

The Influence of the Flipped Classroom Model on the Development of Key Competences of Future Teachers

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Abstract

The study examines the impact of the Flipped Classroom (FCM) on the development of key competences for the 21st century (KC21) in future teachers. Experimental design with two parallel groups was used. The sample consisted of 122 students of the Faculty of Education, i.e., experimental group-EG (60), and control group-CG (62). The EG attended lectures implementing the FCM, while the CG received traditional instruction. Results show that there is no significant difference in self-assessment of competence development between the EG and CG related to creativity, responsible attitude towards work, health and environment. There is a significant difference in the self-assessment of competences related to socio-emotional skills, problem solving, critical thinking, information and ICT literacy and learning to learn. The conclusion is that the implementation of the FCM can influence the development of the majority of KC21.

Keywords: flipped classroom, key competences, primary school teacher education, methodology of teaching

Introduction

Numerous studies have shown that education systems need to respond to contemporary social changes by enabling children and young people to master and develop skills that will facilitate their lives and work in the future. For this reason,

a competence system for the 21st century-KC21 emerged as a significant concept in education (*twenty-first century skills*) (Pellegrino & Hilton, 2013). Therefore, schools must transform in order to equip students with critical thinking, problem solving, development of collaborative skills and communication (Binkley et al., 2012). The focus in education should be transferred from the acquisition of knowledge to its efficient application (learning to learn, problem solving, decision making) and the ability to create new knowledge (creativity, innovation), with the proper use of ICT tools that transform the nature of work and the sense of social relations (flexibility and fast changes adjustment). Children and young people need to develop the capability of data acquisition, their critical analysis and efficient use. It is important that information is effectively exchanged with others through teamwork and team problem-solving.

Considering that teachers play a very important role in the educational process, it is necessary to pay special attention to the education of students of the Faculty of Education. The assumption is that teachers who have developed KC21 will be better educators of students and will better develop student's KC21. In order to enable future teachers to acquire and improve KC21 during their course of study and during professional training, education researchers and university teachers are looking for effective teaching modules. FCM has been recognized as suitable for use in working with students, and numerous studies indicate its effectiveness (Souza, Rodrigues, 2015; Antonova, Shnai, Kozlova, 2017; Kuzminska, Morze, Smyrnova-Trybulska, 2017; Bentaibi, 2018, etc.). It is for this reason that we tried to shed light upon and examine the influence of FCM on the development of KC21 in this research.

Theoretical Background

Flipped Classroom

FCM is defined as a teaching model that promotes thinking inside and outside of the classroom (Freeman, Schiller, 2013) through the idea that schoolwork and homework swap places. Unlike traditional teaching, in which the teacher teaches new lessons, FCM means that students learn new teaching content independently as homework, while they use time more effectively and creatively (Fulton, 2012) for discussion, practical activities, application of acquired knowledge in problem solving, etc. (McLaughlin et al., 2014).

FCM is based on several stages. The first phase is the preparation of necessary teaching materials, different sources of knowledge (video lessons, multimedia

content, texts, hypertexts, etc.). According to research, there is extensive literature on the effect of instructional video podcasts, which have been shown to have a positive impact on student attitudes, student behavior, and student performance. All of this is good for their use in the flipped classroom.

The second FCM phase consists of students' independent work on the educational materials the teacher has prepared. This is homework, which leaves more time for schoolwork (Bentaibi, 2018). Students play a role of an active self-learner (Antonova, Shnai, Kozlova, 2017), solve research tasks, use ICT and online discussions. This gives them greater autonomy, but also a greater responsibility, and the teacher has an insight into the difficulties the students encounter in learning and adjusts the learning styles, planning activities for the next lesson. The advantage of the FCM is reflected in the possibility of individualized instruction (Danker, 2015; Schultz et al., 2014) because students choose the type of teaching material, the time, place, pace and way of learning.

The third FCM phase consists of the implementation of the active teaching lesson. In order to ensure that students are prepared for the lesson, the lesson can begin with a quiz, which will allow for instant feedback of the acquired knowledge. After that, students can realize teaching activities as a team, developing flexibility and cooperation (Bentaibi, 2018) through discussion, asking questions and solving problems. Sezer (2017) has shown that FCM affects students' confidence in asking questions, seeking help from teachers or peers, enabling them to progress faster, to have insights into their achievements, and receive feedback about their work, which can positively influence their motivation and interest in further learning (Danker, 2015). Teachers get more time to spend with students doing authentic research, and students get more time to work with scientific equipment that is only available in the classroom (Fulton, 2012). Numerous research results dealing with different aspects of the FCM model indicate its effectiveness in terms of increasing the level of students' academic achievement, development of their cognitive skills (Bergmann, Sams, 2012) and acquisition of quality knowledge (Bentaibi, 2018; Souza, Rodrigues, 2015; Schultz, et al., 2014). Students grapple with real-world problems and use material for problem solving, which enables them to deepen their understanding of the teaching content. In the realization of the course during FCM, the teacher plays the role of advisor and facilitator of the educational process because it reveals an unpredictable world of science, and the main benefit of FCM is the formation of student-centered relationships (Antonova, Shnai, Kozlova, 2017).

Research (Souza, Rodrigues, 2015) indicates that the FCM is applicable to teaching at faculties (1st year, initial courses), so there are indications that it

can be successfully used with older students in order to develop their skills and competences necessary for life and work in the 21st century (Kuzminska, Morze, Smyrnova-Trybulska, 2017).

Key Competences for the 21th Century (KC21)

A competence is more than just knowledge or skills. It is not limited to cognitive elements (use of theory, concepts, tacit knowledge). It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context. It also encompasses functional aspects (involving technical skills) as well as interpersonal attributes and ethical values. A competence is, therefore, a broader concept that may actually comprise skills (The European Commission's Cedefop glossary /Cedefop, 2014/). On the other hand, Binkley classifies the KC21 into four basic categories: 1. Ways of Thinking (creativity and innovation, critical thinking, problem solving, decision making, learning to learn); 2. Ways of Working (communication, collaboration); 3. Tools for Working (information & ICT literacy) and 4. Living in the World (citizenship, life and career, personal and social responsibility) (Binkley et al., 2012).

In order to distinguish the key competences we would choose for our research, we relied on a comparative analysis of the most renowned and commonly used concepts of KC21 in the world, implemented by Pešikan and Lalovic (2017) in accordance with the Salas-Pilco analysis (2013). The classification created by these authors includes the following KC21: socio-emotional competences (knowledge of oneself and others /self-awareness/, self-regulation, social awareness, social skills, cooperation and responsible decision-making), problem solving (development of research skills), critical thinking, creativity/productivity, information literacy, ICT literacy (mastering ICT skills and tools, applying ICT in other areas of learning and work), learning to learn and metacognition, responsible attitude towards work and obligations, entrepreneurship, responsible attitude towards health and the environment (taking care of one's own health, the health of others and the development of healthy lifestyles, developing ecological awareness and environmentally responsible behavior) (Pešikan, Lalović, 2017).

An important aspect of this study lies in the fact that it contributes to the distribution of existing knowledge pertaining to the application of FCM in teacher education for the development and self-evaluation of key competences in education for the 21st century. The use of FCM in the education of teachers in our educational practice, but also in the education system of Serbia, represents an innovation that was used to connect the Methodological Practicum of Teaching Science and Social Studies (MPTSSS) with the KC21. The objective of the study

was to examine the impact of FCM on the development of KC21 of future teachers. Whether FCM can improve the KC21, especially within the interdisciplinary MPTSSS subject.

Research Methodology

The research was conducted at two faculties of education of the University of Kragujevac, Serbia. The questionnaire for the collection of numerical data and the quantitative method for their analysis was used as an instrument. We used an experiment with parallel groups, in which the pre-test and post-test were performed. An appropriate sample of participants was a group of students from two faculties of the University of Kragujevac, which was selected on the basis of accessibility or expediency. All the participants enrolled in the MPTSSS course, lasting two semesters, in the 4th year of the basic Teacher Education studies (Bachelor's studies). The program of these subjects was coordinated with the contents, topics and the number of hours at both faculties. During the MPTSSS course, which is a compulsory subject for all students, EG students had to process teaching content using FCM, a total of two hours a week. EG students were given the task of applying FCM in their work with primary school students during their practice.

Research Sample

122 students of two pedagogical faculties of the University of Kragujevac participated in the research. These were students of the 4th year of the Basic Academic Studies of the Teacher Training Program. The research was conducted from 2017 to 2019 and lasted one term (two semesters). The students were divided into two groups, an experimental group (EG), which consisted of 60 students (54 female and 6 male), and a control group (CG), which consisted of 62 students (58 female and 4 male). All the students enrolled in the study previously successfully completed the Didactics course.

Instrument

Based on the previously studied literature, the KC21 research results and the application of FCM, an electronic questionnaire of the Scale of Self-Assessment of the Competence of Future Teachers (SSACFT) was constructed for the purposes of this research.

The first part of the questionnaire was intended to gather basic information about the respondents, such as didactics assessment results. The second part of

the questionnaire was a five-step Likert-type scale with 9 positively formulated items, which were used to examine how the students self-evaluate their KC21. We assessed the reliability of the questionnaires by calculating the Cronbach α reliability coefficient, which showed a satisfactory index of internal consistency ($\alpha = 0.852$, $\alpha > 0.7$).

Items within the instrument (SSACFT) concerned the self-evaluation of KC21 development (Table 1).

Table 1. Item definition and KC21 classification

Items code	Classification of KC21 (Pešikan, Lalović 2017)	Item definition
IT-1	Socio-emotional skills	During the hours of the MPTSSS, my socio-emotional competences for effective communication at practical lectures Science and Social Studies (SSS) improved.
IT-2	Problem solving	I am sufficiently methodologically trained to successfully solve problems in the preparation and realization of SSS, to conduct research using the acquired knowledge in new and unusual situations.
IT-3	Critical thinking	I feel competent enough to critically contemplate (select and evaluate) the information related to teaching materials, contents, didactics, theories and work models that can be used in SSS.
IT-4	Creativity and innovation	I am sufficiently methodologically trained to successfully apply innovation skills and create new, original ideas for the realization of SSS.
IT-5	Information literacy	I feel competent enough to use different sources, effectively finding, presenting and adapting to students relevant information for the preparation and implementation of SSS.
IT-6	ICT literacy communication	I am sufficiently methodologically trained to successfully use appropriate technological, digital means of communication (ICT tools) and networks for finding, creating and presenting information.
IT-7	Learning to learn, metacognition	I am capable of basing my personal and professional progress on continuous learning, both individually and in a group, through effective time management and information.
IT-8	Responsible attitude towards work and responsibilities	I have developed competences related to a responsible attitude towards work and obligations, which I can apply in working with students.
IT-9	Responsible attitude towards health and environment	I am competent to care for my own health, but also for the health of students through the development of a healthy lifestyle, ecological awareness and responsible behavior.

Procedure

At the beginning of the experiment, the EG and CG group of students are equalized according to the average Didactics grade. Both groups are familiar with the KC21 concept and competence definitions. After that, the EG and KG were given a pre-test for the self-assessment of KC21.

The students from the CG realized the MPTSSS contents using the traditional teaching model during the research. A theoretical part of the MPTSSS curriculum was presented by using the frontal form, ex-cathedra. In the classes implemented at the faculty, the students attended the teacher's lectures, doing practical homework at home.

The students from the EG were introduced with the FCM at the beginning of the MPTSSS course, its phases and the mode of its realization. The students of the EG had MPTSSS lectures using FCM, two hours a week on average, during two semesters. The theoretical part of the lecture was presented to them through video materials, which they studied at home using the YouTube application and Linoit table. And in college classes, they used Kahoot! application, mini quizzes, discussion, problem solving, application of knowledge in new and unusual situations through teamwork. At the end of the research, the EG and CG completed a post-test for the self-assessment of KC21.

Research Results and Discussion

In order to harmonize the EG and CG at the beginning of the research, we compared their academic achievement and their Didactics assessments results. We chose Didactics because it represents one of the basic subjects, in which the students gain the key skills and competences that are necessary for the realization of lectures in elementary schools. Results of this study have shown that the groups are homogeneous in terms of their Didactics grades (Table 2).

Table 2. Primary school teacher achievement in MTSSS and Didactics courses

	Group	Median	Mean Ranks	Sum of Ranks	Kolmogorov-Smirnov test		Mann-Whitney test		
					Damx	Sig.	U	Z	Sig.
Didactics	CG	7.82	59.85	3710.50	0.198	0.000	1757.5	-0.542	0.588
	EG	7.30	63,21	3792.50	0.220	0.000			

In the further course of the research, we calculated the teachers' results on SSACFT before and after the FCM application. Analysis of the findings showed that there was no significant difference between the KG and EG of the teacher's self-evaluation of the KC21 scores in pre-test (Table 3). There was no statistically significant difference in the results in individual items. The CG and EG were homogeneous in terms of their self-evaluation KC21.

Table 3. Teachers' self-evaluation KC21 of EG and CG in pre-test

Items	Group	Median	Mean Ranks	Sum of Ranks	Kolmogorov-Smirnov test		Mann-Whitney test		
					Dmax	Sig.	U	Z	Sig.
IT1	EG	3.00	67.36	4041.50	0.218	0.000	1508.50	-1.889	0.059
	CG	3.00	55.43	3461.50	0.189	0.000			
IT2	EG	3.00	64.00	3968.00	0.189	0.000	1705.00	-0.832	0.405
	CG	3.00	58.92	3535.00	0.237	0.000			
IT3	EG	3.00	65.59	4066.50	0.183	0.000	1606.50	-1.344	0.179
	CG	3.00	57.28	3436.50	0.189	0.000			
IT4	EG	3.00	60.06	3723.50	0.220	0.000	1770.50	-0.475	0.635
	CG	3.00	62.99	3779.50	0.193	0.000			
IT5	EG	4.00	67.19	4166.00	0.233	0.000	1507.00	-1.913	0.056
	CG	4.00	55.62	3337.00	0.235	0.000			
IT6	EG	4.00	61.89	3837.00	0.232	0.000	1836.00	-0.129	0.897
	CG	4.00	61.10	3666.00	0.259	0.000			
IT7	EG	4.00	58.03	3598.00	0.245	0.000	1645.00	-1.165	0.244
	CG	4.00	65.08	3905.00	0.248	0.000			
IT8	EG	5.00	61.64	3821.50	0.439	0.000	1851.50	-0.055	0.956
	CG	5.00	61.36	3681.50	0.434	0.000			
IT9	EG	4.00	63.38	3803.00	0.287	0.000	1747.00	-0.617	0.537
	CG	4.00	59.68	3700.00	0.308	0.000			
Total score	EG	38.00	60.76	3645.50	0.193	0.000	1815.50	-0.230	0.818
	CG	38.00	62.22	3857.50	0.178	0.000			

At the end of the experiment, both groups were given a post-test that contained the same scale of 9 items that were used in the pre-test. The results in the post-test are shown in Table 4.

Table 4. Teachers' self-evaluation KC21 of EG and CG in post-test.

Items	Group	Median	Mean Ranks	Sum of Ranks	Kolmogorov-Smirnov test		Mann-Whitney test		
					Dmax	Sig.	U	Z	Sig.
IT1	EG	4.00	67.63	4057.50	0.250	0.000	1492.50	-2.004	0.045
	CG	4.00	55.57	3445.50	0.267	0.000			
IT2	EG	4.00	67.71	4062.50	0.282	0.000	1487.50	-0.205	0.040
	CG	4.00	55.49	3440.50	0.278	0.000			
IT3	EG	3.00	68.42	4105.00	0.266	0.000	1445.00	-2.25	0.024
	CG	3.00	54.81	3398.00	0.233	0.000			
IT4	EG	3.00	60.06	3723.50	0.220	0.000	1770.50	-0.475	0.635
	CG	3.00	62.99	3779.50	0.193	0.000			
IT5	EG	4.00	67.56	4053.50	0.274	0.000	1496.50	-1.983	0.047
	CG	4.00	55.64	3449.50	0.223	0.000			
IT6	EG	5.00	82.00	4920.00	0.409	0.000	630.00	-6.650	0.000
	CG	3.00	41.66	2583.00	0.232	0.000			
IT7	EG	4.00	68.11	4086.50	0.275	0.000	1463.50	-2.134	0.033
	CG	3.50	55.10	3416.50	0.184	0.000			
IT8	EG	4.00	61.24	3674.50	0.246	0.000	1844.50	-0.085	0.933
	CG	4.00	61.75	3828.50	0.242	0.000			
IT9	EG	4.00	63.38	3802.50	0.242	0.000	1747.50	-0.621	0.535
	CG	4.00	59.69	3700.50	0.220	0.000			
Total score	EG	36.00	80.28	4816.50	0.144	0.048	733.50	-5.786	0.000
	CG	31.50	43.33	2686.50	0.105	0.003			

The results show that there is an increase in the total pre-test results and the post-test in the self-assessment of the KC21, in both the EG and the CG teachers. The teachers of the EG showed a higher increase in KC21 compared to CG. Estimates that the EG teachers evaluated their KC21 with and the estimates of the CG are significantly different. These results are embedded in the findings of Souza and Rodrigues (2015).

When comparing the results for each individual item, we found that there is a statistically significant difference between the CG and EG in the post-test results for 6 items. The results of the teachers of the EG show that they believe that they significantly improved their learning skills during the MPTSSS Course using FCM ($U = 1463.50$; $p = 0.033$), followed by socio-emotional competences ($U = 1492.50$;

$p = 0.045$), ability to solve problems ($p = 0.040$), to critically think ($p = 0.024$), to obtain the necessary information ($p = 0.047$) and to apply ICT ($p = 0.000$). On the other hand, the CG teachers assessed their KC21 with much lower marks. These results are in accordance with the research that shows that FCM affects the development and improvement of self-regulation, persistence and collaboration, team spirit, and students are more likely to seek help (Sezer, 2017). The findings of our research are consistent with the results that show that the FCM implementation in the development of the KC21 implements pedagogical requirements such as involving pupils in independent cognitive and practical activities, the use of ICT and information literacy of students. It is particularly important that activities in the FCM put students and teachers in a research position that affects the development of an individual's ability to think systematically and divergently, independently learn and make decisions (Kuzminska, Morze, Smyrnova-Trybulska, 2017).

Regarding other items, when it comes to *creativity, responsible attitude towards work, health and environment*, we did not find statistically significant differences between the EG and CG in the post-test results for self-assessment of KC21. The reasons for this can be found in the relatively small sample size, in the number of realized FCM hours and the content of the MPTSSS included in the study. There is a possibility that the results obtained would be different under different, strictly controlled circumstances and larger sample. It would be useful to further examine the factors that influenced the results of this part of the research, and in accordance with this, improve the FCM to be effective in respect to the development of the other KC21 group.

Conclusions

The obtained collective results of the EG and CG showed that there is a statistically significant difference in the self-assessment of KC21, and that the application of the FCM positively influences the development of KC21, as assessed by the teachers. The study showed that the FCM, according to the students' assessment, influenced the development of their competences for *problem solving, critical thinking, information and ICT literacy, learning to learn* and *socio-emotional skills*. The research showed that there is no statistically significant difference in self-assessment of KC21 related to *creativity, responsible attitude towards work, health and environment*. Considering the fact that there are some limitations of this research relating to the sample size and the specific structure of the realized course, the

findings of the study cannot be generalized, but they can serve as the starting point for examining other dimensions and effects of the FCM in the framework of university education.

The FCM should, no doubt, find its place in the education system, because its application has advantages. However, it also requires great inventiveness and expertise of a competent teacher, who is well acquainted with the modern methodological tendencies and knows how to apply them in teaching practice. Accordingly, the results of this research can be of relevance for researchers of the Teacher Faculty of Education searching for potentially useful methods for education of future teachers.

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