Developing innovation competences in schools. A practical perspective.

Jan Fazlagić, Mirosława Kaczmarek, Cornelia Connolly

The empirical results presented here were obtained from a national study commissioned by the Polish Ministry of Development in 2017. The main purpose of the study was to propose a set of measures and recommendations in regard to the national reform and development plan of schools in Poland. We have developed a list of 18 innovation competences following a thorough literature review. The research findings are used in a pilot project currently operated by the non-government organisation CEO (https://szkoladlainnowatora.ceo.org.pl/). For the purpose of this study we extended the scope of our investigation and looked at some of the demographic characteristics of Polish teachers in regard to their attitudes towards innovation competences. The growing interest in innovation around the world was reflected in the decision of the Polish government to take action towards increasing the innovation performance of the Polish economy. We argue that the role of primary and secondary education in the development of innovation competences is somewhat overshadowed by the vastly overestimated role of higher education in the development of these skills. Fostering critical thinking, creativity, and behavioural and social skills should be viewed as a central element of the remit of schools, colleges and universities (OECD, 2016), as creativity and innovation are key to EU education policy (Coate & Boulos, 2012; European Union, 2010), and OECD countries have long recognised the need to develop skilled people through education and training (OECD, 2011).

Defining innovation competences

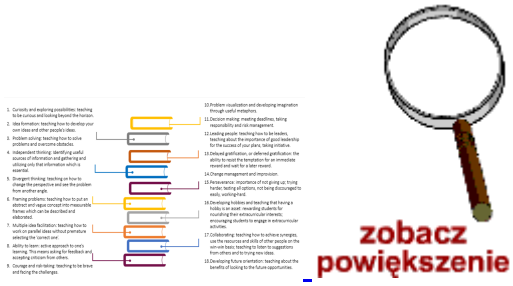
Over the last 20 years a range of terms such as key or core skills, key or core competences, and objectives to be achieved have been used in European countries and, depending on the country and sub-sector of education and training, one or another may be favoured (Gordon & O'Toole, 2015). Competences are described as clusters, bundles, or "a complex combination" of commitments, knowledge, skills, understanding, values, attitudes. Creativity or innovation is neither a specific competence in most national sets or frameworks, nor is it specifically identified as a 'skill'. According to the OECD (2019) "skills are the ability and capacity to carry out processes and be able to use one's knowledge in a responsible way to achieve a goal. Skills are part of a holistic concept of competency, involving the mobilisation of knowledge, skills, attitudes and values to meet complex demands".

In order to answer the fundamental question: "What are the innovation competences for schools?" and develop an innovation competence guiding framework, a meta-analysis of the many competence tools was conducted (Alshannag & Hamdan, 2015; Amabile, 1983; Bailey & Ford, 2003; Bakhshi & Mateos-Garcia, 2013; Banaji et al., 2013; Berger, 2014; Brookhart, 2013; Brown & Eisenhardt, 2004; Cropley, 2015; Csapó & Funke, 2017; Erol et al., 2012; Fuller & Clarke, 1994; Gordon & O'Toole, 2015; Hallam & Ireson, 1999; Hebert & Link, 2006; Heilmann & Korte, 2010; Kabukcu, 2015; Muijs & Reynolds, 2011; OECD, 2011; OECD, 2014; OECD, 2015; OECD, 2016; Scott & Bruce, 1994; Scott et al., 2010; Sternberg & Williams, 1996) and 55 research papers pertaining to innovation/education/creativity (e.g. European Innovation Council, 2021; Heilmann & Korte 2010; Markides, 2013; Mwasalwiba, 2010; Ramankulov et al., 2016; Samašonok & Juškevičienė, 2021; Samašonok & Juškevičienė, 2022; Shaheen, 2010). The result of this analysis contributed to the development of a comprehensive framework, with the aim to encompass all perspectives, and for use in this study (see: Figure 1) Our approach to developing the list of competences shares many similarities with the approach presented by Guilford (1985), who saw his list as an educator's 'periodic table' (p. 255) and believed that his model (of creativity development) could be used to guide curricula. Guilford's 'periodic table' included 150 intellectual abilities with which teachers could assist students and suggested that teachers could use his list in the preparation of their lesson plans, in making assignments, and in assessing classroom performance. The model organised various abilities along three dimensions: content, product, and process. Guilford's research procedure

consisted of tests for each combination of the possibilities on these three dimensions, expecting that a person could be high on some of these abilities while being low on others (see: Barlow, 2000).

Figure 1

Eighteen innovation competences



Source: authors' own work.

Research design

Context of study, research background and challenges

The recognition of innovation competences, Figure 1, as important drivers of the modern economy was the foundation of a research project we conducted in 2017. The main goal of the research project was to obtain at least some proxy of the relationship between the performance of the most innovative economies in the world and the level of emphasis on the development of innovation competences in their systems of education. The main research task consisted of the following steps:

1. Definition of innovation competences.
2. Developing a questionnaire.
3. Conducting a national survey.
4. Data analysis.

The questionnaire consisted of two main questions:

1. A question containing 18 statements, where each statement was linked to the 18 pre-defined competences. For example, in the case of the first competence: "Curiosity and exploiting possibilities" the item in the questionnaire read: "In our school we teach curiosity and to explore possibilities" followed by a 2-4 sentence definition intended to avoid ambiguity and misinterpretation. Each of the 18 items was ranked on a Likert scale.
2. The second question in the questionnaire consisted of 11 opinions regarding the school management and pedagogies.
3. The third question was an open-end question in which the respondents were requested to share their opinions and suggestions regarding the development of innovation competences.

At the end of the questionnaire there was a demographics section in which we asked about the following information: (a) age of the teacher; (b) occupied position; (c) gender; (d) administrative region of Poland (województwo). Our research approach, where the teachers were the subjects and their answers considered as representative, was similar to the research approach taken by Chell & Athayde, 2009.

Research background and challenges

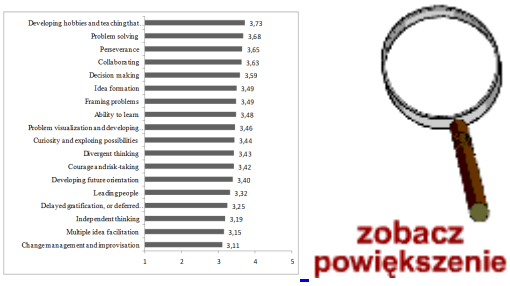
We did not differentiate between school levels and types of school, as our main focus was the system of education as such. Each respondent expressed their opinion on their school. In specific, before developing the final version of the questionnaire, we considered asking the respondents about their opinion on *their own personal experience* ("I teach...") and we finally chose to ask about *their school* ("In our school we teach/develop...") assuming that such formulation of an opinion should offer an option to express a more objective assessment, especially that we were interested in the system of

education and not the personal practices of individual teachers. Thus, it was 'the school' (in the opinions of teachers) rather than the personal practice of a teacher that was the unit of analysis. Every item in the first question, in its full version in Polish, started with the following: "In our school we teach/develop...". We could not apply fully objective criteria for the measurement of competences (as they do not exist) and resorted to the assessment by the respondents which are most knowledgeable about the situation in their direct environment.

In order to identify innovation competences we searched for articles containing such terms as 'innovation skills/competences', 'creativity (skills)', 'creative environments'. The limited number of resources reflects the scarcity of literature on the subject (see for example: Davies et al., 2013). The first research objectives examined in this paper were to establish a list of innovation competences in a shape and form matching the current state-of-the-art in social sciences. We carried out a meta-analysis and customary compilation of existing interpretations of innovation competences and developed a list which would be later used for practical (not academic) applications within the system of education on a large scale (including: Amabile, 1983; Amabile, 1997; Banaji et al., 2013; Barnett, 1953; Brookhart, 2013; Fuller & Clarke, 1994; Heilmann & Korte, 2010; Markides, 2013; OECD, 2014). The list was then used in a national survey among Polish teachers to identify those innovation competences that are most and least efficiently developed in Polish schools. Our second research objective was to establish the degree to which Polish schools are effective in developing innovation competences.

Figure 2

Most and least developed innovation competences in Polish schools



Source: authors' own work.

The third research objective was to identify the difference degrees of variation in assessment of different competences developed in schools depending on the different teacher positions and age groups. We supported our literature review with consultations with international experts (one from each of the several countries which we covered and which were indicated by the Ministry as our benchmarks). As a result we collected a list of 148 competences, which following analysis and iteration, grouping competences and skills which bore some resemblance, we shortened down to 18. In this paper we present only the results from the quantitative study in Poland. Similar studies were carried out in benchmark countries, although using another method (Figure 1). For each question a 5-point Likert scale with 5 categories of response was applied (*definitely does not develop or support this skill, rather does not develop or support this skill, develops the skill to a certain extent, definitely develops or supports this skill, don't know or undecided*). In order to identify those factors which are the most and the least pertaining to innovation competences, as developed by respective school units, we calculated (estimated) means for their comparison (Figure 2).

The aims of the study and hypotheses

We formulated the following goals:

1. To identify the innovation competences which are most and least efficiently developed by Polish schools.
2. To identify the differences in assessment of different competences developed in schools depending on the different teacher positions and age groups.

The research goals ensued from the pragmatic standpoint: the Polish Ministry of Development aimed to align Poland's innovation policy with the strategic objective of the Polish Ministry of Education, which was interested in the current picture of the Polish K12 education. We measured the performance of the Polish education system through the opinion of teachers. We associated "efficiency" with the alignment of the Polish system of education with the demands of an innovative knowledge-based economy, which Poland aims to expand, and referred to the most innovative economies of the world (World Bank, 2017).

Generally speaking, it is difficult to measure the impact of schooling as there are no direct cause-effect relationships. c. Given the level of bureaucracy in many education systems, including Poland, the formulation of clear guidelines and a common point of reference may offer great potential for change management, as encapsulated in the famous quote: "What gets measured gets managed" by V. F. Ridgway (1956). We chose two demographics characteristics of teachers for statistical analysis: 'teacher position' and 'age'. These variables frequently used in studies on education systems. The age may indicate the possible forthcoming changes in the education system: if younger teachers demonstrate a more supportive stance towards the development of innovation competences one can predict a positive change in the future. If, in turn a similar study is conducted in the future and indicates a similar structure of answers, then we may be able conclude that as teachers grow older, their capacity to develop innovation competences diminishes. We perceive our study as a small contribution to a larger debate on how education systems should be managed and re-shaped. The position is also a relevant variable to analyse. Consequently, resulting from these project aims, we postulated the following two hypotheses:

H1: Competences which require creativity and the ability to find unconventional solutions from students are least developed in schools (these include: *ability to improvise, work without a pre-set agenda, breaking mental models and thinking "outside the box"*).

H2: The type of position held by teachers more often than their age differentiates opinions about the type of innovative competences developed by schools.

Research sample

The online survey was conducted over 7 weeks, between 28 February 2017 and 22 March 2017, among 15,400 Polish teachers representing all of the 16 regions of Poland. For further statistical analysis the research sample was narrowed down to 10,050 questionnaires in order to ensure accurate and appropriate representation of all major segments. We also gleaned information on the location of each school (rural/urban), the demographics of our sample are presented in Table 1. The representativeness of the research sample was assessed based on a chi-square statistical test analysing the compliance of the distribution of the research sample and the distribution of the general population in relation to two traits: the position held and the age of the teacher. Over 80% of respondents were females, which corresponds with the distribution of gender traits in the general population of Polish teachers (83%).

Table 1

Demographics and the general population

Demographic feature	Item	Share in the general population	Share in the research sample	Test value χ2
Position held	Trainee teacher	4.6	3.8	
	Contract teacher	16.3	13.5	3.42
	Appointed teacher	27.1	21.7	
	Chartered teacher	52.0	61.0	
Age in years	Up to 30	12.5	8.6	
	31-45	44.8	46.7	2.24
	46-55	32.7	32.5	
	Over 55	9.9	12.1	

Note: Critical value chi2 for α = 0.05 and n - 1 = 3 amounts to 7.82.

Source: authors' own work.

Data analysis and discussion

For each of the 18 items of the Likert scale an average value was calculated. This allowed us to identify the most and least developed innovative competences in Polish. Average values of competence development assessments for particular age groups and for teaching positions were also calculated. The identification of differences among the opinion of teachers depending on their position and age was calculated with the ANOVA Kruskal-Wallis test (the assumed significance level $\alpha = 0.05$) using STATISTICA 13.1. Statistically significant differences ($p < 0.05$) are marked in bold (see: Table 2 and 3).

The average score for the development of the 18 innovation competences was 3.44. *Developing hobbies and teaching that having a hobby is an asset* is a competence which, according to teachers, is developed in Polish schools to the largest extent among the 18 competences. It was rated 3.73 points on a 5-point scale. The second rank, attributed to *problem solving*, ranked (3.68), and the third rank was attributed to perseverance (3.65). Other competences that are relatively well-developed in Polish schools include *collaboration* (3.63) and *decision making* (3.59).

Compared with *developing hobbies and teaching that having a hobby is an asset, idea formation and analytical thinking* ranked slightly lower (both: 3.49). According to the teachers, schools could be more efficient in developing the ability *how to learn* (3.48). The teachers also identify deficits in openness to the world: *curiosity and exploring possibilities* is ranked (3.46), *changing the perspective of looking at the problem* (3.44) and *explaining and making sense to the world* (3.43). The teachers are of the opinion that more emphasis should be put onto *independent thinking*, even when it entails courage and defying logic (3.25). Sadly, according to our study, developing (intrinsic) motivation among pupils poses a challenge, which is expressed in low scores of such competences as *delayed gratification, or deferred gratification* (3.19) and *multiple idea facilitation* (3.15). Schools also incorrectly teach competence *change management and improvisation*. This competence has the lowest score among all of those assessed (3.11). Thus, our findings confirm hypothesis H1, which says that the least developed innovation competences in school are those which develop creativity and looking for unconventional solutions.

Development of innovation competences and teachers' positions and age

The statistical analysis reveals significant differences is opinions regarding the development of innovation competences in relations to the positions held and the age of teachers. We tested whether different positions held by teachers could explain the differences in innovation competences. Tables 2-3 show the data analysis for the hypothesis H2: The type of position held by teachers differentiates opinions about the type of innovative competences developed by schools more often than their age.

Some significant differences among the opinions of teachers based on their professional position were observed in 7 out of 18 innovation competences. Three of them were listed among the five competences that teachers included as those which are least developed by schools, which are: *change management and improvisation* ($p = 0.037$), "independent thinking", that is unconventional thinking against conventional wisdom ($p = 0.000$) and *leading people* ($p = 0.012$). The lowest average characterises trainee teachers, which are teachers at the lowest level of professional development, and increases along with the level of professional development. Thus, the teachers who are probably under the largest pressure to deliver and perform are also those who are most critical about the efficiency of developing employment innovation competences in schools. At the other end of the continuum, which describes the intensity of focus on the development of certain competences, are chartered teachers, i.e. those who have achieved the highest professional status. Only in the case of *change management and improvisation* are the opinions equally critical with the opinions of the youngest teachers.

Teachers also vary regarding their opinions on divergent thinking, i.e. the ability to produce less expected ideas ($p = 0.040$) and the *ability to learn* ($p = 0.001$). This should not be surprising, however, as in the case of other previously mentioned competences, trainee teachers are more critical regarding the ability of schools to develop innovation competences. These teachers are likely to possess the most up-to-date knowledge on education, contrary to many teachers who do not strictly

keep up with the recent developments in teaching theories. Trainee teachers are also more critical about the ability of schools to develop *idea formation* ($p = 0.009$). *Idea formation* is perhaps the most important competence for an innovative, knowledge-based economy. Trainee teachers less often than teachers holding other positions on the professional development ladder agree with the opinion that schools develop *perseverance* ($p = 0.033$). At the same time the ability not to give up easily is one of the three competences considered to be the best developed in Polish schools, according to all groups of teachers. Opinions regarding the remaining 18 competences do not significantly vary according to the Kruskal-Wallis test. The analysis of averages indicates the intensity of focus on the development of certain competences of trainee teachers as high compared with other categories of teachers, especially compared to chartered teachers (Table 2).

Table 2

Average rating of competences and values of ANOVA Kruskal-Wallis test by position of teachers

Name of competence	Total	Position held by the teacher				Kruskal-Wallis test	Significance *p*
		Trainee	Contract teacher	Appointed teacher	Chartered teacher		
Change management and improvisation	3.11	3.10	3.14	3.14	3.09	8.48	**0.037**
Multiple idea facilitation	3.15	3.13	3.15	3.18	3.15	2.86	0.414
Independent thinking	3.19	3.10	3.15	3.17	3.22	18.85	**0.000**
Delayed gratification, or deferred gratification	3.25	3.30	3.25	3.26	3.24	2.87	0.410
Leading people	3.32	3.25	3.29	3.31	3.34	10.76	**0.012**
Developing future orientation	3.40	3.35	3.39	3.40	3.40	1.78	0.620
Courage and risk-taking	3.42	3.36	3.46	3.42	3.42	5.81	0.121
Divergent thinking	3.43	3.35	3.45	3.44	3.42	8.34	**0.040**
Curiosity and exploring possibilities	3.44	3.38	3.45	3.43	3.44	3.51	0.319
Problem visualization and developing imagination through useful metaphors	3.46	3.38	3.46	3.46	3.46	3.46	0.325
Ability to learn	3.48	3.33	3.49	3.49	3.49	16.58	**0.001**
Framing problems	3.49	3.43	3.44	3.50	3.50	7.37	0.061
Idea formation	3.49	3.48	3.54	3.50	3.48	11.50	**0.009**
Decision making	3.59	3.51	3.60	3.59	3.59	7.15	0.067
Collaborating	3.63	3.57	3.64	3.63	3.64	5.60	0.134
Perseverance	3.65	3.57	3.66	3.66	3.65	8.71	**0.033**

Problem solving	3.68	3.63	3.69	3.70	3.68	6.77	0.079
Developing hobbies and teaching that having a hobby is an asset	3.73	3.68	3.70	3.72	3.74	5.62	0.131

Source: authors' own work.

Compared with the level of professional development, the age of the teacher is a factor that differentiates the opinions of teachers regarding the development of innovation competences to a significantly lower degree. Only in the case of four competences can significant statistical differences be observed. The most visible difference of opinions among teachers representing different generations refers to *independent thinking* ($p = 0.000$). A similar difference can be observed for *ability to learn* ($p = 0.022$) and *idea formation* ($p = 0.032$). The most critical opinions regarding these competences are voiced by young teachers aged up to 30. The age differentiates the teachers in respect to *framing problems* ($p = 0.005$). The efficiency of schools in developing *framing problems* received the highest notes from the oldest teachers. The results confirm Hypothesis 2, which states that the position of professional development differentiates the opinions of teachers on the efficiency of development of innovation skills better than the age of teachers.

Table 3
Average rating of competences and values of ANOVA Kruskal-Wallis by age of teachers

Name of competence	Total	Age of teachers				Kruskal-Wallis test	Significance *p*
		up to 30	31 - 45	46 - 55	over 55		
Change management and improvisation	3.11	3.14	3.11	3.09	3.10	2.88	0.411
Multiple idea facilitation	3.15	3.13	3.17	3.14	3.14	3.67	0.299
Independent thinking	3.19	3.10	3.17	3.23	3.25	27.55	**0.000**
Delayed gratification, or deferred gratification	3.25	3.27	3.25	3.24	3.24	0.98	0.806
Leading people	3.32	3.28	3.31	3.34	3.35	6.78	0.079
Developing future orientation	3.40	3.39	3.41	3.38	3.40	4.37	0.224
Courage and risk-taking	3.42	3.45	3.42	3.41	3.45	4.89	0.181
Divergent thinking	3.43	3.43	3.44	3.41	3.44	3.44	0.075
Curiosity and exploring possibilities	3.44	3.44	3.42	3.45	3.48	6.88	0.076
Problem visualization and developing imagination through useful metaphors	3.46	3.43	3.45	3.46	3.49	2.69	0.442
Ability to learn	3.48	3.44	3.48	3.48	3.54	9.64	**0.022**
Framing problems	3.49	3.47	3.48	3.48	3.56	14.15	**0.005**
Idea formation	3.49	3.52	3.51	3.48	3.46	0.80	**0.032**
Decision making	3.59	3.59	3.60	3.57	3.59	7.07	0.070
Collaborating	3.63	3.67	3.62	3.63	3.65	5.37	0.147
Perseverance	3.65	3.66	3.65	3.65	3.68	1.38	0.710
Problem solving	3.68	3.68	3.68	3.67	3.69	2.47	0.481

Developing hobbies and teaching that having a hobby is an asset	3.73	3.73	3.72	3.74	3.73	2.47	0.481

Source: authors' own work.

As well as comparing the age and positions of the teacher, impacting their opinion of innovation competences, we were also interested in which segments or clusters teachers can be identified with, in relation to their assessment of innovation competences. For this purpose we used the two-step segmentation method for cluster analysis, an exploratory tool designed to reveal natural groups (or clusters) in such a way that objects in the same group are more similar (in some sense) to each other than to those in another group (clusters). This is among the main tasks of exploratory data analysis, and a common technique for statistical data analysis. The advantage of this method in comparison to the traditional (hierarchical) cluster analysis is the possibility to analyse clusters based not only on continuous variables but also on those measured in nominal and ordinal scales, automatic selection of the number of clusters and, what is also relevant to our research - the capacity to effectively analyse large data sets. Analysis based on the two-step segmentation method was carried out using the IBM SPSS Statistics 27.

The analysis of the age variable indicates that two clusters of teachers can be identified. Cluster 1 includes teachers who are critical of more often than their age he Innovation competence amongst students. Comparing this cohort with teachers from Cluster 2, their average assessment is lower by one point. This cluster includes approximately one third of the teachers and is populated by teachers aged up to 30 years old (27.7%) and teachers aged 46-55 years old (21.3%). Cluster 2 includes teachers who's opinions on the ability of schools to develop innovation competences are more positive, although the difference between the two cohorts is merely 0.2-0.3 points compared to the general average. A lack of clear dominance of any age group in either of the two segments confirms that the age variable is differentiating the assessment (21,3%). Cluster 2 consists of teachers, whose opinions on the ability of schools to develop innovation competencies are more positive. In other words, younger teachers are not exceptionally more critical of the innovation competences than older teachers.

Larger differences can be observed between the teachers according to the level of their professional development. Here we also identified two clusters. In the cluster of teachers who gave a low assessment in regard to the ability of schools to develop innovation competences of students the dominating group are trainee teachers. Such teachers include as many as 43.3% of all teachers. Only in the case of a few competences did the average in cluster 1 exceed three points in a five point scale. These included: *developing hobbies* (3.18), *decision making* (3.06), *perseverance* (3.12). *problem solving* (3.26) and *collaboration* (3.11).

Research limitations

In our research we emphasise the importance of two demographic features of teachers: age and the level of professional training. We did not, however, analyse the type of school with regard to developing innovation competences. We assume that the type of school - public or private, strongly influences the efficiency in developing innovation competences. We also did not look at the results achieved by students, as such research would require the development of psychometric tools covering a very broad spectrum of human behaviour. Nevertheless, if more time and resources were to be engaged, a more comprehensive study involving other stakeholders (parents. employers. students) as well as other complementary methods of data gathering would certainly further increase the quality of the findings. Lee Cronbach (1971) proposed that an assessment is a procedure for making inferences: 'One validates not a test, but an interpretation of data arising from a specified procedure', and this was the approach adopted. We also support the view that a datum (in our case the responses from teachers) becomes evidence in some analytic problem when its relevance to one or more hypotheses being considered is established (Black & William, 2018). A more in-depth study of the efficiency of developing innovation competences would have to include a longitudinal study comparing on several intervals the position of Poland in innovation rankings compared with the results of the following editions of our survey. Such a study would still have its limitations, which

would be flawed with all studies on systems of education, that is the unavoidable interference of other non-school-related factors.

The data we presented describes the performance of specific schools where the respondents were working. Some responses may come from more than one teacher from the same school (the total number of schools in Poland is approximately 23,000). Thus, the unit of analysis is an isolated teacher expressing their opinions on behalf of their school. In our research we looked at the impact of only two background variables (the age and 'position' of teachers). These factors are especially relevant as education systems, as they give a bird's eye view of the system. In our research we endeavoured to connect the micro (classroom level) perspective of individual teachers (analysed in our survey) with an attempt to draw some macro-level conclusions. We believe that by demonstrating both to the practitioners (through the list of the 18 innovation competences) and the researchers (through conducting a statistical analysis of some results from our survey) we were able to mainstream the concept of translational research to foster engagement and conversation between researchers and practitioners. The research approach we took (for example by demonstrating the relationships between only a limited number of dependent and independent variables) is a compromise between the expectations of practitioners who seek simple, hands-on, easy to implement solutions, and the researchers. There might be many other influencing factors from the perspective of teachers, and factors from the perspective of schools, which are certainly more important, were not taken into account. Without other variables no serious conclusions could be drawn regarding teacher and school related factors influencing the effective development of innovation competences of students.

Conclusions

Our research confirms that schools are not well suited for 'intellectual rebels', and the current curricula and teaching methods do not offer sufficient conducive conditions for intellectual development that would enhance curiosity of the world amongst talented and strongly-motivated individuals. The obligatory national curriculum does not offer space for the development of critical thinking and problem-solving skills in classroom discussions. Some approaches to overcoming such obstacles are developed in extra-curricular classes, special interests' group. e.g. the arts, theatre, science etc. These approaches, however, are limited, as extracurricular classes are not present in all schools and are therefore an option for few students, and many such schools are underfunded with low budgets for purchasing educational aids. In essence, there are not many public or private schools efficient in developing innovation competences. With regard to developing innovation competences, it is the personality and level of motivation of the teacher that help to motivate the students. Our analysis revealed that unlike trainee teachers, teachers who occupy higher positions are less inclined to provide critical comments (which does not imply that they are oblivious to these perceived problems). Paradoxically, less experienced teachers are better at identifying and incorporating innovation. The more experienced teachers tend to focus on 'teaching for tests', whereas young teachers recognise the need to develop innovation competences. As indicated at the beginning of the paper, the results of this study are intended as translational research, i.e. the kind of research that seeks to produce more meaningful, applicable results. The actions and recommendations ensuing from the study are presented in a separate publication (see: Fazlagić, 2018).

References

- Alshannag, Q., & Hamdan, A. (2015). Schools killing creativity! What can we do? The case of enhancing creativity and inquiry based learning in teaching science. In *The Second International Conference for Gifted and Talented "Towards National Strategy for Enhancing Creativity"* (pp. 25-62). College of Education. UAEU. https://conferences.uaeu.ac.ae/gtic/ar/papers/25_62e.pdf
- Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology, 45*(2), 357-376. https://psycnet.apa.org/doi/10.1037/0022-3514.45.2.357
- Amabile, T. M. (1997). Motivating creativity in organizations: On doing what you love and loving what you do. *California Management Review, 40*(1), 39-58.

https://doi.org/10.2307%2F41165921

- Bailey, J. R., & Ford, C. M. (2003). Innovation and evolution: managing tensions within and between the domains of theory and practice In L. Y. Shavinina (Ed.), *The international handbook on innovation* (pp. 248-58). Pergamon.
- Bakhshi, H., & Mateos-Garcia, J. (2013). *A Manifesto for the Creative Economy*. NESTA. https://www.nesta.org.uk/report/a-manifesto-for-the-creative-economy/
- Banaji, S., Cranmer S., & Perrotta, C. (2013). What's stopping us? Barriers to creativity and innovation in schooling across Europe In K. Thomas, & J. Chan (Eds.), *Handbook of research on creativity* (pp. 450-463). Edward Elgar Publishing.
- Barlow, M. Ch. (2000). *Guilford's structure of the intellect*. The Co-Creativity Institute. http://www.cocreativity.com/handouts/guilford.pdf
- Barnett, H. (1953). *Innovation: The basis of cultural change*. McGraw-Hill.
- Beblavý, M., & Veselková, M. (2014). Future of skills in Europe. Convergence or polarisation? *CEPS Working Document, 390*.
- Berger, W. (2014). *A more beautiful question: The power of inquiry to spark breakthrough ideas*. Bloomsbury.
- Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in Education: Principles. Policy & Practice, 25*(6), 551-575, https://doi.org/10.1080/0969594X.2018.1441807
- Brookhart, S. M. (2013). Assessing creativity. *Educational Leadership, 70*(5), 28-34.
- Brown, S., & Eisenhardt, K. (1998). *Competing on the edge: Strategy as structured chaos*. Harvard Business School Press.
- Chell, E., & Athayde, R. (2009). *The identification and measurement of innovative characteristics of young people*. Research Report. Nesta. https://core.ac.uk/download/pdf/90615.pdf
- Coate, K., & Boulos, A. (2012). Creativity in education: challenging the assumptions. *London Review of Education, 10*(2), 129-132. http://dx.doi.org/10.1080/14748460.2012.691278
- Cronbach, L. J. (1971). Test validation. In R. L. Thorndike (Ed.), *Educational measurement*, 2nd ed. (pp. 443-507). American Council on Education.
- Cropley, D. H. (2015). *Creativity in engineering*. Academic Press.
- Csapó, B., & Funke, J. (Eds.). (2017). *The nature of problem solving: Using research to inspire 21st century learning*. OECD Publishing. http://dx.doi.org/10.1787/9789264273955-en
- Davies, D., Jindal-Snapeb, D., Collier, Ch., Digbya, R., Hay, P., & Howe, A. (2013). Creative learning environments in education - A systematic literature review. *Thinking Skills and Creativity, 8*, 80-91. https://doi.org/10.1016/j.tsc.2012.07.004
- Erol, M., Böyük, U., Şahingöz, R., Harrison, T., & Costa, M. (2012). Developing experiment based science teaching skills: A lifelong learning opportunity for teachers in a rural area of Turkey. *Energy Education Science and Technology Part B-Social and Educational Studies, 4*(4), 2327-2338.
- European Innovation Council. (2021). *The 2021 challenge: Skills for tomorrow - Shaping a green and digital future*. https://eic.ec.europa.eu/eic-funding-opportunities/eic-prizes/european-social-innovation-competition/2021-challenge-skills-tomorrow-shaping-green-and-digital-future_en
- European Union. (2010). *2010 joint progress report of the Council and the Commission on the implementation of the 'Education and Training 2010 work programme'*. (2010/C 117/01). https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:117:0001:0007:EN:PDF
- Fazlagić, J. (2018). *Szkoła dla innowatora. Kształtowanie kompetencji proinnowacyjnych*. Ośrodek Doskonalenia Nauczycieli.
- Fuller, B., & Clarke, P. (1994). Raising school effects While ignoring culture? Local conditions and the influence of classroom Tools. Rules and pedagogy. *Review of Educational Research, 64*(1), 119-157. https://doi.org/10.2307/1170747
- Gordon, J., & O'Toole, L. (2015). Learning for well-being: creativity and inner diversity. *Cambridge Journal of Education, 45*(3), 333-346. https://doi.org/10.1080/0305764X.2014.904275
- Guilford, J. P. (1985). The structure-of-intellect model. In B. B. Wolman (Ed.), *Handbook of intelligence: Theories. measurements. and applications* (pp. 225-266). Wiley.
- Hallam, S., & Ireson, J. (1999). Pedagogy in the Secondary School. In P. Moretimore (Ed.), *Understanding pedagogy and its impact on learning* (pp. 68-97). Paul Chapman Publishing, A

SAGE Publications Company.
- Hebert, R., & Link. A. (2006). The entrepreneur as innovator. *The Journal of Technology Transfer, 31*(5), 589-597. https://doi.org/10.1007/s10961-006-9060-5
- Heilmann, G., & Korte, W. B. (2010). *The role of creativity and innovation in school curricula in the EU27. A content analysis of curricula documents*. European Commission, Joint Research Centre Institute for Prospective Technological Studies. http://www.pim.com.mt/pubs/JRC_curricula.pdf
- Kabukcu, E. (2015). Creativity process in innovation oriented entrepreneurship: The case of Vakko. *Procedia - Social and Behavioral Sciences, 195*, 1321-1329. http://dx.doi.org/10.1016/j.sbspro.2015.06.307
- Markides, C. (2013). Do schools kill creativity? *Business Strategy Review, 24*(4), 6-6. https://doi.org/10.1111/j.1467-8616.2013.00983.x
- Muijs, D, & Reynolds, D. (2011). *Effective teaching: Evidence and practice*. Sage.
- Mwasalwiba, E. S. (2010). Entrepreneurship education: A review of its objectives. teaching methods and impact indictors. *Education and Training, 52*(1), 20-47. http://dx.doi.org/10.1108/00400911011017663
- OECD. (2011). *Skills for innovation and research*. https://doi.org/10.1787/9789264097490-en
- OECD. (2014). *PISA 2012 results: Creative problem solving. Student's skills in tackling real-life problems*. https://doi.org/10.1787/9789264208070-en
- OECD. (2015). *Schooling redesigned: Towards innovative learning systems*. https://www.oecd.org/education/schooling-redesigned-9789264245914-en.htm
- OECD. (2016). *Innovating education and educating for innovation. The power of digital technologies and skills*. http://dx.doi.org/10.1787/9789264265097-en
- OECD. (2019). *Conceptual learning framework. Skills for 2030*. https://www.oecd.org/education/2030-project/teaching-and-learning/learning/skills/Skills_for_2030_concept_note.pdf
- Ramankulov, S., Usembayeva, I., Berdi, D., Omarov, B., Baimukhanbetov, B., & Shektibayeva, N. (2016). Formation of the creativity of students in the context of the education informatization. *International Journal of Environmental & Science Education, 11*(16), 9598-9613.
- Ridgway, V. F. (1956). Dysfunctional consequences of performance measurements. *Administrative Science Quarterly, 1*(2), 240-247. https://doi.org/10.2307/2390989
- Samašonok, K., & Juškevičienė, A. (2021). Social competence-based prognostic possibilities of creativity expression among students of social profile. *Entrepreneurship and Sustainability Issues, 8*(3), 324-339. http://doi.org/10.9770/jesi.2021.8.3(20)
- Samašonok, K., & Juškevičienė, A. (2022). Perceived creativity and the big five personality traits of specialists trained for profession: trends in their interaction. *Entrepreneurship and Sustainability Issues, 9*(3), 265-283. http://doi.org/10.9770/jesi.2022.9.3(16)
- Scott, P., Asoko, H., & Leach, J. (2010). *Student conceptions in conceptual learning in science* In S. K. Abell, & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 31-56). Routlege.
- Scott, S., & Bruce, R. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal, 37*(3), 580-607. https://doi.org/10.5465/256701
- Shaheen, R. (2010). Creativity and education. *Creative Education, 1*(3), 166-169. http://dx.doi.org/10.4236/ce.2010.13026
- Sternberg, R. J., & Williams, W. M. (1996). *How to develop students creativity*. Association for Supervision and Curriculum Development.
- World Bank. (2017). *Doing Business*. https://archive.doingbusiness.org/content/dam/doingBusiness/media/Annual-Reports/English/DB17-Report.pdf

INFORMACJE O AUTORZE:

Jan Fazlagić

The author is a full-time professor at the Poznan University of Economics and Business in Poznan, Poland, and a former Senior Fulbright Scholar at Sam Houston University (TX, USA) and Marie Curie Research Fellow at the Centre for Social Innovation in Vienna, Austria, as well as a European Commission Lead Expert in the URBACT III programme. He is the author of over 300 books, research papers and popular media articles on knowledge management, intellectual capital, education and local governments. He was involved in a number of projects supporting Polish public institutions, including government agencies and ministries.

https://orcid.org/0000-0003-1968-2163

Mirosława Kaczmarek

The author is a professor at the Poznań University of Economics and Business. In her scientific activity she focuses on the research of consumer behaviour and the application of methods of statistical multivariate analysis in the analysis of this behaviour. She is especially interested in the behaviour of users of banking mobile applications. She popularises knowledge in this area on the financial portal "Obserwator Finansowy" (https://www.obserwatorfinansowy.pl), which functions with the National Bank of Poland.

https://orcid.org/0000-0002-3844-6310

Cornelia Connolly

The author is an Associate Professor at the School of Education at the University of Galway, where she lectures on postgraduate and undergraduate teacher education programmes. In addition to a Ph.D. in pedagogical innovation, she holds a B.Eng. (Hons) in Computer Engineering and M.Eng. (Hons) through research. Her teaching and research interests centre principally on STEM knowledge transfer where she has published extensively.

https://orcid.org/0000-0001-9778-5569