolio negatively affect student motivation. There is also a positive correlation between the computer literacy of students and their perception of the e-portfolio. However, it should be noted that according to the study [46], a positive student attitude towards e-portfolios is associated with user-friendliness and the reliability of the infrastructure. The researchers note [26] that website navigation problems and an inconvenient system for downloading documents and feedback negatively affect student motivation to use e-portfolios. There is a strong correlation between the expected support and motivation to use an e-portfolio, and feedback and support from peers and educators are important for self-regulated learning [46]. Students also had negative perceptions of the e-portfolio when the requirements were not properly balanced with other coursework [39].

However, e-portfolio implementation requires a lot of resources in addition to an effective platform; therefore, there is a lot of research devoted to the issue [20]. For example, cultural preferences, the use of e-portfolios on multinational campuses to help students apply knowledge in the local and foreign culture, environment and context. It is also feasible to study the effect of student assessment and preferences on the adoption of e-portfolios.

The study of the e-portfolio effectiveness to assess students is of interest; the students were asked to create an electronic portfolio based on any academic discipline, knowledge gained in traditional and virtual classes, literature, discussion, quizzes, and exams. As a result, it was revealed that an e-portfolio is an effective tool for assessing scientific literacy skills that include scientific communication, observation and experimentation, scientific and creative thinking, professionalism, as well as e-portfolio structure and content development [47].

5 Conclusion

The e-portfolio can become a versatile tool providing pedagogical and career benefits and allowing students to reflect on academic performance, get feedback, and complete assignments in order to get the assessment and showcase it to prospective
employers. The most significant factor that affects the intrinsic motivation of students to actively participate in the creation and use of a portfolio is their view on the value and usefulness of this tool. Students are ready to use the e-portfolio in the future rather than consider it as an assignment to complete for assessment. The respondents recognized the value of an e-portfolio as a learning and assessment tool. Nevertheless, the experience shows that work on a portfolio should be supervised by the teacher. The research results showed that 60% of students should improve their cooperation skills while skills related to conceptualization and implementation, critical thinking and decision-making, assessment and modification, meta-cognition and progress should be developed in 44%, 33%, 52%, and 64% of students, respectively. The replicated experiment showed an increase in the results; however, this can be explained by the fact that students had adjusted their portfolios to meet the requirements of hypothetical employers.

There is an obvious need for further research on the development and evaluation of e-portfolios. At the next stages of research, the development of a teacher manual aimed at the summative assessment of a student portfolio is a promising research area. Effective assessment tools can help teachers provide better recommendations to students and support student learning, especially in an increasingly dynamic web environment. In this regard, it seems promising to develop an artificial intelligence-based system, which will guide student progress providing recommendations and tasks to improve the professional profile based on student self-analysis data and teacher feedback.

The limited number of the experiment participants is due to the fact that the classes were optional. The experiment was carried out on a voluntary basis. Obviously, more extensive research to determine the key challenges and prospects for the long-term use of e-portfolio should be conducted in the future. There are other factors, including knowledge and ability to interact with ICTs, which can also influence the perception and use of an e-portfolio. This issue should be addressed in order to make this valuable tool more accessible to a wider audience of students. The results of the study may be of interest to teachers and academic administration.

6 References


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