Project-Based Thinking as A Key Competence of the 21st Century and The Openness of Hungarian Secondary School Students to It

Ágnes Csiszárik-Kocsir[1], Csaba Berényi[2]

Abstract

Projects and thinking in projects is one of the key competences of the 21st century and a buzzword of our era. It is very important that today's education system should recognise the need for project-based thinking and project-based education. The objective of our study is to investigate the perceptions and aptitude of secondary school students to think in projects and to work in teams within a defined framework. We would like to raise awareness of the importance of this by looking at the other side, i.e., the participants' views on the subject. In addition, we want to define the competences on which we can build for a successful future participation in the labour market on the part of the students, and which we consider important to develop through the different subjects. Our work is based on the results of a primary research among secondary school students in Hungary, highlighting some of the determinants of working in projects.

Keywords: *project-based thinking, teamwork, autonomy, Generation Z, STEM.*

INTRODUCTION

Our daily lives are full of projects. We encounter many events and decisions that are of a novelty value, we have no experience of them, but they can be resolved. However, if the wrong decision is taken, it may cause us financial or other types of damage. To the best of our knowledge, it is advisable to assess the circumstances of the decision brought, the alternatives, and manage it as a project, with a time and budget allocation. We plan, organise, implement, control and, finally, conclude these decision situations, which are not always called projects now, even if unconsciously, by drawing the necessary lessons. The project approach we learn in our private lives is also useful in the world of work. A project mindset helps us to use resources more effectively, set priorities and plan to achieve project goals. This also helps to ensure that projects in the workplace are completed successfully and on time, which has many benefits for the organisation. This competence also helps employees to adapt to the changing work environment and the rapidly changing business environment. Flexibility and the ability to manage change are particularly important in the competitive and innovative workplaces of the 21st century (Varga, 2017). The project approach makes employees more responsible, focusing on results while learning new knowledge and skills. For all these reasons, it is important to start imparting the ability to think in a project mindset to the younger generations early on, in order to make them more successful both as individuals and as employees, while gaining additional benefits.

[1] Keleti Károly Faculty of Business and Management, Óbuda University, Budapest, Hungary
[2] Doctoral School of Safety and Security Sciences, Óbuda University, Budapest, Hungary

LITERATURE REVIEW

Generations cover a time span of about three decades, based on the age differences between parents and children. Generations are linked and connected by shared values, common experiences and shared life experiences (Törőcsik et al, 2014). The explosion of information and communication technology has undoubtedly brought about the most spectacular change (Cavas et al, 2004). Thanks to the IT explosion, creativity, problem-solving and innovativeness are the keys to prosperity (Varga, 2015), so schools and educational institutions should focus on developing these competences (Ozkan et al, 2021). Apart from the generations born before 1980, there are few generations that have had to learn and use so many technological innovations. The pace of our lives has accelerated, we face new challenges every day and we feel from our own experience that the generation gap is widening (McCrindle, 2009).

Members of Generation Z and Alpha have had access to the latest technological advances since birth. Having grown up with more and more modern technological devices, their expectations of life are also completely new, and they naturally come to primary and secondary schools with different ideas (McCrindle, 2009; Garai-Fodor - Popovics, 2023). Today's secondary education and the thinking of Generation Z students are increasingly project-oriented. Young people like working independently at their own pace and are both attracted to and motivated by creative, real-life tasks (Clark et al, 2007).

Labour demand in science, technology, engineering and mathematics (STEM) fields is projected to increase over the next decade, highlighting the importance of these sectors relative to others. The importance of STEM education is recognised by academia, society, business and industry (Bybee, 2010; Capraro, 2013; Samsudin et al, 2020; Han et al, 2015, White, 2014; Marrero et al, 2014). However, the importance of STEM will continue to expand in the 21st century, with the inclusion of an additional 'A' (A = Arts). STEAM now incorporates the arts into the system, further reinforcing the importance of creative thinking. The 'A' also emphasises social sciences and humanities, which can be used to achieve additional creative acts, placing additional creative content into the learning process (Yakman, 2008; Carvalho et al, 2015, Daugherty, 2013). In STEM education, the focus is on problem solving and inquiry-based learning, whereas STEAM orientates students more towards real-life solutions (Brown et al, 2011). Through STEM and STEAM education, project-based learning (PBL) is enabled, allowing teachers to give students tasks that allow them to interact with the wider community, plan and organise their own solutions to the task, based on their own ideas, and respond to problems and challenges, giving them hands-on experience of solving real-world problems in real-life situations (Song, 2020; Beckett, 1999). In STEM and STEAM education, students are expected to investigate, think logically and collaborate, thereby bringing greater attention to the learning process as a whole and its practical role in future prosperity. This approach, however, not only expects students to think in new ways, but also requires teachers to pay more attention to the interactions between subjects and their practical elements (Caparo, 2013).

Developing the skills of young people can help improve their employment prospects and also enhance their quality of life and well-being (Nguyen et al, 2020). The transformation of human life is closely linked to the development of technology. It is therefore important to prepare students for the challenges of the future. Academic research, internships and engineering practices are essential to become citizens who can adapt to new circumstances and solve new problems (Bybee, 2013).

In today's modern information society - especially due to the trend of digitalisation - the acquisition and development of competences is an active process, as everyone has personalised competences, which enable us to influence the situation at hand (Perry et al, 2014). Individual competences play an important role in adapting to change. Education has been radically transformed in recent years due to digitalisation and technological

advances. The industrial society has been gradually replaced by the information society and then by the knowledge society, which has completely rewritten the way and process of communication between people. In the 21st century, digital literacy not only implies access to and use of info-communications technologies, but also includes the possession of related and appropriate knowledge, skills and attitudes (Keengwe-Kidd, 2010; Dabbagh- Nannaritland, 2005). It's no coincidence that there is a lot of research on what solutions, methods and content can be relevant and experiential for the new generation in education (Jun et al. 2020, Al-Adwan–Smedley, 2012).

A project is a series of interrelated tasks with a definite beginning and end, the most important characteristic of which is that it works according to a plan and contains the tasks to be performed, their interrelationships, the persons performing the tasks, the persons responsible and the deadlines (Csiszárik-Kocsir - Varga, 2017a; Csiszárik-Kocsir - Varga, 2017b, Csiszárik-Kocsir et. al, 2022). In projects, students work in small or large groups, with the guidance of teachers, to identify problems, formulate hypotheses, collect data, experiment, develop solutions and finally select the most appropriate solutions to the problems (Wyness, 2018; Benton et al, 2019). In school, a project task puts students in realistic, problem-solving situations that are directly related to real-life problems. They gain real-world experience and explore the interrelationships between phenomena (Blumenfeld et al, 1991). School projects motivate lower-achieving students, reduce achievement gaps and also increase their interest in science, technology, engineering and mathematics (Breiner et al, 2012). According to Stehle, teaching STEM subjects adopts an approach that focuses on developing students' self-direction and builds on problem solving, collaboration and project management (Stehle, 2019), which are key competences for becoming either an entrepreneur or a valuable employee in the future (Csillag et al., 2020).

MATERIAL AND METHOD

The analysis presented in this study is the result of a questionnaire survey carried out in 2023. The sample presented in the present study was preceded by a pre-testing phase, the results of which have been incorporated into the current survey. The research used a complex, standardised questionnaire to measure the attitudes of secondary school students towards digitalisation processes, their digital culture and their project approach. The survey itself took place in May 2023, in the form of an online questionnaire. The students surveyed remained completely anonymous throughout the study and their responses were processed in a non-identifiable way. The questionnaire contained closed questions for the most part in order to allow the results to be measured as effectively as possible using statistical methods. The research process involved students from grade 9 to grade 14 who were studying in vocational education. As a result of the survey, 508 questionnaires were returned, of which 427 were fully assessable. In the present study, we assessed the responding students' project approach, their roles in projects, their cooperativeness and their ability to work together from different aspects. The students expressed their opinions on 19 statements related to projects on a four-point scale according to how much they agreed with them. The advantage of using this scale was that it allowed us to measure students' opinions, attitudes, preferences and other psychological characteristics. The scale we use provides a choice of four levels, which allows for a more subtle perception of differences between respondents, thus providing a more detailed and deeper understanding of students' opinions on the statements asked, in addition to its simplicity and ease of interpretation.

FINDINGS

In the survey, we asked the students to examine 19 statements related to projects, teamwork and independent work. The statements were judged on a four-point scale, with a score of 1 representing the least agreement and a score of 4 representing the strongest agreement. The statements included a mixture of statements on project roles, work, teamwork and teacher-student roles.

We tried to organize the responding students into groups based on their project orientation, project approach and aptitude for teamwork. To this end, a factor analysis was carried out, the results of which are shown in the table below. The KMO value indicates that the data are suitable for factor analysis. Several trials were conducted, in the form of two and four factor analyses, of which the three-factor split sample was considered the most suitable and expressive.

Table 1 Factors based on students' project mindset, suitability for project work

	Factor 1	Factor	Factor 3
I would like to work in a team, in a group, where we have to figure out, design, and operate systems together, without any prior training (knowledge).	0.697	-0.133	0.141
I am motivated to do a task that I have not done before.	0.617	0.327	0.075
I like learning through project work.	0.606	0.356	0.052
When I work on a project task, I like to do the task collaboratively.	0.589	-0.369	0.441
When doing a project task, I prefer to help others.	0.532	0.164	0.005
I like challenges.	0.496	0.388	-0.157
I would like to learn about a technology that I did not know anything about before.	0.439	0.072	-0.040
When I work on a project, I like completing the task independently.	-0.053	0.788	-0.156
Compared to traditional forms of teaching, a project assignment has a particularly strong emphasis on independent learning.	0.119	0.634	0.085
I work persistently when doing a project assignment.	0.426	0.585	0.024
When working on a project, I concentrate on the task at hand throughout the collaborative work.	0.320	0.399	0.192
Project work fundamentally inverts the traditional teacher-student role.	-0.005	0.359	0.250
I prefer working on a project topic of my own making.	0.091	0.319	-0.260
The time management of projects is very flexible.	0.265	0.305	0.071
I tend to ask for help when setting up a project.	0.122	-0.006	0.728
I feel rather insecure when doing a project assignment.	-0.201	-0.043	0.665
I prefer working on a project topic set by a teacher.	0.124	0.180	0.594
When I work on a project assignment, I expect my tutor or teacher to guide me or help me to collaborate on each step of the work.	0.050	0.082	0.571
In the project assignment, group work is a priority.	0.415	-0.161	0.485

(Principal Component Analysis, KMO = 0.749)

Source: authors' own research, 2023, N = 472

The resulting factor groups are defined as follows:

1. Factor group 1 (Motivated Project Orientation) included statements related to challenges, innovative solutions, novelty,

2. Factor group 2 ("Independent Project Orientation") includes statements related to working independently, perseverance, and

3. Factor group 3 (Supported project orientation) was dominated by statements relating to guided, less independent work.

After performing the factor analysis, a cluster analysis was performed on the factor groups using K-means method, where three well-defined clusters were identified.

Table 2 Generation Z segments by project orientation

	Uncertain team players N = 145	Motivated project-oriented N = 168	Independent project-oriented along clear task assignment N = 114
Motivated project orientation	-0.431	0.302	0.102
Independent project orientation	-0.905	0.409	0.548
Supported project orientation	0.042	-0.792	1.114

Source: authors' own research, 2023, N = 472

Based on the above cluster analysis, the following clusters were identified:

1. Cluster 1: Uncertain team players

Young people in this group are those who do not like working independently but prefer working in a team. They are the team members who are the back office workers of the project, responsible for document management and administration, which is about as important as the task itself. Young people with this attitude do not like responsibility, they do not like working independently. They are more effective and confident when they are helped and guided from outside, giving them support and direction. They feel secure in the presence of a team, a project leader (or, in the case of school projects, the teacher).

2. Cluster 2: Motivated project oriented

Young people in this group are true innovators. They are looking for new things and are motivated by tasks that challenge them, situations to be solved. They like working in teams, they like learning new things through projects and they are looking for new things, things they have not experienced before. They are the true driving force behind project teams, always pushing beyond difficult situations, looking for solutions and ways forward.

3. Cluster 3: Independent project-oriented

These young people are the self-propelled geniuses of project teams. They do not really like boundaries, they like going their own way, exploring and finding solutions. They are absolutely task-oriented, always focused on the goal and do not like to be distracted by the majority opinion of the team. They work at their own pace, they are the ones who cannot cope with 8-hour days, but they need clear guidance to succeed. They expect a concrete definition of the task from the project sponsor (teacher), but they want to work towards a solution independently. "It does not matter when I work, the important thing is that the work is done". They are true Generation Z young people, persistent, self-motivated and goal-oriented, which is a very important factor for project success.

The above analysis shows that the roles of young people in the project team are well defined. Where each young person fits in and what tasks they can be assigned to can be measured and identified using different personality tests. The task for the future is to identify, by means of various project-specific questionnaires and surveys, the characteristics of individual employees, tailored to the project, which can be strengthened to ensure more successful and more efficiently managed projects.

SUMMARY, CONCLUSIONS

This illustrates how much the skills and competences needed to equip young people in the 21st century for the challenges of the 21st century have been transformed. In a digital world, there is an unprecedented need for problem-solving skills, innovative thinking, and the ability to recognise and manage situations. Based on the literature presented in this study and the results obtained, it can be stated that the two hypotheses previously formulated have been confirmed. The average perception of the statements shows that young people of the late Generation Z prefer project-based tasks and, due to their generational characteristics, they prefer to work independently, freely and informally, which confirms the first hypothesis. The second hypothesis is confirmed by factor and cluster analysis, which clearly identifies groups of secondary school students who are or will be suitable to work on projects.

The challenge for education today is to ensure that the young generation is equipped with these skills and competences. However, the transfer of these skills cannot start in higher education but requires active secondary education in order to consolidate some of the elements of project thinking. If we treat our tasks as projects, we are forced to think ahead, to take into account our limitations, our possibilities, our partners and our risks. STEM and STEAM-based education helps to develop these skills and competences, but it has not yet been given the space in the education system to develop successful workplace skills in a wide range of young people. The changing needs and learning characteristics of the younger generation also need to be considered in terms of generational characteristics. Our objective with this research was to assess the characteristics and attitudes of a subset of Hungarian secondary school young people towards project thinking and project-based learning. It can be concluded that the young (Z) generation is more open and more apt to do their work in the future on a fully project basis. It is possible to find characteristics among the young people in the sample that enable everyone to play a role in project teams for their success. It is the task of the education system to continue to strengthen the characteristics in students that will prepare them to be successful workers in the future. Identify their place in the team and in the workplace by strengthening their competences so that they can be as successful as possible in the world of work.

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