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## The Effect of Collaborative vs. Individualized Learning in the Cloud

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**Abstract.** The present study compared the effect of collaborative vs. individual learning of summary writing in a cloud-based instructional module. The participants were 98 college students enrolled in the Department of Math and Sciences at Plovdiv University, Bulgaria. The participants' level of proficiency and summary writing skills were tested prior to the experiment in order to ascertain that the two experimental groups did not differ significantly at the onset of the instructional module. Learning outcomes were established through an immediate post-test and a delayed post-test of summary writing. Special measures were taken to guarantee the reliability of the summary scoring. The two groups' immediate post-test and delayed post-test scores were compared through independent t-tests. The results showed a significant priority for the collaborative group on both the immediate post-test and the delayed post-test. These findings provide assurance that collaborative work in a cloud-based instructional module can lead to learning outcomes that are not only not inferior to individual work, but can even be superior.

**Keywords:** Cloud, cloud learning, collaborative learning, individualized learning, summary writing, web-based learning

### Introduction and Background to the Study

The rapid advancement in Information and Communication Technology has opened up numerous opportunities for new platforms for teaching and learning. McLoughlin and Lee (2007, p.664) define these affordances as instrumental in how "we teach, communicate, learn and create know-ledge." As a natural consequence of the increasing role of cloud technologies, research about this new learning paradigm is also evolving (Butoi, Tomai, & Mocean, 2013.).

The diversity of cloud-based media and tools leads to a wide variety of methodological implications as to how these media and tools can be applied into the structure and design of specific learning modules. These, otherwise inspiring new tools, can also be disturbing because educators and course designers are faced with continuous dilemmas in choosing the most effective ways in which they can incorporate them in the teaching and learning process. These dilemmas can relate to the design and presentation of the input, the types and interactivity of the activities, and methods of assessment, as well as to the management of the virtual classrooms.

For example, due to its numerous affordances, cloud technology provides equal opportunities for both collaborative and individualized learning. However, the emphasis seems to be more on collaborative vs. individual learning tasks and modules. That is, most publications about cloud learning focus and promote its collaborative nature (Arancibia, Oliva, & Valdivia, 2013). Yet, no studies, at least to the knowledge of this researcher, has examined the effectiveness of collaborative cloud-based learning against individualized cloud-based learning. Providing empirical evidence for the better outcomes of collaborative vs. individualized learning through cloud technologies will bring assurance to instructors and course designers and will help them make informed decisions about choosing the most appropriate teaching approach.

Having been faced with the dilemma between collaborative and individualized structuring of cloud-based learning modules, and with conflicting feedback from students' course evaluations for and against collaborative learning, this researcher set up to find evidence through an empirical investigation of the problem. The remaining sections of this paper describe the methodology, results, and conclusions of the study.

### Purpose

The purpose of the present study was to examine the effectiveness of collaborative vs. individualized cloud-based learning in teaching summary writing to students enrolled in the Department of Math and Sciences at the University of Plovdiv, Bulgaria. The rationale for selecting summary writing as the focal point of interest is that the ability to write a good summary is of practical importance for students majoring in Math and Sciences since it partakes in all types of written assignments, such as technical reports and scientific papers, where published sources are reviewed and used as the framework of students' own work.

### Methodology

The study followed the Pre-test → Immediate post-test → Delayed post-test design with two experimental groups (Kirk, 1995). This design was considered as the most appropriate way to establish the effectiveness of collaborative vs. individual learning in a cloud-based instructional environment since it involves strict control of the experimental conditions, allowing statistical comparisons between participants' competences and skills prior to the treatment and after the treatment.

The experiment involved five inter-related stages. These stages were planned and executed in strict adherence to Kirk's (1995) description of experimental research, such as determination of the treatment levels (collaborative vs. individual), specification of the experimental procedure, and formulation of statistical hypotheses to be tested through the experiment.

In Stage One, participants' level of proficiency was established through a standard institutional English language test. In Stage Two, the participants were assigned to two experimental conditions (collaborative and individualized), and the proficiency levels of the two groups were examined for statistical differences through an independent t-test. In Stage Three, both groups were administered a pre-test in which they had to produce a 100-word summary of a short article about *Adware programs*. In Stage Four, both groups were taught how to write a summary, using exactly the same instructional input and tasks with the only difference being that one of the groups completed all stages of the instruction individually, whereas the other group completed

the tasks in team work through collaborative effort. In Stage Five, after the instruction was completed, the Immediate post-test was administered in which the participants had to write a 100-word summary of another short article about *I-beta.com*. In Stage Six, the experiment concluded with a Delayed post-test, administered four weeks after the Immediate post-test, which required writing a 100-word summary of a third short article about *SimpleFiles*.

According to Martella, Nelson, and Marchand-Martella (1999) for an instrument to be reliable it should produce consistent results; whereas for an instrument to be valid it should measure the construct it is intended to measure. In view of these principles, the three texts for the pre-test, immediate post-test, and the delayed post-test were selected with great care and attention to detail. First of all, all three texts discussed technical issues related to computer viruses and malware. Second, the readability statistics for each text were calculated, and some modifications were done where necessary, to make all three texts equal in length, sentence structure, sentence length, and vocabulary difficulty (Flesch, 1948; Kincard, Fishburne, Rogers, & Chissom, 2008).

Other reliability measures included keeping strict control over the testing environments and making sure that all three tests were performed under the same conditions. Specifically, all three tests were administered online, within a time limit of 20 minutes, and with a word limit of 100 words.

### Research Hypothesis

As already mentioned in the introduction, empirical research about the effectiveness of collaborative vs. individualized learning in a cloud-based teaching context is lacking in the respective literature. For this reason, it was considered inappropriate to formulate a firm hypothesis about which type of experimental condition will produce better results. Therefore, the hypothesis was stated as non-directional:

**Research Hypothesis:** There is a significant difference in the effectiveness of collaborative and individual learning of summary writing in English in a cloud-based instructional environment. This hypothesis is formulated below in terms of the corresponding Null and Alternative Hypotheses.

Ho: Mean collaborative group = Mean individualized group

Ha: Mean collaborative group  $\neq$  Mean individualized group

### Participants

The participants in the pedagogical experiment were 98 college students enrolled in the Department of Math and Sciences at Plovdiv University, Bulgaria. Specifically, there were 54 participants in the collaborative group and 44 in the individual group. Within the collaborative group, there were 36 male and 18 female participants, and within the individual group there were 28 male and 16 female participants.

For the reliability of the results, it was crucial to ascertain that the proficiency levels of the participants in the two groups were not statistically different, participants' placement test results were compared through an independent samples t-test (Martella, Nelson, & Marchand-Martella, 1999). The t-test results were interpreted under the equality of variances and showed that the two groups were not significantly different in their overall English language proficiency,  $t(96) =$

1.834,  $p = .07$ , *Cohen's d* = .37. The low value of *Cohen's d* = .37 provided further confirmatory evidence that the English language proficiency of the participants in both conditions was similar and should not be a concern for establishing the unbiased effect of the treatment (See Cohen, 1988).

### Reliability of scoring of the pre-test, immediate post-test, and delayed post-test summaries

Following Brown and Abeywickrama (2010), an analytic scoring rubric including five assessment categories was created to serve the purposes of scoring the summaries that were produced by the participants. The rubric included 2 criteria that captured the macro-skills content and organization, and 3 criteria for the micro-skills, namely lexical appropriateness (vocabulary) grammatical appropriate-ness and mechanics (spelling and punctuation). The scoring scale ranged between 2 to 6, where 2 = poor and 6 = excellent, the Bulgarian grade assignment system. If a summary met all the requirements in all five categories, it would be awarded 6 points for each component. The contribution of each of the five components was weighted in order to give more importance to those components that are essential for summary writing.

The scoring rubric was created with the help of an assessment expert. It was critically evaluated by a team of writing and assessment specialists and subsequent corrections and improvements were made based on the recommendations of the team of specialists. It was made sure that the rubric covered all essential elements of summary writing and that the criteria were consistent across the levels of performance.

The revised rubric was used by the researcher and another independent writing specialist to score each of the 294 summaries written by the participants in the pre-test and the two post-tests. Each rater assigned an independent score for content, organization, grammatical appropriateness, lexical appropriateness, and mechanics. Once the scoring was completed, raters compared their scores, focusing on the ones that were different. For those scores that showed disparity between raters, they returned to the specific summaries and agreed on a compromise score, applying the criteria of the rubric. Once all disparities in scoring were solved, the scores for each of the five criteria were weighted and the total scores were calculated.

### Data Analysis and Results

In view of the experimental nature of the present investigation, the methods of data analysis included statistical tests. For the purpose, all data were entered in the PASW Statistics for Windows, Version 18.0. Since the independent variable included two groups (collaborative and individualized) and the dependent variables (the three tests) were measured on an interval level, it was considered that the *t-test* for independent samples was the most appropriate statistical procedure as recommended by Martella, Nelson, and Marchand-Martella, (1999). Specifically, three t-test comparisons were conducted in as follows: 1) on the pretest summary writing scores; 2) on the immediate post-test summary writing scores; and 3) on the delayed post-test summary writing. All three t-tests were performed at level of significance  $\alpha = .05$

Before the t-tests were conducted, the assumption of equal variances between groups was checked through Levene's test of equal variances. This assumption is important for the interpretation of the results of a t-test according to George and Mallery (2009). All three tests met the assumption of equality of variance since all of them had a *Sig value* bigger than .05, respectively *Sig* = .797 for the pre-test, *Sig* = .166 for the immediate post-test, and *Sig* = .649 for the delayed post-test. Accordingly, all three t-test results were interpreted under the assumption of equality of variances.

Subsequently, the results of the t-tests (See Table 1) revealed that there was no significant difference between the two groups on the pre-test in their summary writing scores,  $t(96) = 1.282, p = .203, \text{Cohen's } d = .08$ . This lack of significant differences on the pre-test provided further evidence that at the onset of the pedagogical experiment the two groups were very similar in their ability to write summaries in English. This piece of evidence is extremely important for establishing the unbiased effect of the two treatment conditions and the distinctive learning benefits of the cloud-based instruction for each group.

**Table 1.** Results of the effectiveness of collaborative vs. individualized learning in the cloud

Tests	Collaborative				Individualized				t-test results			
	N	M	SD	%	N	M	SD	%	t	df	Sig	Effect size
Pre-test	54	4.59	.59	72	44	4.64	.59	73	1.282	96	.203	.08
Immediate post-test	54	5.34	.44	87	44	5.15	.36	83	2.241	96	.027*	.48
Delayed post-test	54	5.49	.36	90	44	5.34	.38	87	1.991	96	.049*	.41

Note: A single asterisk marks a significant difference at level of significance  $\alpha = .05$

As seen from Table 1, for the immediate post-test the collaborative group achieved 87% fulfillment of the requirements for summary writing, whereas the individualized group had 83% achievement. This difference was found to be significant by the statistical analysis,  $t(96) = 2.241, p = .027, \text{Cohen's } d = .48$ , providing evidence against the Null hypothesis ( $H_0$ : Mean collaborative group = Mean auto-nomous group) and in favor of the Alternative Hypothesis with a significant priority for the collaborative group,  $H_a$ : Mean collaborative group > Mean individualized group.

The better performance of the collaborative group was sustained on the delayed post test as well. The t-test results showed statistical evidence against the Null hypothesis ( $H_0$ : Mean collaborative group = Mean individualized group),  $t(96) = 1.991, p = .049$ . In other words, the Alternative Hypothesis was accepted in favor of the collaborative group which had a 90% achievement vs. 87% by the individual group.

### Discussion and Conclusions

As discussed in the introduction of this paper, the unprecedented advancement of modern technology and the Internet have provided a plethora of new tools for teaching and learning. Cloud-based instruction is one of these recent educational innovations, which holds numerous opportunities for collaborative and individualized learning. Despite the emphasis given to collaborative learning in ICT related publications (Arancibia, Oliva, & Valdivia, 2013), research is lacking in empirical support for the superiority of collaborative vs. individualized learning through cloud-based tools. In view of this lack, the present study aimed to provide empirical evidence that can possibly be useful to curriculum and course designers, who maybe asking themselves as to which approach to use when designing cloud-based lessons and modules.

Considering the strict steps that were taken to ascertain the equality of the two experimental groups at the onset of the experiment, the results of the present study suggest that the learning outcomes of cloud-based instruction can be better when the students are asked to complete the tasks collaboratively, in team work, than when they are asked to worked on the same tasks individually. These findings were supported by statistically significant results and thus provide empirical support for claims that cloud technology is conducive to collaborative learning.

However, it should also be noted here that despite the fact that the statistical tests showed a significant priority for the collaborative group, the actual difference in achievement between the two groups was that big, as shown by the close percentages of achievement and rather small effect size values of the differences in means between the groups. In other words, the statistical priority of the collaborative group should not be interpreted to the detriment of the individual group. Rather, it should be taken as an assurance that collaborative work in a cloud-based instructional module can lead to learning outcomes that are not only not inferior to individual work, but may even be superior.

The findings of his study not only reinforce the benefits of collaborative learning in a cloud-based instructional module, but also call for more research on the same problem with different learning tasks. It should also be noted here that some learning tasks or objectives can be more amenable to collaborative learning, whereas others maybe more conducive to individualized learning. In addition, feedback from the learners and correlating this feedback with the learning outcomes can bring further valuable insights into the effect of collaborative vs. individualized learning in the cloud.

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#### **Сравнение между эффективностью экипной и индивидуальной работы в Облаке**

**Аннотация:** Целью этой статьи является сравнение эффективности экипной работы с индивидуальной работой при создании резюме. Эксперимент следует за методом инструкции, вполне вынесенным в пространствах Облака. В исследование приняли участие 98 студентов на факультете математики и информатики Пловдивского университета имени Паисия Хилендарского в Болгарии. Уровни владения английским языком каждого студента, как и их умения писать резюме были установлены до приложения метода с целью доказать, что обе группы на одном стартовом уровне по этим параметрам. Результаты проанализированы с помощью непосредственного теста и теста прочности знания на основе создания резюме в Облаке. Были применены конкретные меры, гарантирующие надежность результатов резюме. С помощью независимых t-тестов были сравнены непосредственный тест, как и тест на прочность знаний обеих групп. Результаты показывают значительное преимущество в пользу группы, работающей в экипе, по обоим тестам после применения метода в Облаке. Эти данные дают уверенность исследователю утверждать, что коллективная работа в Облаке может привести к результатам, которые не только не уступают тем, достигнутым в индивидуальной работе, но даже превосходят их.

**Ключевые слова:** Облако, обучения в Облаке, индивидуальная работа, экипная работа, создание резюме, обучение на основе уэб