DIFFUSION OF INNOVATION IN MODERN SCHOOL

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Abstract: This paper presents the results of research aimed to examine how teachers are interested in the application of innovation in teaching and in their personal development. An attempt was made to determine their opinion on the application of innovation in education. Sample consisted of 162 teachers (N = 162) in primary and secondary schools. We used the technique of scaling and instrument evaluation scale that was specifically designed for this research. The results show that teachers easily and smoothly implement innovations in their educational work and the knowledge gained by applying innovation far better in terms of practical application and durability of the knowledge acquired without the use of innovation. A qualitative analysis has shown that the majority of respondents had positive views of the use of innovations in their schools.

Keywords: innovation, modern schools, information technology, teacher education.

1. Introduction

Modern information technology has changed the way of working in all areas of life. This new information technology has influenced major changes in the school system. Alexander King points out that "after the steam engine no other single invention has had such a huge impact on all areas of human activity as the phenomena of chips and integrated circuits". Educative work continues to be performed according to the formula of J. A. Komenski, which was introduced more than three centuries ago. Schools must fundamentally change the approach to work as influenced by information technology, gradually abandoning the tradition established by Komenski. It was a revolutionary step in the development of education, but over time, its possibilities are exhausted so that it is in the present circumstances it has become a factor that limits the the contemporary role of schools [8]. Teachers, students and the school itself have now found themselves in a very different information environment than before. Schools that accept this environment will be much more modern and more successful and will not look like traditional schools where the teacher and the textbook are the only available sources of knowledge. By applying information technology, schools can continually innovate their new knowledge. Innovation is the requirement that the school does not remain at the traditional level.

The term "innovation" came into use in 1930, as a term used in sociology and cultural anthropology, and is directly connected with the idea of expanding cultural phenomena. This approach is different in spatial and temporal distribution of time, which has different rates, widespread at present. The innovation in this approach is considered as the basis of changes in culture and dissemination of cultural features or subculture of their own borders. The term innovation is of Latin origin (*novus* - new, *inovatio* - novelty, change, innovate - to do something new). Innovation is considered to be improving, upgrading, modernization and development. However, there are various definitions of the concept of innovation. Everett Rogers says that "the idea that innovation is the new individual. It does not matter if the idea is objectively new or not, it is time that has elapsed since its first use or discovery." LaPiere points out that innovation is a new idea. D. McClelland says that innovation is something new or different from the previous time or special situation. V. Djurić notes that it is an idea that has been recently created, or we recently got in

touch with, and is different from the existing ones. B. Vlahović believes that every educational innovation consciously constructs and creates a change that brings new moments and positively changes the essence of the current state of the educational process [8]. Most authors agree, however, that Rogers's understanding is correct. P. Mandić said that innovation in the upbringing and educational activities is a synchronized system of pedagogical, social, organizational and economic measures (based firmly on educational and other sciences) aimed at raising the level and quality of educational work, the rational use of human resources, time and creativity of teachers and students. He gives a more extensive classification of innovation that includes the education system and work in schools. He distinguishes innovation as changes in educational objectives, the function of the school system, teaching contents and function of teachers, resources, work, organization, implementation and evaluation of teaching.

We tried to find out the perception of teachers towards the implementation of innovations in educational work.

2. Methods

The goal of this research is reflected in the effort to investigate how teachers are interested in the application of innovations in teaching and for their personal development. The study sample consisted of 162 teachers, 57 in primary and 105 in secondary schools.

The tasks of this study were to: examine whether, based on the beliefs of teachers, SPISŠ1 scale meets the criteria of reliability, examine whether the results obtained from SPISŠ1 scales meet the criteria of normality curvature distribution, i.e. parametric criteria, examine whether there is interconnection among the items of SPISŠ1 scale on the basis of which they can be reduced to a smaller number of more fundamental variables (factors) that explain this inter-connectedness; to examine whether the beliefs of male teachers are more positive beliefs than female teachers.

The method applied in this study is selected in accordance with the objectives, goals and tasks of research, and in accordance with the hypotheses. The survey will use scaling technique and instrument evaluation scale (Likert), which will be specially designed for this research. It consists of 15 items that include statements that describe the perceptions of teachers towards the implementation of school innovation. Every statement is offered as a five-point response scale from 1 to 5, where the numbers mean the following: 1-very strongly disagree, 2-Disagree, 3-Tend to agree, 4-agree, 5-agree very.

3. The organization and flow of the experimental research

The study was conducted in primary and secondary schools; primary schools “Branko Radičević” in Vranje, and “Vuk Karadžić” in Surdulica, and in Technical Secondary School and Secondary School of Economics in Vranje. There were 57 (35.2%) elementary school teachers (20 primary school and 37 middle school teachers), and 105 (64.8%) secondary school teachers (Table 1).

Table 1. The structure of the sample of teachers

Variables		*f*	%
Gender	Male	68	42
	Female	94	58
	Total	162	100
Type of school	Elementary School	57	35,2
	Secondary school	105	64,8
	Total	162	100
Work experience	Up to 10 years	41	25,3
	10-30 years	100	61,7
	Over 30 years	21	13
	Total	162	100
Profession	Primary school teacher	20	12,3
	Middle school teacher	37	22,8
	Secondary school teacher	105	64,8
	Total	162	100

SPSS17 software was used to process the data (Statistical Package of Social Sciences for Windows-and for parallel Monte Carlo analysis).

4. Results and Discussion

In the preliminary research there were 15 primary manifest variables. Since the number of participants should not be less than 100, or less than the number of initial variables multiplied by 5, it met the initial criteria. Table 2 shows the communality of prominent variables that tells us how much of the variance of each variable explained with a certain number of retained components (factors).

Table 2. Communality manifest variables

	Initial	Derived
V1	1.000	.681
V2	1.000	.550
V3	1.000	.519
V4	1.000	.319
V5	1.000	.480
V6	1.000	.079
V7	1.000	.490
V8	1.000	.561
V9	1.000	.592
V10	1.000	.682
V11	1.000	.645
V12	1.000	.344
V13	1.000	.635
V14	1.000	.477
V15	1.000	.575

Extraction method (Extraction Method): The analysis of the main factors

The scale was subjected to a principal components analysis (PCA Principal Component Analysis) to SPSS v. 17. Prior to the implementation of the PCA, the suitability of data for factor analysis was ranked. A review of the correlation matrix revealed many coefficient values of 0.3 and above. The value of the Kaiser-Meyer-Okinov indicators (Table 3) was 0.877, which exceeds the recommended value of 0.6. [2, 3] The Bartlett test of sphericity (Bartlett, 1954) also reached statistical significance. Value Bartlett test for statistical significance of the correlation matrix 2 = 980 594 with 105 degrees of freedom and sig. 1% confirms the appropriateness of statistical analysis of the data collected by factor analysis. Bartlett indicator is significant (p = 0.000), and factor analysis was justified.

Table 3. Testing assumptions of reliability data for factor analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.877
Bartlett's Test of Sphericity	Approx. Chi-Square	980.594
	df	105
	Sig	.000

According to Kaiser Gutmann criteria only those factors that best explain the variability are taken into account, i.e. with a value greater than one. Principal components analysis revealed the presence of three components with characteristic values exceeding 1, explaining 38.110%, 50.862% and 58.245%. Only the first three components have characteristic value above 1 (5,716, 1,913, 1,107). As the third component has the approximate value of 1, it should not be taken into consideration. The first two components explain 50.86 percent of the variance. Table 4 shows the variance explained by individual factors.

Table 4. Principal components analysis

Component	Initial eigenvalues			Featured sum of squares of saturation			Rotated sum of squares of saturation
	Total	% variance	Cumulative series %	Total	% variance	Cumulative series %	Total
1	5.716	38.110	38,110	5,716	38,110	38,110	4,762
2	1.913	12.752	50,862	1,913	12,752	50,862	4,535
3	1.107	7.383	58,245				
4	.967	6.449	64.694				
5	.855	5.701	70.394				
6	.704	4.695	75.090				
7	.617	4.112	79.202				
8	.534	3.563	82.765				
9	.514	3.425	86.189				
10	.449	2.995	89.184				
11	.401	2.673	91.856				
12	.356	2.376	94.233				
13	.337	2.245	96.478				
14	.271	1.806	98.284				
15	.257	1.716	100.000				

Extraction method (Extraction Method): The analysis of the main factors

For further confirmation of the factor analysis and determining the number of factors a parallel analysis was performed (Table 5) and the results were compared with those obtained in SPSS (Table 6).

Table 5. The results of the parallel analysis

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Monte Carlo PCA for Parallel Analysis
Version 2.5
1/26/2013 10:49:53 AM
Number of variables: 15
Number of subjects: 162
Number of replications: 100

Eigenvalue #	Random Eigenvalue	Standard Dev
1	1.5595	.0730
2	1.4326	.0494
3	1.3287	.0372
4	1.2433	.0421
5	1.1668	.0392
6	1.0955	.0321
7	1.0336	.0324
8	0.9692	.0314
9	0.9140	.0283
10	0.8541	.0289
11	0.8011	.0296
12	0.7436	.0305
13	0.6860	.0320
14	0.6201	.0330
15	0.5518	.0376

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Monte Carlo PCA for Parallel Analysis

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Table 6. Comparison of characteristic values obtained by PCA and threshold values obtained by the parallel analysis

Serial number of components	The actual characteristic values of PCA	Values obtained by parallel analysis	Decision
1	5,716	1.5595	Accept
2	1,913	1.4326	Accept
3	1,107	1.3287	Reject
4	0,967	1.2433	Reject

The outcome of the parallel analysis supports our conclusion to keep the two components. Here is a review of Cattell's landslide method. Diagrams show (Scree Plot) the existence of a clear break point after the third component. Based on Cattell's criteria it was decided to retain for further exploration of two components.

This is supported by the results of parallel analyzes, with only two components whose characteristic values exceed the corresponding threshold values obtained with the equally large array of random numbers (variable 15 * 162 respondents).

Fig. 1 A number of factors of Cattell's method by landslides (Scree Plot)

The attached chart clearly shows fracture at the junction of the second and third components. And the first component explains much more of the variance of the remaining components. The greatest burden lies on the first factor, which has the highest value in explaining manifest variables. Each successive factor explains a smaller proportion of the total variance.

Processing of data in a table shows that the component 1 has eight weight factors, component 2 also has eight factors, component 3 has only one factor above 0.3. It would be ideal if each component had three or more of the weight factors, so this solution is not optimal, which means that it should accept only two factors.

This two-component solution explained a total of 50.86% of the variance, with a contribution of 1 component of 38.11%, and 2 components of 12.75%. To help interpret these two components rotations were performed. Rotated solution revealed the presence of a simple structure, in which both components have a lot of big weight factor and all variables provide considerable weight of only one component.

Two-factor solution explained only 50.86 percent of the variance. After the rotation two-factor solutions we can see that the main component weight factor 1 the items 9, 11, 8, 10 and 15 The main items of Component 2 are 13, 1, 2 and 5 (Table 7).

Table 7. Primary Factors to evaluate

	Component	
	1	2
V9	.834	
V11	.792	
V8	.778	
V10	.752	
V15	.727	

V7	.648	
V12	.416	
V13		.847
V1		.832
V2		.748
V5		.732
V14		.625
V4		.496
V3	.381	.466
V6		

Extraction method: principal component analysis
Rotation Method: Oblimin with Kaiser normalization

Factor 1, which has the highest value, can be called "Innovation in teaching" because it is characterized by variables related to the implementation of innovations in teaching, use of the Internet in teaching and the use of innovation in teaching.

Factor 2 is related to the school system and the use of innovations in schools which is why we can name it “Innovation in schools”. Variables that describe this factor are: use of systemic innovation in schools, the use of space and technical innovations in schools, the implementation of the evaluational and docimological innovations.

By using two-factor univariate ANOVA on data obtained SPISŠ1 scale we tried to determine the interconnection of independent variables (gender and occupation) in relation to the beliefs of teachers in the interest of application innovation in teaching (Table 8).

Table 8. Tests influences between variables

Gender	Profession	M	SD	N	^{a}F	^{a}p	^{b}F	^{b}p	^{c}F	^{c}p
1 Male	Primary school teacher	4.00	.	1						
	Middle school teacher	4.62	.719	16						
	Secondary school teacher	4.27	.802	51						
	Total	4.35	.787	68						
2 Female	Primary school teacher	4.11	.994	19						
	Middle school teacher	4.19	.814	21						
	Secondary school teacher	4.28	.763	54						
	Total	4.22	.819	94						
Total	Primary school teacher	4.10	.968	20						
	Middle school teacher	4.38	.794	37						
	Secondary school teacher	4.28	.778	105						
	Total	4.28	.806	162	,136	,713	,546	,580	1,024	,362

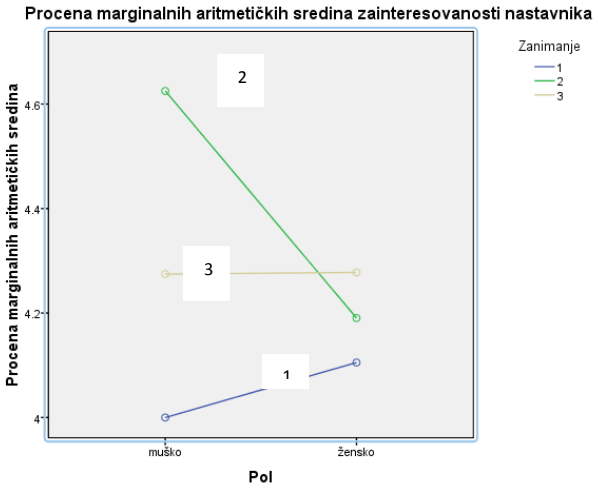
From Table 8 we can see that the beliefs of male teachers (M = 4.35) were not significantly different from those of female teachers (M = 4.22), which confirms the F ratio (f = 0.136) was not statistically significant. We conclude that

the result is not consistent with the assumption that the responses of male subjects are more positive than the responses of female respondents. Also, the value of F ratio indicates that there is no statistically significant difference between the average degree of deviation from the standard of results between the male members (SD = 0.78) and female members (SD = 0,81).

As for the interaction of gender and occupations, it can be said that there is a mutual relationship between these independent variables in relation to the factor of interest in the application of innovation (bf = .54). From this we can conclude that there is no statistically significant difference in the beliefs of male and female teachers.

The beliefs of male middle school teachers (M = 4.62) were more positive than those from female teachers (M = 4,19). Overall, middle teachers' beliefs (M = 4.38) were more positive than those of secondary school teachers (M = 4.28) and primary school teachers (M = 4,10). That's all we can see and the inclination of the line on the graph where the line 2 steepest, followed by line 3 and at the end of line 1

Fig. 2 Means - The interest of teachers in the use of innovations in teaching



Note: 1-primary school teachers, 2-middle school teachers, 3-secondary school teachers

Given the overall high scale value of M = 4.28 we can say that middle school teachers are interested in the application of innovation in education. Despite these results, it is desirable to conduct a new research on the beliefs of teachers in the implementation of innovations in education and look for the dominant factors that increase teachers' motivation for innovation in education.

5. Conclusion

This paper was written with the aim to investigate and determine what the attitudes toward implementation of innovation in education are. In the paper, we set up a hypothesis on which we have conducted research and have come to the following conclusions.

The first hypothesis is related to the fact that the scale meets the criteria of reliability. As the value of the Cronbach alpha coefficient equals 0.875, the scale meets the criteria of reliability, which we confirmed the first hypothesis.

The second hypothesis is related to the fact that the set items meet the parametric criteria. Using the Kolmorgor-Smirn test and Shapiro-Vilkov test we found that the distribution of results SPISŠ1 scale is at the level of significance of p = 0.001 and for all 15 claims which

have confirmed the second hypothesis. This means that further analysis of the results we can use parametric tests.

Among the items of SPISŠ1 scale interconnection exists on the basis of which they can be reduced to a small number of fundamental variables (factors) that explain the interconnection. Factor analyses of the 15 items of the scale are factorized and get two fundamental variables: innovations in teaching and school innovation.

The results are consistent with the assumption that the responses of male subjects are more positive than the responses from female respondents. From this we can conclude that there is no statistically significant difference in the beliefs of male and female teachers.

The overall grade of middle school teachers' beliefs (M = 4.38) was more positive than that of high school teachers (M = 4.28) and primary school teachers (M = 4,10).

Modern schools have extensive experience in teaching, which must be carried out in certain educational activities. Very often it remains unused because most teachers do not see the need for its study and application. In practice, teachers often do not think about the need and feasibility analysis of their own teaching experience. The innovative nature of the teacher involves the creation, development and use of pedagogical innovation and the creation of conditions for their successful development and implementation. The introduction of new items requires constant search for new forms of organization, ICT education. The innovative nature of a teacher includes the introduction of practical results of teaching activities in psychological and educational research.

The introduction of optimality in the application and dissemination of innovations in modern school means efforts and resources for teachers to achieve results. With the help of innovations, all of which are present due to the development of information and communication technologies, different teachers can achieve equally good results in different areas and with different intensity of their own work. Analysis of the literature and the results obtained by empirical studies suggests a lack of intensity of use of innovation in education. The reasons for this are that the innovation and application of new ICTs does not bring the expertise needed to use innovative means and that the application of innovation is not preceded by organizational or technical preparation in schools and individuals. The hesitation to introduce innovations in school is mostly the result of psychological aversion of teachers (not all) due to a lack of technical expertise in implementation. This suggests that teachers need to prepare for the implementation of innovations in education in order to get the most out of them and therefore shift from a traditional to a modern school.

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