Assessment of university students' creativity and teamwork skills based on a survey

Veronika Orfánusová, Anna Veszprémi Sirotková & Renáta Ševčíková

University of Economics in Bratislava
Bratislava, Slovakia

ABSTRACT: The purpose of the article is to present results of a survey focused on the comparison of teamwork and creativity skills of students from two universities in Slovakia - the University of Economics in Bratislava (EUBA) and Slovak University of Technology in Bratislava (STU). The skills were tested before and after the introduction of the *New Generation of Founders*/*Grow with Google* (NGF/G) programme in on-line workshops focused on the implementation of design thinking tools, where students worked on several tasks in teams. Some teams consisted of students from both universities. In the on-line survey taken via Google Forms, the semantic differential method for evaluation of survey results was applied, while IBM SPSS Statistics and MS Excel statistical software were utilised for data processing. For hypothesis testing the Mann-Whitney test was applied. The survey results demonstrate some differences between these universities in their students' assessment of teamwork and creativity skills before and after completing the workshops. The results of the feedback highlight not only the positives, but also shortcomings in teamwork during the workshops.

INTRODUCTION

This article presents the results of a survey that aimed to assess and compare the creativity and teamwork skills of students from two different universities in Bratislava, Slovakia - the University of Economics in Bratislava (EUBA) and Slovak University of Technology in Bratislava (STU), and the skills development through special workshops organised with the external partner, Google Slovakia, s.r.o (limited liability). The aim of the article is to show differences between students of business and management, and students of design and architecture, their improvement achieved during the workshops, and shortcomings in the teamwork during workshops that should be improved in the future.

SOFT SKILLS

The role of universities is to prepare their students for their future professional career. The process of education results in improving their skills. Skills - special abilities to do something [1] are classified into two basic groups, hard and soft ones. Hard skills are gained via formal education and are necessary for doing the job professionally, as well as for solving tasks in personal lives. Soft skills are recurrently explicated as socio-emotional, generic, transferable across disciplines or employment-related skills [2]. They are correlated with attitudes, attributes, habits and practices that enable positive relationships, influence learning, and allow to successfully interact with work colleagues, the close environment and the world [3].

These skills are highly demanded by enterprises [4] as they need to assure employees' efficiency and productivity in a well-organised work environment and foster the company image as a well-managed and productive organisation [5]. More precisely, soft skills typically include communication, self-management, ability to work under pressure [6], critical thinking, responsibility, teamwork, interpersonal skills, imagination, planning and organising, creativity [7], willingness to learn, attention to detail, vision, maturity, professionalism, emotional intelligence, and many others [8].

CREATIVITY AND TEAMWORK

Creativity is a highly demanded skill, described often as the ability to create something new that results from creative thinking. Here is necessary to point that

> *…there are three basic modes of thinking: analytical, judicial, and synthetic. …Creative thinking combines analytical, judicial, and synthetic thinking in regulated ways. Thus, creative thinking is not a thinking mode but a combination of thinking modes. Creative work needs a balance between analysis, synthesis, and evaluation* [9].

Guilford defined four factors that influence creativity: problem sensitivity, fluency, flexibility and originality, which are very often used in literature. Next factors are imagination and innovation, although not always under the same names [10]. *A solution is creative when it is novel and useful* [9]. A creative solution is useful when it (better) satisfies a human need. The creative process ends not with an idea but with a tangible outcome. Creative solutions are forwardly oriented in time [11]. At universities, there are growing numbers of teachers that implement some design thinking approaches in their teaching and learning.

Teamwork is defined as activities managed and carried out by a group of people with diverse abilities who have the same commitment to goals, performance measures, responsibilities and the same approach [12]. Students with employability skills will have high self-esteem, good problem-solving skills, and the ability to form good working relationships with co-workers making them better prepared to work in a new environment [13]. *Big dreams*, big questions and big ideas figure centrally in design thinking. However, they are not associated with a random soaring off into space. Rather, a strict emphasis on the *user need* as the focal point of attention throughout the whole project continuously provides purpose and orientation [14]. Universities may support teamwork by implementing project-based learning and by giving tasks that present real problems of companies and society.

Design thinking is being increasingly applied within non-design professions for dealing with complex problems [15]. Design thinking has become a pedagogical phenomenon in higher education due to its relevance across many disciplines. Growing interest in research and practice regarding creativity, innovation and problem-solving, and its apparent contribution to economic growth and social benefit has contributed to the development of design thinking as a widespread phenomenon in education, comprising the higher education context [16-19].

METODOLOGY

The subjects of the research were students of two different universities; namely, students at the EUBA studying business and management, and students at the STU studying design and architecture. Their age was between 21 and 24, 24.4% of them were men and 75.6% were women. The goal of the interdisciplinary connection of the two universities was to support better team co-operation and creative thinking of students. Students participated in the *New Generation of Founders/Grow with Google* (NGF/G) programme in on-line workshops in co-operation with the external partner Google Slovakia, s.r.o. (limited liability), on the Google Meet platform. The workshops focused on the implementation of design thinking tools in solving the given problems/tasks. The workshops were involved in the following courses: Production Management, Environmental Management, and Small and Medium-sized Entrepreneurship at the EUBA, and in the course Product Design at the STU.

The aim of this research was to investigate the differences in the level of teamwork and creativity skills of students of these two universities, measured through on-line pre-test and post-test questionnaires administered through Google Forms during the period September-October 2022.

A total of 188 answers to the questionnaires from students of two faculties of the EUBA (144 received answers; 77% of the answers) and students of one faculty of the STU (44 received answers; 23% of the answers) were evaluated. In this article, are presented assumptions that were confirmed by testing the following hypotheses:

1. $H1_0$: there is no significant difference in the evaluation of questions of the EUBA and STU students.
   $H1_1$: there is a significant difference in the evaluation of questions of the EUBA and STU students.

2. $H2_0$: there is no significant difference in the evaluation of questions between the pre-test and the post-test.
   $H2_1$: there is a significant difference in the evaluation of questions between the pre-test and the post-test.

To measure the level of students' skills in teamwork and creative thinking, the semantic differential method was used. Charles E. Osgood, the author of the semantic differential method defines it as a method of measuring the psychological meaning of things, usually concepts [20]. His methodology for quantifying significant concepts in the so-called semantic space - a space that differentiates the meaning of concepts. The semantic differential consists of a larger number of scales, the scale being formed by two bipolar adjectives that serve as anchors at both ends of the scales [21]. IBM SPSS Statistics and MS Excel statistical software were used for data processing.

RESULTS

In the on-line questionnaires, students from both universities were asked to rate their views on the following statements (Q) on a scale of 1 to 5 (1 means *strongly disagree*, 5 means *fully agree*):

Q1: I think teamwork is very important in creating new solutions.
Q2: I often have trouble accepting the different opinions of team members on how to solve a given problem.
Q3: I like to share my ideas in the team and build solutions based on the ideas of my colleagues.
Q4: I am very good at using my creativity to generate new ideas.
Q5: I enjoy creating lots of ideas.

Q6: In the team, we also use the knowledge of team members from other disciplines, such as the one I am studying now.
Q7: I have trouble adapting to the special terminology of another scientific discipline.

Table 1 shows the basic distribution of answers to the set questions according to the university attended by the respondents - EUBA and STU.

Table 1: Means, standard deviations and response distribution.

Descriptive statistics - EUBA

Question	N	Minimum	Maximum	Mean Pre-test	Mean Post-test	Mean	SD
Q1	144	2	5	4.32	4.11	4.26	0.842
Q2	144	1	5	2.31	4.40	2.97	1.28
Q3	144	2	5	3.92	2.43	3.46	1.21
Q4	144	1	5	3.27	3.98	3.49	0.943
Q5	144	1	5	3.56	4.01	3.73	0.959
Q6	144	1	5	3.98	3.52	3.84	0.948
Q7	144	1	5	2.88	3.52	3.01	0.999
Valid N (listwise)	144						

Descriptive statistics - STU

Question	N	Minimum	Maximum	Mean Pre-test	Mean Post-test	Mean	SD
Q1	44	2	5	3.89	3.56	3.82	0.936
Q2	44	1	4	2.09	4.56	2.59	1.249
Q3	44	1	5	3.86	2	3.48	1.270
Q4	44	2	5	3.51	4.33	3.68	0.847
Q5	44	2	5	4.17	4.44	4.23	0.765
Q6	44	3	5	4.17	4.33	4.20	0.725
Q7	44	1	5	2.43	3.44	2.64	1.17
Valid N (listwise)	44						

When comparing the average scores in selected areas of teamwork and creative thinking, one may find that the EUBA students value the importance of teamwork in creating new solutions to a greater extent (mean 4.29, *versus* 3.84, value of significance 0.024), but compared to the STU students, they have more difficulty in accepting the different opinions of team members (mean 2.82 *versus* 2.53, value of significance 0.003). This was confirmed via the Mann-Whitney test with values of significance lower than the given significance level of 0.05.

The analysis of next questions showed, but was not confirmed at the given significance level of 0.05, that the STU students were more confident in using creativity to generate new ideas, they experience fewer troubles when adapting to the special terminology of another scientific discipline, and they use more knowledge of team members from other disciplines, which is also expected given the focus of their studies. Both groups of students have very similar results (mean 3.46 and 3.48) in the statement related to their willingness to share their ideas in the team and to build solutions based on the ideas of their colleagues, see Figure 1.

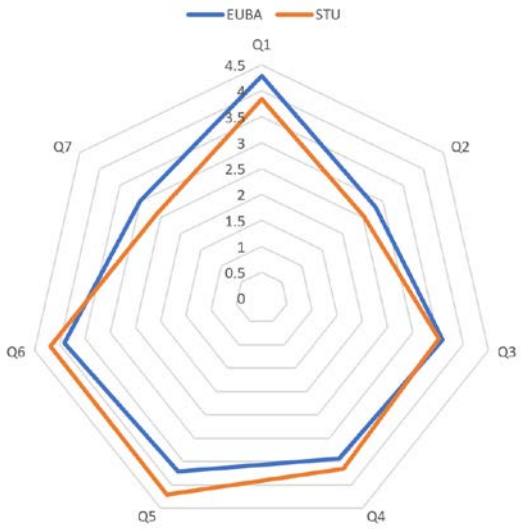

Figure 1: Semantic differential - comparison of answers of students from different universities.

The comparative analysis of pre-test and post-test showed a significant difference at the level of significance 0.035, lower than the given significance level of 0.05 only in Q4 (*I am very good at using my creativity to generate new ideas*). This means that students from both universities responded to this statement more positively after the workshops (see Table 2).

Table 2: Means and standard deviations of the pre-test and post-test.

Statement	Mean Pre-test	SD Pre-test	Mean Post-test	SD Post-test	Difference of means
Q1	4.21	0.811	4.04	1.036	0.19
Q2	2.26	0.863	4.43	0.735	2.17
Q3	3.91	0.996	2.35	1.003	-1.56
Q4	3.34	0.882	4.02	0.85	0.86
Q5	3.72	0.934	4.15	0.89	0.43
Q6	4.03	0.863	3.67	0.981	-0,63
Q7	2.77	1.007	3.52	0.995	0.75

With the exception of Q4, the results in Table 2 were not confirmed at the given significance level of 0.05, but they pointed to that:

- Students did not change their view of importance of teamwork in creating new solutions, they understand and value it highly (Q1).
- After trying teamwork with colleagues whom they did not know personally, students changed their statement in the post-test regarding having troubles accepting the different opinions of team members on how to solve a given problem. From their feedback it was visible, that they had the least problems in teams that worked in the same composition even before the workshops, but the mixed team was a great opportunity to show them what working with different people would look like in practice (Q2).
- There was also a big shift in the opinions in regard to statement Q3, when the students' own experience showed them how difficult it is to try to assert their opinions in the team and to suppress their ego by accepting the ideas of their colleagues and to the benefit of the whole team to build a solution to the given task on this basis.
- In statement Q4, the success of the workshops was noted by the students strengthening their self-awareness of their creative abilities with the shift in the value of mean from 3.34 to 4.02.
- The results of Q5 show the positive effect of the workshops on the level of student enjoyment in creating lots of ideas during the creative process.
- The assessment of Q6 requires a deeper investigation, as it was not possible to determine whether the decrease in the value of using interdisciplinary knowledge in the team was due to the composition of the teams, the passivity of the team members from the other scientific discipline or the fact that the students have a lot in common, often working in similar companies. Another possibility is that the students had experience with other teams before the workshops and in the post-test they evaluated the team within the workshop. In the future authors will give more attention to prevent these ambiguities.
- Despite the fact that the students felt that they did not use the knowledge of the team members from other disciplines to the extent that they declared in the pre-test (Q6), the shift in the value of mean from 2.77 to 3.52 in Q7 may be understood as they realised more clearly after the workshops that they had a problem adapting to the special terminology of the other scientific discipline.

CONCLUSIONS

In the survey, the authors of this article were focused on the assessment of the teamwork and creativity skills of students from two universities. Hypothesis $H1_1$ was confirmed in Q1 and Q2, which means that the surveyed STU students attached less importance to teamwork and declared less issues in accepting different opinions of team members on how to solve a given problem. The remaining test results do not confirm this hypothesis at the given significance level of 0.05, but they indicate that the STU students were more confident in using creativity, more adaptable to the use of knowledge and co-operation with people from another scientific discipline. Both groups of students had very similar willingness to share their ideas in the team and to build solutions based on the ideas of their colleagues.

Hypothesis $H2_1$ was confirmed only in Q4 at the given significance level of 0.05, which mean that students from both universities declared higher self-awareness of their creativity after the workshops. Some differences in responses were observed in regard to the level of soft skills between the pre-test and post-test (Table 2).

The authors consider the results of Q2 to be a weakness as in the post-test, students declared that they have trouble accepting the different opinions of team members on how to solve a given problem. Encouraging, however, is that students understand and accept the importance of teamwork in the creation of new solutions. The challenge is to encourage students to get more involved in the sharing of their ideas in the team and build solutions based on the ideas of their colleagues. The most positive is that during the workshops, students strengthened their self-awareness of their creative abilities and experienced working in a new environment.

According to the feedback of students from the questionnaires, the students created ideas that helped them solve the identified problem within the given topics. Forty-four percent of the students were fully satisfied. They enjoyed their new experience. They liked the positive atmosphere at the workshops and co-working with their colleagues from the other university. The rest of the students wanted more communication or more involvement of some team members in working on tasks. This was caused by the on-line environment of these workshops, where it was not technically possible to control all teams at the same time. In the future, the authors would like to include more courses and techniques than in the present study, where creative and teamwork skills could be trained in interdisciplinary environments.

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