Journal of Studies in Social Sciences and Humanities
http://www.jssshonline.com/
Volume 6, No. 4, 2020, 222-234
ISSN: 2413-9270

The open educational resources for the support of the students' performance improvement in the fifth - grade of the primary school

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Abstract
The purpose of this study was to investigate the students' performance improvement in the fifth grade of a primary school in Greece in the subjects of Language, Mathematics, Science, Geography and History with the support of open educational resources (OER). A quasi-experimental approach was used for the data collection due to the inability to collect data from a random sample. Sixteen students from a fifth-grade class participated in the experimental group and sixteen from other fifth-grade glass class in the control group. Both groups were given pre-tests and post-tests. The quantitative data were analyzed using descriptive statistics, Schapiro-Wilk's normality test, Levene's test for equality of variances and covariance analysis (ANCOVA). The results of data analysis showed that the post-test students' performance in Language, Mathematics and Science subjects was statistically significant with ANCOVA. On the contrary, the performances in Geography and History seem to be statistically not significant.

Keywords: open educational resources, support, fifth grade students, improvement, performance

Introduction

Over the past twenty years, global information, innovation and knowledge sharing are transferred from one place of our planet to another in unbelievable time. An important factor in the rapid transfer of the above in terms of time is the internet (Staub and Hodel, 2016). However, it is not uncommon for the internet users to confuse the internet with the World Wide Web. According to Curran et al. (2016), if the internet is a restaurant, the web is nothing but a restaurant table on which very nice dishes are placed. The web is an application layer that operates over the internet and offers up-to-date information (Keerthana et al., 2017)

The use of internet, particularly in education, has led, on the one hand, to the weakening of the "Paradigm" of traditional teaching and, on the other hand, it has significantly contributed with the new theories of learning towards the emergence of the New Pedagogy in Education (Fullan, 2013). Undoubtedly, the most important influence of the Internet in education has been exerted by the open educational resources (OER) or applications (Virtic, 2012). The term "Open Educational Resources" was adopted by the United Nations Educational, Scientific and Cultural Organization Forum (UNESCO, 2002). The new term was related to the open sharing of educational resources (Commonwealth of Learning [COL],2017). Nowadays, OER in many cases in tertiary education is the same as MOOCs (Massive open online courses).

The efforts to define the concept of Open Educational Resources (OER) are many. However, the bibliography on the definition of the concept proves that the definitions are relatively unclear (Shaffert, 2010; Jena, 2012). The last definition was given by UNESCO (2015): "An open educational application is defined as any educational resource of the Internet available for free usage to educators and students".

In the declaration of the Ljubljana 2nd World Conference on OER (2017) that was held recently it was realized that there is an urgent need for transition from commitment to action. The global community is called to develop strategies for the exploitation of OER in such a way as to achieve the goal of an open and equitable quality of education and lifelong learning by 2030 (Commonwealth of Learning, 2017).

One of the most significant benefits of OER is free provision to the end users. In addition to free access, OER offer equally knowledge, practices and opportunities, curricula, skills development, course planning, targeting activities at improving the quality of learning, interaction between users and resources, collaboration, easy and fast virtual and written communication (COL, 2017). Also, they give users the opportunity to learn independent of the place, time and pace of learning, enable the study of a huge volume of digital and non-digital educational materials (COL, 2017). UNESCO classifies the OER in multimedia applications, digital textbooks, interactive maps, videoconference, educational games, learning management platforms, lessons, learning activities, repositories and any other application that can support the learning process (UNESCO, 2015).

Butcher & Moore (2015) categorize OER in Directories for example Directory of Open Access Journals - Public Library of Science - OER Commons, Platforms for example Wikipedia - OER Commons, Storage spaces for example Siyavula (collection of mathematics, science and technology open textbooks for primary and secondary education) MIT Open Course Ware (lessons, lectures, notes, tests, student papers) - Open University OpenLearn (short curricula and courses on distance learning) - Khan Academy (courses for post-secondary education, art and economics courses, computer programming) - Internet Archive (electronic books, digital movies, software and digital music).

OERs are widely used in higher education but, also, in secondary and primary education. Attempting a revision of the literature from 2008-2018 there is a plethora of studies that focuses mainly on improving the performance of primary school students through the use of OER at school and at home. The majority of studies focuses on a learning subject and some studies on two subjects. Most of the above studies show an improvement in the students' performance. However, the results of the above studies do not seem to include the full range of students' overall learning performance. Therefore, aiming at a larger set of subjects using OER in the present study, an effort is made in order to reach general conclusions as far as possible regarding the improvement of the Primary School students' performance with the support of OER.

The purpose of this study was the investigation of the improvement of the fifth-grade students' performance in a Greek primary school by supporting open educational resources in five subjects. These subjects were Language, Mathematics, Science, History and Geography. After researching the bibliography from 2008 to 2018 in Google Scholar, no other research focusing on students' performance with the support of open educational resources in five subjects was found.

Methodology

The quantitative data was not collected by students' randomized sample because this choice was not possible. So, a quasi-experimental approach, without randomized sample, was the unique solution for the data collection. The quasi-experimental approach is conducted via pretests and post-tests of the performance between two groups, the experimental and the control group. The treatment (new teaching intervention) is only taken by the experimental group.

The research questions for this study were:

1. To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the Language subject?
2. To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the Mathematics subject?
3. To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the Science subject?
4. To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the History subject?
5. To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the Geography Subject?

The research has three months duration. The research population was taken by the fifth grade of the 9th Primary School of Alexandroupolis, a town in the northeastern Greece. The two groups of

the fifth grade were approximately equivalent according to the references of the teachers who taught them the previous school years, the pedagogical discussions that took place in the school unit in the previous years, as well as the student score in the School Registry Book. The experimental and the control group consisted of 16 students each. The data were collected by both groups. The ages of the fifth-grade students ranged from 10-11 years.

The research began on 14th September 2018 and was completed on 27th January 2019. Five pretest tests and five post-tests were used for the data collection, before and after the new teaching intervention. For the check of tests' validity, the content method was selected. So, a small committee of the five distinguished colleagues was set up. All of the pre-tests were consisted of twenty questions like: true-false, matching, wrong, match, filling blanks and multiple choice. The percentage scale was selected for the scoring of the tests (each correct question was graded by five percentage points). Each test was consisted of 20 questions. To test the reliability of the researching tool of the pretests, the test-retest reliability method was applied in combination with the alternate form reliability or the parallel – forms reliability.

The pretests of the five learning areas were given to a sample of three students of each group, for each test alternatively. The pilot tests were scored and the reliability factor was found to be 0.90, 0.91, 0.89, 0.89, 0.92 for the tests of Language, Mathematics, Science, History and Geography respectively. The measurement was carried out with the Statistical data analysis program SPSS (Statistical Package for Social Sciences). Then, the pretests of all learning areas were given to the experimental and control groups.

The teaching intervention that was chosen by the researcher for the experimental group, was the mixed or combined or hybrid learning which combines the traditional teaching method with the use of open educational resources. Specifically, the mixed learning model was the station rotation model. According to this model the students rotate to the learning stations in the classroom. During the teaching intervention with the use of practices from various learning theories, such as inquiry-based, constructive, socio-cultural, collaborative and behavioral learning, were applied. The colleague of the control group used the traditional method. All students of two groups were taught the same content of five learning subjects. For the experimental group intervention an educational blog and the social platform of Edmodo were used by the researcher. The blog was the first and the main pillar of the material that was used both for the design courses and for the provision and use of the open educational resources in the experimental group through the research. The Edmodo platform were used for the assign of tasks. The task assignments took the form a weekly assessment of Language, Mathematics, Science, History and Geography courses. The purpose of the assignment was the digital feedback of the students.

After the teaching interventions, post-tests were given to both groups. For the check of the post-tests, the content validity test was again followed. For the check of post-tests reliability, as in the pretests, the test-retest reliability method was applied in combination with the alternative form reliability or parallel-forms reliability method. The same procedure was followed as in the pretests. The reliability factor of the alternative form was measured by the SPSS data analysis program and was found to be 0.91, 0.90, 0.90, 0.91, 0.94 for the tests of Language, Mathematics, Science, History and Geography subjects respectively. Before the official post-tests, trial tests were given by the researcher to a sample of three students. The post-tests were served exactly under the same conditions and the same procedure as the pretest's tests. In addition, it should be noted that the pretests and post-tests of all subjects were rated anonymously and blindly by two assessors and where there was a scoring difference, a discussion between the two assessors was followed until they agreed.

The research limitations

The inability to create a random sample that would help in the collection of quantitative data by experimental approach led to the forced selection of the two students' classes of the fifth grade and the data collection via quasi-experimental approach. According to Creswell (2018); Coen, Manion & Morrison (2018), the internal validity of the research is threatened by the quasi-experimental approach due to the non-randomized assignment of the sample. The threat of internal validity has an impact on the generalization of the conclusions. The threat of the internal validity of the quantitative data of a quasi-experimental approach is diminished when the researcher draws qualitative data, as well because

the one approach covers the weaknesses of the other (Leech & Onwuegbuzie, 2009). In addition, in a quasi-experimental approach the threat of the internal validity of research is diminished by using the statistical measure of differentiation of the mean values which reduces or subtracts the original differences and makes the groups equivalence (CIRT, 2018). The researcher, although he used both of these practices, maintains some niggling reservations about generalizing the findings of the research in specific subjects because the equivalence is not observed by the mean values of the pretests.

A second limitation is the starting date of the research, which began in the last ten days of September. Students do not usually attribute as satisfactorily at the beginning of the school year as at the rest of the time because they are affected by summer holidays, and perhaps the choice of the time influences the data, especially the ones of the pretests.

Finally, although there was agreement between the researcher who taught in the experimental group and his colleague who taught in the control group that they would be taught exactly the same content in all subjects, this does not mean that the quality of their teaching was the same regardless of method that was used.

Results

Descriptive statistics

In table 1 mean values and standard deviations of student's pretests performance per subject are displayed by each group.

Table 1. *Mean values and standard deviations of student's pretests performance per subject are displayed by each group.*

pretest CG= control group EG=experimental group	**Mean values**	**Standard deviations**	**post test CG= control group EG=experimental group**	**Mean values**	**Standard deviations**
CG Language	65,13	16,80	CG Language	48,80	11,05
EG Language	48,63	25,11	EG Language	66,75	16,75
CG Maths	65,80	15,43	CG Maths	58,40	20,05
EG Maths	46,88	22,23	EG Maths	64,19	25,38
CG Science	39,33	13,87	CG Science	42,00	11,26
EG Science	40,63	9,98	EG Science	60,62	13,35
CG History	60,27	8,40	CG History	67,60	13,54
EG History	44,19	19,53	EG History	58,88	18,95
CG Geography	74,67	18,95	CG Geography	61,60	16,71
EG Geography	62,53	24,33	EG Geography	63,79	17,23

In the above table, it is observed that the performance of the control group pretests is better than those of the experimental group in the subjects of Language, Mathematics, History and Geography, while in Science it seems that the performance in both groups is about the same. Also, we observe that the performance of post-tests of the experimental group is better than those of the control group in the subjects of Language, Mathematics and Science. In the Geography post-tests the performance is the same, while in the History post - tests the control group outweighs to the experimental group.

Normality test

In Table 2 we observe the normality of pretests and post-tests performance distribution in all courses. Because the sample is $N \leq 50$, the Shapiro-Wilk normality test was used.

Table 2. *Normality test of pretests and post-tests performance distribution in all subjects*
Normality test of pretests in Language

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,197	16	,098	,913		

	CG	,157	16	,200*	,957		
Normality test of post - tests in Language							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,196	16	,101	,907	16	,104
	CG	,187	16	,166	,929	16	,263
Normality test of pretests in Maths							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,181	16	,168	,936	16	,298
	CG	,112	16	,200*	,971	16	,870
Normality test of post - tests in Maths							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,136	16	,200*	,945	16	,417
	CG	,166	16	,200*	,969	16	,836
Normality test of pretests in Science							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,215	15	,047	,896	16	,065
	CG	,228	16	,034	,896	16	,082
Normality test of post-tests in Science							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,186	16		,944	16	,440
	CG	,238	16		,887	16	,061
Normality test of pretests in History							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,140	16	,200*	,902	16	,085
	CG	,193	16	,136	,898	16	,090
Normality test of post-tests in History							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,193	16	,113	,931	16	,250
	CG	,182	16	,192	,934	16	,310
Normality test of pretests in Geography							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,170	16	,200*	,905	16	,114
	CG	,173	16	,200*	,909	16	,129
Normality test of post-tests in Geography							
	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
performance	EG	,186	16	,171	,909	16	,131
	CG	,129	16	,200*	,953	16	,575

In the table, we see that all p-values are > 0.05 in all tests. Therefore, the parametric tests will follow.

Levene's Test for Equality of Variances

The following table shows the variances equivalence or not in post-tests performances of the groups. In the performance of Science and Geography, the P-value <0.005 and therefore the equality of variations arose. On the contrary, the performance of Language, Mathematics and History did not show

equality of variances because P-value> 0.005. The table results allow us to test the statistical significance of the performance of the experimental group performance for Science and Geography with t-test and for Language, Mathematics and History subjects with AVCOVA test.

Table 3. *Test for equality variances of performances in the post-tests*

Levene's test for equality variances in Language		
F	Sign.	t
7,912	,009	-2,066
Levene's test for equality variances in Maths		
F	Sign.	t
4,688	,039	-2,761
Levene's test for equality variances in Science		
F	Sign.	t.
2,366	,135	-,153
Levene's test for equality variances in History		
F	Sign.	t.
4,386	,045	-2,690
Levene's test for equality variances in Geography		
F	Sign.	t
3,658	,066	-1,446

Significance test for the performance of the experimental group on the Science and the Geography subjects after teaching intervention.

Research Questions 3 and 5

To what extent is the use of open educational resources supporting the improvement of the performance of primary school students in the Science subject?

To what extent is the use of open educational resources supporting the improvement of the performance of primary school students in the Geography subject?

Research hypotheses

Zero hypothesis Ho: The use of open educational resources does not significantly support the performance improvement of primary school students in the Science subject.

Alternative hypothesis H1: The use of open educational resources significantly supports the performance improvement of the primary school students in the Science subject.

Zero hypothesis Ho: The use of open educational resources does not significantly support the performance improvement of primary school students in the Geography subject.

Alternative hypothesis H1: The use of open educational resources significantly supports the performance improvement of the primary school students in the Geography subject.

Table 4. *T-test on the science performance*

t	df	Sig(2-tailed)	Mean difference	Std. Error difference	95% Confidence Interval of difference	
4.567	29	0.0001	18,63	4.078	10.28	26.97

Table 5. T-test on the geography performance

t	df	Sig(2-tailed)	Mean difference	Std. Error difference	95% Confidence Interval of difference	
0.4062	29	0.687	0,19	6.431	10.54	15.75

In Table 4 we observe an excellent statistically significant difference (τ = 4.567 and p = 0.0001). Therefore, the zero hypothesis is rejected and the alternative hypothesis according to which

the use of open educational resources significantly supports the performance improvement of primary school students in the Science subject is accepted.

In Table 5 we observe a statistically non-significant difference (t = 0.406 and p = 0.687). Therefore, the zero hypothesis according to which the use of open educational resources does not support the performance improvement of primary school students in the geography subject is accepted.

Significance test for the performance of the experimental group on the Language, Mathematics and History subjects after the teaching intervention.

Table 6. *Interaction of teaching intervention (independent variable) with pretests data (covariate)*

Data	F	p
Language	1,902	,178
Maths	2,297	,140
History	,544	,467

The table shows that the interaction of the independent variable (new teaching intervention) with the covariate (pretests) is statistically insignificant (p> 0.05). Therefore, it is possible to proceed with the covariance test (ANCOVA).

Researching questions 1,2,4

To what extent is the use of open educational resources supporting the performance improvement of primary school students in the Language subject?

To what extent is the use of open educational resources supporting the performance improvement of primary school students in the Mathematics subject?

To what extent is the use of open educational resources supporting the performance improvement of primary school students in the History subject?

Researching hypotheses

Zero hypothesis Ho: The use of open educational resources does not significantly support the performance improvement of primary school students in the Language subject.

Alternative hypothesis H1: The use of open educational resources significantly supports the performance improvement of the primary school students in the Language subject.

Zero hypothesis Ho: The use of open educational resources does not significantly support the performance improvement of primary school students in the Mathematics subject.

Alternative hypothesis H1: The use of open educational resources significantly supports the performance improvement of the primary school students in the Mathematics subject.

Zero hypothesis Ho: The use of open educational resources does not significantly support the performance improvement of primary school students in the History subject.

Alternative hypothesis H1: The use of open educational resources significantly supports the performance improvement of the primary school students in the History subject.

Table 7. *Covariance analysis of the Language subject data*

Group	N	Mean	SD	Adjusted mean	F
Experimental Group (EG)	16	66.75	16.74	70.67	47.46*
Control Group (CG)	16	48.80	11.04	44.61	

In the table 7, eliminating the "third" variables, the results show that there is a significant statistical difference of post-tests performance in the Language subject between groups (F = 47.46, p = .000) which are taught with two different teaching methods (mixed with the use of open educational resources for the experimental and traditional for the control group). The adjusted means were 70.67 for the test group and 44.61 for the control group. Therefore, the zero hypothesis is rejected and the alternative hypothesis is accepted, according to which the use of open educational resources significantly supports the performance improvement of the fifth-grade students on the Language subject.

Table 8. *Covariance analysis of the Mathematics subject data*

Group	N	Mean	SD	Adjusted mean	F
Experimental Group (EG)	16	64.19	25.39	69.02	4.38*
Control Group (CG)	16	58.40	20.05	53.25	

In table 8, eliminating the "third" variables, the results show that there is a significant statistical difference of post-tests performance in the Mathematics subject between groups (F = 4.38, p = .000) which are taught using two different teaching methods (mixed with the use of open educational resources for the experimental and traditional for the control group). The adjusted means were 69.02 for the test group and 53.25 for the control group. Therefore, the zero hypothesis is rejected and the alternative hypothesis is accepted, according to which the use of open educational resources significantly supports the performance improvement of the fifth-grade students on the Mathematics subject.

Table 9. *Covariance analysis of the History subject data*

Group	N	Mean	SD	Adjusted mean	F
Experimental Group(EG)	16	59.88	18.95	64.20	.362*
Control Group (CG)	16	67,60	19.73	61.39	

Eliminating the "third" variables, the results show that there is not a significant statistical difference of post-tests performance in the History subject between groups (F = .362, p = .552) which are taught using two different teaching methods (mixed with the use of open educational resources for the experimental and traditional for the control group). The adjusted mean values were 64.20 for the test group and 61.39 for the control group. Therefore, the zero hypothesis is accepted according to which the use of open educational resources does not significantly support the performance improvement of the fifth-grade students on the History subject.

Discussion

The performances on the Language subject

For the cognitive area of the Greek language there are not enough open educational resources. However, OER not only provides ready resources but, also, tools for creating infinite resources from teachers. The results show that students were helped by the functions of OER to improve their performance. In particular, the offering of knowledge through innovative resources such as: the creation of mental maps, presentations, videos, blogs, digital textbooks, crosswords, etc. have contributed to increasing of the learning incentives and to mobilizing of the students' interest. At the same time, they facilitated the students' interaction with the learning material and the teacher.

According to the results of the descriptive statistical analysis, the performance means values on the pretests of the control and the experimental group are 65,13 and 48,13 respectively, and the mean values in those of the post-tests are 48,80 and 66,75 respectively. Initially, we notice that there is no equivalence between groups to the pretests. For the experimental group, it is clear that the students' performance has improved quite satisfactorily after the new teaching intervention (about 18 percentage points). As for the control group, the paradoxical phenomenon of dropping students' performance (about 18 percentage points) is observed. On the one hand, we notice that the new teaching intervention improved significantly the students' performance. On the other hand, there is a significant decrease in the students' performance who were taught by the traditional teaching method. The above results of the control group have surprised the investigator because he did not deviate from the design of the research at all. One of the possible explanations is the peculiarity of the fifth grade in the Greek primary school. The 5th grade of the Greek primary school is traditionally the most "difficult" grade. From the researcher's experience, who is teaching in the primary school for 27 consecutive years, the difficulties of students' performances at this grade (especially at the beginning of the school year) are due to the additional presence of four new cognitive subjects which are: Science, Geography and Citizenship Education as well as a second foreign language. Also, at this grade there are more abstract meanings

into the learning subjects. The opposite has been observed to the students of the experimental group. The new teaching intervention with the use of open educational resources and the benefits deriving from them seem to have improved significantly their performance.

As it was mentioned above, there was no equivalence in the groups. That arose from the non-randomization of the sample. In order to reduce or eliminate the initial differences, the statistical measure of the mean values covariance (ANCOVA) was used. All the statistical tests were preceded (normality test, homogeneity test of data dispersion) in order to allow the mean's covariance test of the two groups. The statistical test showed that the open educational resources supports significantly the improvement of experimental group of students in the language area ($F = 47.66$ and $p = 0.000$).

The performances on the mathematics subject

It is well known that the framework of mathematics is common (the symbols and the mathematical operations, the problem-solving practices, the concepts and generally all the mathematics philosophy) for all the world. Therefore, the different language of some mathematical resources cannot be an obstacle to their usage. The presence of the mathematical OER on the internet is storming. Several of them have been developed as games and they increase the student's interest and mobilization. In our research we used such attractive educational resources to motivate our students in order to learning and practice mathematics. Mathematics resources were used for the development of individual and differentiated learning, too. Also, students whose performances were very modest according to pretests, were encouraged to engage in mathematics by using Maths games (according to thematic analysis results). From the results it seems that not only their interest in Mathematics was increased but, also, their performance was increased.

The descriptive statistical analysis allows us to describe general picture of the performance of the students which presented the students of the two groups on the pretests and the post- tests at the cognitive area of mathematics. The mean values which came up for the experimental group were 46.80 (pretests) and 64.19 (post-tests) and for the control group 65.80 (pretests) and 58.40 (post-tests).

As the performances of the Language subject, we observe that there is no equivalence among the pretests of two groups in the performance of the mathematics subject. For the experimental group, it is clear that students' performance has improved quite satisfactorily after the new teaching intervention (about 18 percentage points). As for the control group, there is again a decrease in student performance, but not as great as in the Language (about 7 percentage points). On the one hand, we notice that the new teaching intervention improved significantly the students' performance. On the other hand, there is a significant decrease in the students' performance who were taught Maths by the traditional teaching method. Perhaps this difference is again due to the same reasons mentioned above by the researcher for the Language subject. The results of the inferential statistics, which in this case was used the measure of data covariance (ANCOVA) was used to eliminate or reduce the initial differences of the groups, showed statistical significance of the students' performance in the experimental group compared to those of the control group. Of course, all the statistical tests (normality test, homogeneity test of data dispersion) were preceded in order to allow the covariance's test of mean values of the two groups and it came up that the new teaching intervention with the support of open educational resources significantly improves ($F = 4.38$, $p =, 046$) the students' performance in the cognitive area of Mathematics.

The performances on the Science subject

It is easy for someone who is often browsing the internet to identify a lot of open educational resources for the cognitive area of the Science subject. Science is a broad cognitive area consisted of several cognitive fields linked to each other, these fields are Physics, Chemistry, Biology and Geology. The OER which are related with Science are simulations, analogies, videos with experiments, animations, virtual workshops, etc. All of the above teaching tools offer the innovation in the presentation and the development of the learning process, they strengthen the learning motivations and they promote the self-learning. Several of the OER are created in the Greek language and others in English and other languages. If it is not possible to identify an educational resource of the Science in Greek, the teacher can use resources from other languages without any problem since the picture, the sound and the movement are the main elements that promote understanding in such cases. Besides, the

phenomena and the concepts of Science are common to the entire educational community. In addition to this, the Science subject, although it is introduced for the first time as a standalone subject in the fifth grade, is attractive and raises the interest the small students' interests mainly for the real or the virtual experiments, the presentations or the explanations of the natural phenomena. Also, it contributes a lot to their active participation. The same "picture" appeared for the students of the experimental group of this research.

The mean values of the students' performance in the cognitive area of Science were for the control group 39,33 in the pretests and 42,00 in the post-tests and for the experimental group 40,63 in the pretests and 60,62 in the post-tests. In the pretests it is observed an equivalence on both groups to the initial mean values documented by the Levene's test. Also, it is still observed a statistically significant difference of the students' performance on the experimental group post-tests compared with those of the control group that were improved minimally. Applying the t-test of independent samples, there is a statistically significant difference ($t = 4.567$, $p = 0.0001$) on the students' performance in the experimental group.

The performances on the history subject

The cognitive area of History belongs to the social sciences. Each country has its own national history and every national history has its own database with a different volume of historical events. Of course, in the countries' curricula historical events of global interest as well as historical events that influenced the historical events and the developments of each country are added.

The Greek curriculum of the fifth grade in the Primary School for the History subject contains historical events related to Roman and Byzantine history. Although new Greek technologies have made great progress in the development of OER for Greek History (historical sources, virtual museums, historical documentaries, tools for diagrams and concept mapping, audio documents, etc.), the history subject seems to have a lot of difficulty for students. This is in line with the results of the Fogo (2014), Noboa (2013) studies. The difficulties of the History subject in Primary School are mainly due to the exponential and expanded information (names, places, dates, social, political and economic events, causes and reasons) to their forced memorization (Voglis, 2017), to abstract thinking that creates space-time problems of understanding, as well as to the embryonic development of students' critical thinking (Crab, 2016).

The students who participated in this research encountered the above difficulties. The mean values of the pretests of both groups were 44.19 (experimental group) and 60.27 (control group), and those of the post-tests were 58.88 and 67.60 respectively. From the above values it is observed on the one hand that the groups are not equivalent in the pretests and that the experimental group falls short of the control group, on the other hand there is a moderate increase in the control group's performance and a significant increase in the experimental group performance in the mean values of the post-tests, but not able to approach and overcome those of the control group.

The statistical test (ANCOVA) was used to eliminate or reduce the "third" variables, did not show any statistical significance of the students' performance on the experimental group compared to those of the control group. However, it would be our omission not to refer to the descriptive analysis of the quantitative data through which it is distinguished that there is an increase in the students' performance of the experimental group that is not statistically significant, but it does not mean that it is insignificant.

The performances on the Geography subject

Apart from the equivalence of the initial means values to the performance of the two groups in Science, equivalence was also found in Geography the initial means values in groups performance (74.67 for the control group and 62.53 for the experimental group). In the post-test's performances, the performance of the control group was reduced (mean value 61.60) and was rather increased in the experimental group 63.79.

The development of the open educational resources in the cognitive area of Geography is too great not only at national but also at international level. A browsing on a web will display hundreds of OEP related to the interactive maps, geographic games, documentaries, videos, geological phenomena, etc. From the above, it is understood that, on the one hand, the teaching materials and the supervisory material of the beginning of the present century are in constant growth and, on the other hand, the access

to OER is becoming more and more freely available. However, students face learning difficulties in Geography which are related to the learning of geographical terms and concepts, the memorization of countless names of countries, capitals, cities, terms, rivers, lakes, islands, bays, peninsulas, capes, ferries, the explanation of geological phenomena related to the sciences phenomena, the understanding of abstract concepts e.g. weather and climate, the understanding of solar system concepts, the correlation of socio-economic conditions with geographic conditions, etc. (Dove et al., 2000, Hopwood, 2004; Spyratou & Chalkia, 2006). In addition, for the pupils in Greek Primary School, the Geography Subject is one of the four additional subjects of the fifth grade with which the students first come into contact as autonomous cognitive areas.

The t-test, inferential statistical test of means values, showed that there was no statistically significant difference ($t = 0.406$ and $p = 0.687$). Therefore, the conclusion from the fifth research question (To what extent does the use of open educational resources support the improvement of the fifth-grade primary school student's performance in the Geography Subject?) is that the use of the OER does not significantly support the students' performance Improving to Geography subject.

However, is it necessary to repeat that the result of the inferential statistics may not be statistically significant, but it is not insignificant. This is demonstrated by the results of the descriptive analysis. Students in the control group seem to have been affected by the difficulties mentioned above and this is the possible cause of their performance decline. The same could be true for the students of the experimental group.

Conclusions

After collecting the data of the research, their analysis and the compilation of their findings, the conclusions which arise can be summarized as follows.

According to the tests of inferential statistics, the open educational resources significantly support the improvement of students' performance in the Language subject. Firstly, due to the initial differences from the inability of constitution a random sample, we could maintain a small reservation for the generalization of our conclusion on supporting of OER to the students' performance improvement. However, the ANCOVA test, which eliminates or reduces the differences in initial values on the one hand and the findings of the qualitative approach on the other hand, strengthen the generalization of the conclusion on to the above-mentioned subject.

The open educational resources support significantly the 5th grade students' performance improvement on the Mathematics subject. Although the differences in the initial values of groups were observed in this subject, due to the random sample, however, the use of the ANCOVA test, allows us the generalization of the conclusion on mathematics.

Also, significant support was offered by OER to the 5th students' performance improvement on the Science subject. At the initial values of the quasi-experimental approach equivalence was observed by coincidence in the groups, which allows us to generalize the conclusion.

On the contrary, it is concluded that the OER does not significantly support the students' performance improvement on the history subject. Although the students' performance was improved by the post-tests of the experimental group with the new teaching intervention, this improvement was not a remarkable fact because alongside the performance of the control group improved. However, we must mention the peculiarities and difficulties which the students face in the above subject. Additionally, it is worth noting that there is not a wide range of open educational resources related to the history subject as each country emphasizes its own history and different aspects of the world history.

Also, OER does not seem to support significantly the fifth-grade students' performance in the Geography subject. Although there is a lot of the OER for this subject, it does not seem to support students' performance significantly.

Suggestions

The future researchers, who will focus on related research problems, can expand their research field by adding more learning subjects in order to have more complete and more comprehensive conclusions regarding the support of OERs in the performance of primary school students. For example, the Foreign Languages could be added.

Also, it is suggested the research lens to focus on different primary school grades using the same set of learning subjects or more. Finally, the research results regarding the OERs' use in special education will have great interesting.

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