



## STUDYING THE EFFECT OF USING E-PORTFOLIO ON CRITICAL THINKING SKILLS: CASE OF UNIVERSITY STUDENTS

Ali Shahraki\*<sup>1</sup>, Masoud Najjar Barghi<sup>2</sup>

1. *Ph.D Student of Curriculum Planning, Department of Curriculum Planning, Faculty of Education and Psychology, University of Isfahan, Isfahan, Iran*
2. *MSc in Computer Engineering, Department of Computer Engineering, Faculty of Engineering, Zahedan Branch, Islamic Azad University, Zahedan, Iran*

### ARTICLE INFO

**Received:**

03<sup>th</sup> Jun 2017

**Accepted:**

29<sup>th</sup> Nov 2017

**Available online:**

14<sup>th</sup> Dec 2017

**Keywords:** *E-Portfolio, Critical Thinking Skills, Analysis*

### ABSTRACT

Human needs are given more attention in the present era as the result of fast progresses made in the field of information and communication technology. Critical thinking is one of those fundamental needs playing influential role in development of individual and human culture. Although effects of a vast number of variables on the critical thinking have been investigated so far, those of e-portfolio on university students' skills have been neglected. It motivated us to conduct a quasi-experimental study including pre-post tests given to two groups; experimental and control. First the critical thinking skills of both groups (experimental and control) had been assessed then the experimental group received independent variable (treatment). At the end of semester two groups were given post-test on the critical thinking skills. Finally their scores have analyzed through analysis of covariance. Results of the research showed positive effect of e-portfolio on the critical thinking skills and their subsets. Generally it was revealed that the application of e-portfolio to teaching and evaluating will promise developing the university students' skill of critical thinking. Therefore professors are recommended to take further advantages of this method of teaching and evaluating.

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**To Cite This Article:** Ali Shahraki, Masoud Najjar Barghi, (2017), "studying the effect of using e-portfolio on critical thinking skills: case of university students", *Pharmacophore*, **8(6S)**, e-117382.

### Introduction

The modern life has undergone massive changes over the recent decades. Now it requires particular skills like higher-order thinking caused by social, educational, economic and cultural complexities. Higher-order thinking can be described as a sort of non-algorithmic and complex thinking producing various solutions most of the times. Different types of higher-order thinking have recognized yet including critical thinking [1].

Reviewing the available papers, Aloqaili [2] finds that there is still no consensus of opinion on the definition of the critical thinking. Nevertheless some researchers e.g. Andolina [3] identifies the critical thinking as a process through which ideas, information and its sources are evaluated and ordered coherently and sensibly then connected to other ideas and information. Other resources are taken into account during this process and their implicit concepts will be assessed. Ennis [2] defines the critical thinking as set of logical and discrete skills of thinking focusing on deciding what to believe or do. Finally [4] delineated the critical thinking as purposeful, conscious process to interpret and evaluate information and experiences. Popil [5] describes critical thinkers as flexible, innovative, creative, analytical, communicators, assertive, persistent, caring, energetic, risk takers, knowledgeable, resourceful, and intuitive and have the ability to think laterally, taking all aspects of a scenario into account. The critical thinking is purposeful, self-regulated judgments which results in interpretation, analysis, evaluation, and inference [6]. In other words, it is a purposeful process to make decisions and solve problems in different situations [7]. The critical

**Corresponding Author:** Ali Shahraki, Department of Management and Educational Planning, Faculty of Education and Psychology University of Sistan and Baluchestan, Zahedan, Iran, email: [shahraki.ali@gmail.com](mailto:shahraki.ali@gmail.com)

thinking allows individual to make logical judgment using a course of reasoning based on classical theories, available evidence and accepted standards and criteria [8]. Nowadays training students' critical thinking skills is one of the most complicated and involved issues in the education system since the output of society information of critical thinking of individuals went beyond this information and experts in educational issues have voices their serious concerns about poor critical thinking skills of the students [9]. The importance of the critical thinking is so great that it is claimed to be the major goal of higher education by some experts [10].

As mentioned before, training students' skill of critical thinking is one of the main objectives of higher education, evaluation, in another respect, is among the integral components of all educational trainings and indeed it is generally agreed that evaluation is the basis of learning, especially if deep and effective learning is set as the goal of the educational program [11]. Nonetheless, evaluation was considered a separate category in the past and mainly used to assess and document students' work in the learning process. From this viewpoint, evaluation terminates teaching activities. Using objective tests, old method of evaluation also put stress on those problems and events which, as Woolfolk states [12] bear no similarity to learners' real-life. It should be admitted that tests of educational progress and usual methods of evaluation suffer from deficiencies. Regarding the nature of tests of educational progress, it should be noted that they fail to properly assess important skills and competences such as critical thinking and analysis and problem solving. And we should pursue other remedies to do so. Consequently we could take performance assessment method into account which addresses real problems and encouraging open-thinking besides emphasizing the use of knowledge and direct evaluation of training goals [13]. A group of real or genuine assessment methods are called performance assessment [13]. Evaluation along with portfolio is considered as one of the performance assessment methods. A portfolio, like a jigsaw, is a set of pieces (learner activities) creates a clearer image of a student as a lifelong learner when fitting those pieces together [14]. Electronic portfolio is among new tools derived from modern approaches. "E-portfolio is considered as a learning and assessment tool – measuring both process and outcome of learning- with the capacity to save, manage, correct and offer feedback on learning activities by students in a web- or network- or computer-based digital environment". Contrary to paper portfolios, e-portfolios place no limitation on students, so they can save and have access to their information at any given time or place as well as updating them [15].

Bart put "an e-portfolio makes use of electronic technologies and a container that allows students/teachers to collect and organize artifacts-finished products in many media types (audio and visual, movie and text), using hypertext links to organizing materials, to link the evidence proper outcomes, goals or standards". E-portfolio creates a link between different works of student and facilitates mutual cooperation between teacher and student; it also could publish works of student through internet [16].

E-portfolio is also used for increasing meaningful interaction and learning [17], facilitating cooperation and the principle of cognitive apprenticeship [18], spreading metacognitive knowledge, conducting self-assessment [19], revising self-regulation strategies [20,21,22] and fostering thinking [23].

We have not found any research work directly investigating the effect of e-portfolio on the critical thinking, though that of Zarei Zavaraki and Rezaei [15] revealed a significant difference between means of two groups – one of them evaluated based on e-portfolio (experimental) and the other one based on usual evaluation methods (control) – in favor of the first". Dana Mazraeh [22] studied "the effect of using e-portfolio on self-regulated learning strategies between university students" which showed a positive effect of e-portfolio on the self-regulated learning strategies. Adopting constructivist approach, Tynjala [24] in his research have improved critical thinking skills among students. Results of study performed by Chau and Cheng [25] showed application of e-portfolio was more effective in promoting self-regulated learning between poorly-motivated students than those who were strongly motivated. Cheng and Chau [26] in their research have found higher-order cognitive, metacognitive, self-regulated and cooperative learning skills would be enhanced by using electronic portfolios.

Given increasing importance of the critical thinking skills for the students, it becomes a necessary and fundamental issue, though it receives insufficient attention during educational training of the students. As the result we observe low-level critical thinking skills among the students which require more attention and planning in order to get improved. Also it is impossible to train human resources without relying on information and communication technologies and using electronic learning for teaching and evaluating them; therefore the present paper is looking for an answer to this question "Is using e-portfolio for evaluating the students effective on honing their critical thinking skills?" Accordingly we put forward primary and secondary hypotheses as follow:

#### **Primary hypothesis**

Using e-portfolio for evaluating students is effective on increasing their critical thinking skills.

#### **Secondary hypotheses**

Using e-portfolio for evaluating students is effective on increasing their analysis skill.

Using e-portfolio for evaluating students is effective on increasing their inference skill.

Using e-portfolio for evaluating students is effective on increasing their evaluation skill.

Using e-portfolio for evaluating students is effective on increasing their inductive reasoning skill.

Using e-portfolio for evaluating students is effective on increasing their deductive reasoning skill.

### Method

The research was conducted based on a quasi-experimental method including pre-post tests given to two groups; experimental and control. Population included all students attending Islamic Azad University of Zahedan. Convenience sampling method has been adopted in order to select subjects from the population through which they were divided into two classes, one of them consisting of 30 students while the other one 31, therefore the sample size added up to 61. First we made contact with the University of Zahedan to ensure their cooperation, then giving two groups (experimental and control) pre-test to evaluate their critical thinking skills after discussing how to conduct the research and design e-portfolio with respective professor. Next we chose one of the groups as the experimental and the other one as control randomly. Administrating the pre-test, independent variable (e-portfolio) was given to the experimental group during the following semester (three month). At the end of the term we gave two groups post-test to measure their critical thinking skills based on which required data collected and analyzed. Correspondingly research hypotheses were tested through comparing results of the two groups.

California critical thinking skills test- form B (CCTST) has been applied as the research instrument. The test was designed by Facione in 1990 and consisting of 34 multiple choice questions with 4 and 5 options. Only one answer can be keyed as correct and overall score could be 34 at best. The California Critical Thinking Skills Test returns scores on analysis, evaluation, inference, deductive and inductive reasoning subscales which include 9, 14, 11, 15 & 15 questions respectively. The average score of the test is 15.89 [3].

### Findings

Our sample consisted of 36 female (63.93%) and 22 male students (36.06%). We tested the research hypotheses through running the analysis of covariance (ANCOVA). The reason behind employing this technique was that the pre-test was used as the control variable by researchers so as to control the effect of prior preparation and moderating the effect of this variable on the critical thinking skills of the students.

There are several assumptions underlie the use of ANCOVA and affect the interpretation of results which must be studied before applying this technique. There are as follow: normality of error terms, homogeneity of error variances, and homogeneity of regression slopes. These three assumptions had been studied before running ANCOVA analysis. Fortunately all of said assumptions for ANCOVA were met i.e. it was appropriate to use ANCOVA for analyzing the research data. Table.1. illustrates the results of ANCOVA analysis.

**Table 1.** ANCOVA analysis of Effect of E-portfolio on Critical Thinking

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Corrected Model	1063.793 <sup>a</sup>	2	531.896	89.024	.000
Intercept	21.991	1	21.991	3.681	.060
pretest	707.632	1	707.632	118.437	.000
<b>group</b>	<b>307.646</b>	<b>1</b>	<b>307.646</b>	<b>51.491</b>	<b>.000</b>
Error	346.535	58	5.975		
Total	12731.000	61			
Corrected Total	1410.328	60			

As it could be seen in the ANCOVA table the sum of squares is 307.646 based on which F-value calculated 51.491 which is significant at one percent probability level. Differently put the difference between experimental and control group was significant at 99 percent level of confidence even after moderating the effect of pre-test on the critical thinking skills.

The table below summarizes the results of ANCOVA analysis of effects of using e-portfolio on the components of critical thinking skills.

Variable	Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Analysis	group	52.589	1	52.589	24.460	.000
Inference	group	44.160	1	44.160	41.400	.000
Evaluation	group	22.549	1	22.549	33.585	.000
Deductive Reasoning	group	75.389	1	75.389	46.301	.000
Inductive Reasoning	group	70.635	1	70.635	51.483	.000

As the table shows the sum of squares for analysis is 52.589 based on which F-value calculated 24.460 which is significant at 1 percent probability level. Also the sum of squares for inference is 44.160 based on which F-value calculated 41.400 which is significant at 1 percent probability level. The sum of squares for evaluation is 22.545 based on which F-value calculated 33.585 which is significant at 1 percent probability level. The sum of squares for deductive reasoning is 75.389 based on which F-value calculated 46.301 which is significant at 1 percent probability level. The sum of squares for inductive reasoning is 70.635 based on which F-value calculated 51.483 which is significant at 1 percent probability level.

## Conclusion

The main goal of the present research was to investigate the effect of e-portfolio on evaluating students' skills of critical thinking which revealed that the e-portfolio was effective in honing those skills. Furthermore 5 secondary hypotheses suggesting the effect of experimental method of using e-portfolio on the 5 components of the critical thinking skills have been examined. Accordingly the effective role of experimental method in bringing about a significant increase in scores of critical thinking skills and its components, comparing to the control group, have been confirmed by all the 6 research hypotheses ( $P < 0/01$ ). T sum up, the results of this paper implies that students' skills of critical thinking could be enhanced through using e-portfolio for teaching and evaluating them. These results could be seen as experimental support to show the effect of evaluation method on learning of the students and emphasize the mutual connection between them (evaluation and learning); indeed evaluation constitutes the key element of learning and it outlines the educational program of teachers and organizes students' effort to learn [13].

The results of our study showed a significant difference between scores of experimental and control group. The results are also consistent with those of Rezaei [15], Dana Mazraeh [22], Tynjala [2004], Chau and Cheng [25], Cheng and Chau [26].

Further explaining the findings reported in this study as well as those of previous works, it should be noted that the thinking in general (and critical thinking in particular) help students to initiate the process and measure the outcomes of components of their portfolios. The portfolio allows them to check on their progress by university standards and evaluating their educational outcomes and tracking their progress to satisfy their needs. While using e-portfolios, Learners set out goals, oversee their works and manage their times and efforts in order to reach them, therefore they take responsibility to learn, it makes them aware of their strengths and weaknesses and motivates them to overcome their weaknesses and boost their strengths, it will make them critical learners at the end [22]. According to Heidari and Gharabaghi and Pakpour [17], e-portfolio enhances the components of thinking – strengths, skills and self-motivation- through developing interaction and promoting meaningful learning, raising self-awareness and conducting more self-assessments. Fernsten put “the components of thinking – fundamental parts of portfolio which is considered as an essential learning tool – teach students to carefully analyze their performance, detect their errors and what has been done properly, employ effective strategies in improving their situations in the future works and shoulder responsibility for their learning while thinking. All abovementioned activities will improve and broaden students' skills of critical thinking.

Generally we can arrive at conclusion from this paper as well as others, mentioned above, that using e-portfolio – which was derived from constructivism – facilitates critical thinking and learning in education. In fact constructivist learning theory and evaluation models, developed based on which such as e-portfolio, help students to oversee their thinking process and, through which, evaluate their progress in fostering their thinking skills and critical thinking in particular. Vygostky [27] assumes that “there is no room for development of critical thinking skills in a class only one voice could be heard. Such class just produces a number of consumers having no ideas or opinions. Therefore, given the importance of developing thinking skills as one of the primary goals of higher education, we recommend trainers and instructors to design plans and tests in a way that grants learners more freedom to voice their opinions for and against the various scientific issues. If they are given such chance, they can understand others’ viewpoints and come up with new ideas. We also advise professors to take advantage of well-established, investigate and constructivist-based evaluation methods in their classrooms. Applying these methods will foster students’ critical thinking as well as their analysis, inference, evaluation, deductive and inductive reasoning skills. Below we outline recommendations on the basis of the results of our research:

1. Educational institutions and universities are recommended to try to bring their instructors up to date on the modern methods of evaluation, learning and teaching, such as e-portfolio, through providing adequate facilities and in-service training besides scheduling workshops on respective issues.
2. Administrators and authorities in the Ministry of Science, especially curriculum planners, are advised to plan curriculum based on e-portfolio for those subjects require thinking skills.
3. Authorities and those involved in the Ministry of Education are recommended to induce teachers to employ this method of assessment, teaching and learning in the teaching guidebooks and putting forward viable solutions in order to implement those methods.
4. It is recommended that more time devoted to teaching subjects based on e-portfolio learning method as it is a time consuming one.
5. Educational institution, schools and universities are advised to provide their professors and instructors with in-service computer training since e-portfolio-based learning activities require computer literacy and respective skills.

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