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THE STUDENTS PREFERENCES IN LECTURES METHODS (ON THE EXAMPLE OF THE UNIVERSITY OF TECHNOLOGY IN KOSZALIN)[1]

Abstract: The aim of this study is to investigate the Polish students preferences of economic and non-economic specialties in the way of learning in lectures. The paper provides an answer to the following research question: how to teach students in the modern condition. Statistically proven that Polish students of economic and non-economic specialties do not prefer the auditory way of learning in lectures. The result is very highly statistically significant (99,9%). Statistically proven that the difference in the preferences of students of economic and non-economic specialties must be taken into account. The result is highly statistically significant (99,0%). The result of the study may be useful for changing of Polish Higher Education. It is necessary to equip all lecture halls with visual learning tools. It is necessary to train lecturers to use visual learning tools.
Key words: student's preferences, lecture, way of learning in lectures, auditory way, visual way.

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[1] The article contains test results that are part of the scientific project WPL_BS_Economics and management of educational systems and processes, 2018 carried out at the Pedagogical University in Krakow. The study was carried out in Poland in 2018 with the support of the East European Study Group (Azerbaijan, Belarus, Poland, Serbia, Ukraine) and the scientific project: 02. Analysis of the effectiveness of educational processes on the basis of competencies and opinions of the participants of the educational process: innovations in the management of educational systems and processes (Pedagogical University of Cracow).

Introduction

Nowadays universities are subject to pressures of the marketplace[2]. The R. Dearing *Report*[3] first identified students as the principle customers of universities and, as a result, HEIs have become increasingly subject to commercial pressures. Below the authors answered the rhetorical question of didactics: how to teach students in modern conditions?[4] In the paper it is considered the attitude of Polish students to the way of learning in lectures. It has been studied two alternative ways of learning in lectures: the auditory way and the visual way. The authors studied the lecture as a process of providing educational services to consumers. Until now, auditory learning has been widely used by teachers. It is a learning style in which a person learns through listening. An auditory learner depends on hearing and speaking as a main way of learning[5].

Nowadays new sources of visual information affect young people. In relations with students, also teachers use modern forms of communication (i.e. Internet, social media)[6]. Students use social media to complete homework-related tasks and maintain friendship[7]. The youth of Poland has changed. The

[2] A. Abubakar, H. Hilman, N. Kaliappen, *New Tools for Measuring Global Academic Performance*, SAGE Open, Volume 8, issue 3, 2018, pp. 1-10. https://doi.org/10.1177/2158244018790787

[3] R. Dearing, *Higher Education in the Learning Society: Report of the National Committee of Inquiry into Higher Education*, Her Majesty's Stationary Office, London 1997.

[4] *Didactika kak oblast pedagogiki*, http://www.studfiles.ru/preview/3048519/page:4, access: 02 May 2017.

[5] See: J. Carnevale, *Auditory Learners*, https://study.com/academy/lesson/auditory-learners-definition-characteristics.html, access: 03 May 2018; Fil. Kayalar, Fet. Kayalar, *The effects of Auditory Learning Strategy on Learning Skills of Language Learners (Students' Views)*, IOSR Journal Of Humanities And Social Science (IOSR-JHSS), Volume 22, Issue 10, Ver. VII, 2017, p. 04-10; M. J. Kostelnik, A. K. Soderman, A. P. Whiren, *Developmentally Appropriate Curriculum: Best Practices in Early Childhood Education* (3rd ed.). Columbus: Pearson, Merrill Prentice Hall, 2004.

[6] See: Y. Wang, *U.S. State Education Agencies' Use of Twitter: Mission Accomplished*? SAGE Open, Volume 6 issue 1, 2016, pp. 1-12, https://doi.org/10.1177/2158244015626492; S. Aydin, *A review of research on Facebook as an educational environment*. Educational Technology Research & Development, No. 60, 2012, p. 1093-1106; J. Kurtz, *Twittering about learning: Using Twitter in an elementary school classroom*. Horace, No. 25(1), 2009, p. 1-4; V. Cho, J. Ro, J. Littenberg-Tobias, *What Twitter will and will not do: Theorizing about teachers' online professional communities*. Learning Landscapes, No. 6(2), 2013, p. 45-62.

[7] S. Weeden, B. Cooke, M. McVey, *Underage children and social networking*. Journal of Research on Technology in Education, No. 45, 2013, pp. 249-262.

youth of Poland use the achievements of technical progress. Their way of thinking changes after the emergence of new gadgets.

Young people have changed. They are following technological advances. Their way of thinking is changing. And it is possible that students do not prefer an auditory way of learning by now. That is why we do not study the results of learning in lectures. We study the priorities of Polish students in the process of obtaining knowledge in lectures.

The aim, materials and methods

The aim of the study is to answer two research questions:

1. do students of economic and non-economic specialties prefer the auditory way of learning in lectures?
2. is there the equality of preferences of students of economic and non-economic specialties?

Tabela 1. Characteristics of respondents

Specialty	The number of choices			$\dot{X}$	δ_x	δ_{x-1}
	response 1	response 2	response 3			
Economic specialties						
Economics, master degree	15	1	0	0.93	0.25	0.26
Finance and Accounting, bachelor course	15	2	0	0.88	0.32	0.33
For economic specialties	30	3	0	0.91	0.28	0.29
Non-economic specialties						
Management, bachelor course	13	2	2	0.76	0.42	0.44
Tourism and Recreation, bachelor course	15	5	0	0.75	0.43	0.44
For non-economic specialties	28	7	2	0.76	0.42	0.43

Source: The results of own calculations.

In the research, the following research methods have been applied: questionnaire survey, statistical processing of questionnaires, statistical verification

of hypotheses[8]. The methods of statistical research where used. It is not a quantitative analysis. It is a qualitative analysis.

The questionnaire was created at the Pedagogical University in Krakow. The main question discussed in the paper was: What way of learning in lectures do I prefer? There were three possible answers:

1. The teacher has a presentation, and I write with a slide show.
2. The teacher slowly dictates, and I write.
3. The teacher quickly says, and I note.

The first answer refers to the visual way of learning in lectures. The second and third answers refer to the auditory way of learning in lectures. The research methodology comes from *BUS_9641_Business_Statistics_3*[9]. The study was carried out in University of Technology in Koszalin since June till October 2018. Well-documented and powerful methods of analysis were used. All of methods were economically justified. The characteristic of respondents is given in Table 1. Thus, there were 70 respondents from University of Technology in Koszalin who tooks part in the survey. It was four groups of respondents economic and non-economic specialties. These were full-time students of a bachelor course and master degree.

Results and discussion

The first stage incudes primary and statistical processing of questionnaires. The results are given in Table 2. The value "0" is assigned to the auditory way of learning for statistical calculations. The value "1" is assigned to the visual way of learning in lectures. Answer №2 and answer № 3 were combined for the study.

According to Table 2 the expected value $\dot{X}$ in four groups of respondents is more than 0.75. The ratio of the auditory and visual ways of learning is shown in Figure 1 and Figure 2.

The overall situation in four groups of respondents is presented in Figure 1. According to the research results the auditory way of learning does not dominate in the preferences of students. The figure shows that the visual way of learning dominates in the preferences of students (76%-92%).

[8] Sociological methods have not been applied, according to M. Tsvetkova, (*Lies of the Reader: Disadvantages of the Sociological Research Methods for the Study of the Reading*, European Journal of Contemporary Education, No. 7(1), 2018, pp. 190-213). The Author have found 15 disadvantages of the sociological methods of the study of reading, as a result of which, science can get a false view.

[9] *BUS_9641_Business_Statistics_3*, Textbook for the Program „Masters of Business Administration" – USA. NY. Kingston University, 2010, 122 p.

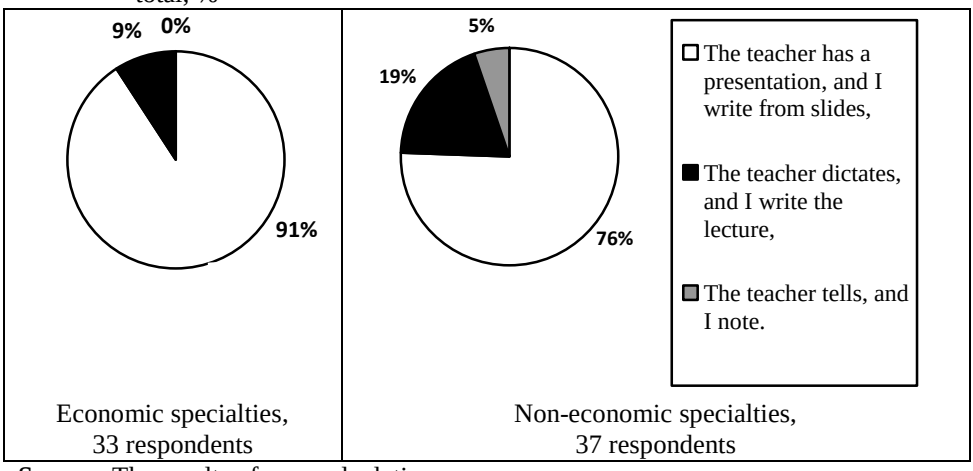
The situation in each of four groups of respondents is presented in Figure 2. According to the results the auditory way of learning does not dominate in the preferences of students (7% -25%). The visual way of learning dominates in the preferences of MPSU's students (75%-93%).

Table 2. The results of processing of questionnaires (number of choices of different responses)

Specialty	The number of choices			$\dot{X}$	δ_x	δ_{x-1}
	response 1	response 2	response 3			
Economic specialties						
Economics, master degree	15	1	0	0.93	0.25	0.26
Finance and Accounting, bachelor course	15	2	0	0.88	0.32	0.33
For Economic specialties	30	3	0	0.91	0.28	0.29
Non-economic specialties						
Management, bachelor course	13	2	2	0.76	0.42	0.44
Tourism and Recreation, bachelor course	15	5	0	0.75	0.43	0.44
For Non-economic specialties	28	7	2	0.76	0.42	0.43

Source: The results of own calculations.

Figure 1. The number of choices of the auditory way and the visual way of learning in total, %

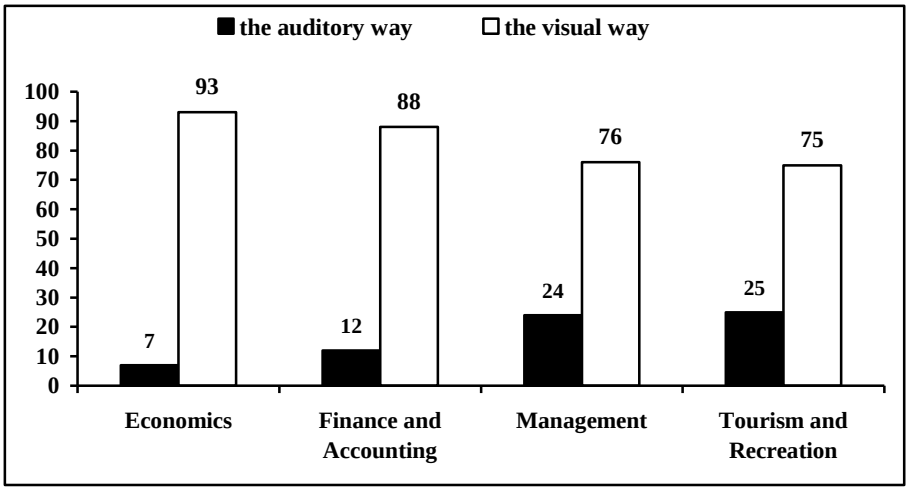


Source: The results of own calculations.

Preferences for four groups of respondents are presented at Figure 1 and Figure 2. The resukts can not guarantee that such preferences are in the general population of students. Therefore, two alternatives were considered at the next stage of the research. Firstly – students of economic and non-economic special-

ties prefer the auditory way of learning in lectures. Secondly – students of economic and non-economic specialties do not prefer the auditory way of learning in lectures.

Figure 2. The number of choices of the auditory way and the visual way of learning by specialities, %



Source: The results of own calculations.

The second stage of the research covers verification of statistical hypotheses to determine students' choice: Polish students prefer the auditory way of learning in lectures:

- hypothesis testing: students of economic and non-economic specialties prefer the auditory way of learning;
- null hypothesis (H_0: $\mu = 0.0$): students of economic and non-economic specialties prefer the auditory way of learning in lectures, if you do not take into account random deviations;
- alternative hypothesis (H_1: $\mu \neq 0.0$): students of economic and non-economic specialties do not prefer the auditory way of learning in lectures, if you do not take into account random deviations.

According to the null hypothesis the unknown average of the general population of students of economic and non-economic specialties $\mu = 0.0$. Whereas referring to the alternative hypothesis the unknown average of the general population of students of economic and non-economic specialties $\mu \neq 0.0$.

Table 3 shows data for the verification of statistical hypotheses for $\mu_0 = 0.0$.

Table 3. Data to verification of statistical hypotheses

Indicator	Group			
	Economics	Finance and Accounting	Management	Tourism and Recreation
the size of a sample, n	16	17	17	20
the expected value, $\dot{X}$	0,93	0,88	0,76	0,75
the standard deviation for the sample, δ_x	0,25	0,32	0,42	0,43
average error, $\dot{S}_{\dot{X}} = \delta_x / \sqrt{n}$	0,063	0,078	0,102	0,096
quantitative variable $\mid t_{stat} \mid$ for $\mu_0 = 0{,}0$, $(\dot{X} - \mu_0) / \dot{S}_{\dot{X}}$	14,762	11,282	7,451	7,812
the value t_{tabl} for the level of significance 99,9,% [10]	4,073	4,015	4,015	3,883
Result, $\mid t_{stat} \mid > t_{table}$	Yes	Yes	Yes	Yes

Source: The results of own calculations.

The size t_{stat} more than value t_{tabl} for the level of significance 99,9% (Table 3). Therefore, we accept alternative hypothesis: the unknown average of the general population $\mu \neq 0.0$. This means, students of economic and non-economic specialties do not prefer the auditory way of learning in lectures, if you do not take into account random deviations. For the level of significance 99,9%[11], we accept the following result: The general population of students of economic and non-economic specialties does not prefer the auditory way of learning in lectures. This is proved that general population of students of economic and non-economic specialties does not prefer the auditory way of learning in lectures. The result is very highly statistically significant (99,9%).

The second stage of the research contains Verification of statistical hypotheses for estimating the differences between two independent samples: a comparison of the preferences of students of economic and non-economic specialties. The statistics, creating the basic criterion for testing the equality of mathematical expectations of two general totalities, are based on the difference between the sample averages[12].

[10] *BUS_9641_Business_Statistics_3*, op. cit., p. 42.
[11] Ibidem, p. 75.
[12] *Chto takoe z-ocenka? Chto takoe p-znachenie*?, http://desktop.arcgis.com/ru/arcmap/10.3/tools/spatial-statistics-toolbox/what-is-a-z-score-what-is-a-p-value.htm, access: 2 May 2018.

To estimate the differences between two mathematical expectations, we can formulate the following Z-criterion:

$$Z = [(\dot{X}_1 - \dot{X}_2) - (\mu_1 - \mu_2)] / \sqrt{(\dot{S}_1^2 - \dot{S}_2^2)}$$

where:
$\dot{X}_1$ – average sample value from the first general totality,
μ_1 – mathematical expectation of the first general totality,
$\dot{S}_1$ – average sample error taken from the first general totality,
$\dot{X}_2$ – average sample value from the second general totality,
μ_2 – mathematical expectation of the second general totality,
$\dot{S}_2$ – average sample error taken from the second general totality.

The assumptions:

- The research hypothesis: there are no significant differences between two independent samples; the research hypothesis is H_0: $\mu_1 - \mu_2 = 0.0$;
- The alternative hypothesis: there are significant differences between two independent samples; the alternative hypothesis is H_1: $\mu_1 - \mu_2 \neq 0.0$.

The research hypothesis asserts that there are no significant differences in the preferences of students of economic and non-economic specialties, if one does not take into account random deviations. The alternative hypothesis asserts that there are significant differences in the preferences of students of economic and non-economic specialties, if one does not take into account random deviations. For the standard significance level of 99% (p = 0,01), $Z_{tabl} = 2{,}58$[13].

Table 4. Data to verification of statistical hypotheses

Indicator	Specialties	
	Economic	Non-economic
the size of a sample, n	33	37
the expected value, $\dot{X}$	0.91	0.76
$\dot{X}_1 - \dot{X}_2$	0.15	
$\mu_1 - \mu_2$	0.00	
the standard deviation for the sample, δ_x	0.28	0.42
average error, $\dot{S}_{\dot{X}} = \delta_x / \sqrt{n}$	0.049	0.069
$\dot{S}^2$	0.002	0.005
$\lvert \dot{S}_1^2 - \dot{S}_2^2 \rvert$	0.003	
$\sqrt{(\dot{S}_1^2 - \dot{S}_2^2)}$	0.055	
$\lvert Z_{stat} \rvert = [(\dot{X}_1 - \dot{X}_2) - (\mu_1 - \mu_2)] / \sqrt{(\dot{S}_1^2 - \dot{S}_2^2)}$	2.727	
the value Z_{tabl} for the level of significance 99.0	2.58	
Result, $\lvert Z_{stat} \rvert > Z_{table}$	Yes	

Source: The results of own calculations.

[13] Ibidem.

Figure 1 shows the difference between the preferences of students of Economic and Non-economic specialties. The value of preference for visual way of learning equal to 91% for students of economic specialties. The value of preference for visual way of learning equal to 76% for students of non-economic specialties.

The authors used the Z-criterion to estimate the difference between two mathematical expectations at a confidence level of 99 (Table 4).

In the case $|Z_{stat}| = 2{,}727$. Since $|Z_{stat}|$ is higher than Z_{tabl}, then the Alternative hypothesis is accepted: there are statistically significant differences between two independent samples. This means there are significant differences in the preferences of students of Economic and Non-economic specialties, if one does not take into account random deviations.

Thus, we found the answer to second question: is there the equality of preferences of students of Economic and Non-economic specialties?

The difference in the preferences of students of Economic and Non-economic specialties must be taken into account. The result is highly statistically significant (99%).

Are there new scientific results in the study? First of all, we found the answer to first question: do students of Economic and Non-economic specialties prefer the auditory way of learning in lectures? Secondly, we found the answer to first question: is there the equality of preferences of students of economic and non-economic specialties?

The theory of statistics gives no reason to doubt the correctness of our results. The theory of statistics frees the authors from the need to prove the correctness of the results. Anyone who disagrees with our results can only refute the results. S/he should organize a new study[14] and must use a large sample or higher statistical significance.

At the second stage – verification of statistical hypotheses about the preferred way of learning in lectures – the result is very highly statistically significant (99,9%). The result indicates that the decision will be correct in about 99,9% of cases and wrong only in 0,1% of cases. In this sense, we have a decision-making process with accurate, controlled probability. We are sure that general population of students of economic and non-economic specialties does not prefer the auditory way of learning in lectures.

At the third stage – verification of statistical hypotheses for estimating the differences between two independent samples – the result is highly statistically significant (99%). The result indicates that the decision will be correct in about 99,0% of cases and wrong only in 1,0% of cases. In this sense, we have a decision-making process with accurate, controlled probability. We are sure that the

[14] *BUS_9641_Business_Statistics_3*, op. cit.

difference in the preferences of students of Economic and Non-economic specialties must be taken into account.

That is why the higher education system of Poland must not ignore the interests of students who do not prefer the auditory way of learning in lectures. This means that the Polish Higher Education needs to change. It is worth to equip all lecture halls with visual learning tools. Whereas it is worth to train lecturers to use visual learning tools.

Conclusions

It was carried out the verification of statistical hypotheses about the equality of preferences of students of economic and non-economic specialties. The research aims have been achieved. These the answers for two research questions were found: do students of economic and non-economic specialties prefer the auditory way of learning in lectures? is there the equality of preferences of students of economic and non-economic specialties?:

- Statistically general population of students of economic and non-economic specialties does not prefer the auditory way of learning in lectures.
- Statistically the difference in the preferences of students of economic and non-economic specialties must be taken into account.
- The scientific result Nr 1 is very high statistically significant (99,9%). The result indicates that the decision will be correct in about 99,9% of cases and wrong only in 0,1% of cases. It means we have a decision-making process with accurate, controlled probability.
- The scientific result Nr 2 is high statistically significant (99,0%). The result indicates that the decision will be correct in about 99,0% of cases and wrong only in 1,0% of cases. It means we have a decision-making process with accurate, controlled probability.

The Polish Higher Education needs to change. It is worth to equip all lecture halls with visual learning tools. Whereas it is worth to train lecturers to use visual learning tools.

The task of the next study is to assess the preferences of students of Economic and Non-economic specialties in other European Countries.

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PREFERENCJE STUDENTÓW W ZAKRESIE METOD WYKŁADOWYCH (NA PRZYKŁADZIE POLITECHNIKI KOSZALIŃSKIEJ)

Celem artykułu jest zbadanie preferencji polskich studentów specjalności ekonomicznych i nieekonomicznych na drodze uczenia się na wykładach. W artykule są odpowiedzi na następujący badawczy pytanie: jak uczyć studentów w obecnych czasach. Statystycznie udowodniono, że polscy studenci specjalności ekonomicznych i nieekonomicznych nie preferują audytoryjnych metod nauczania na wykładach. Wynik bardzo wysoko statystycznie istotny (99,9%). Statystycznie udowodniono, że należy wziąć pod uwagę różnicę w preferencjach studentów specjalności ekonomicznych i nieekonomicznych. Wynik jest wysoko statystycznie istotny (99,0%). Wynik badania może być pomocny w celu zmiany polskiego szkolnictwa wyższego. Warto wyposażyć wszystkie sale w sprzęt wizualizacyjny. Warto szkolić wykładowców korzystania z wizualnych środków nauczania.

Słowa kluczowe: specjalności ekonomiczne, specjalności nieekonomiczne, preferencje studentów, wykład, metoda nauczania na wykładach, metoda słuchowa, metoda wzrokowa.