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**online
learning**

ICT in education
Lifelong learning
Business and technologies
New trends in management
Teaching methods and programs

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Dear “e-mentor” readers,

In 2020 the “e-mentor” volumes were dominated by the topics concerning the change the COVID-19 pandemic has brought to education all over the world. While those issues are still present in the current edition of the journal, the shift towards the lessons learned can be observed along with the questions referring to teachers’ well-being and other self-efficacy aspects.

An interesting aspect, almost absent in Polish publications although quite well recognized in the foreign literature, is the possibility to use beacons in education and the benefits they can bring to it. Another useful example of enhancing modern education by technology is the article written by two employees of FeedbackFruits, the Dutch EdTech company. The application called Interactive Document helps to engage students in the process of learning while studying text documents and video recordings.

The rapid shift to distance work also raised the question about the role of technologies in contemporary business and the need for digital transformation in organizations. In the current volume, there are also articles concerning the implementation of agile methodology in large organizations and the role of transactional and transformational leadership in the context of organizational justice.

I do hope this collection of papers creates a valuable reading for everyone interested in education and management worldwide.

“E-mentor” is an open-access journal available for free both online and in printed form. It continuously increases its international outreach, which is confirmed by the submissions from a growing number of countries such as Spain, Germany, the US, Japan, India, and the Netherlands. The US, UK, and German experts also collaborate with our journal serving as the reviewers.

All scientific papers are peer-reviewed (we apply a double-blind procedure). Every article gets its individual DOI registered in Crossref, and the journal is indexed in several global databases, including Web of Science ESCI and EBSCO. There is no publishing fee for the authors. We encourage you to get familiar with a brief guide for authors on the penultimate page of the journal. More detailed instructions (including the submission form) are available online at http://www.e-mentor.edu.pl/eng/page/8/Info_for_Authors. If you have any questions concerning the publications in “e-mentor,” please contact the editorial team at redakcja@e-mentor.edu.pl.



Maria Zajac
editor

WE RECOMMEND



Johnathan Adams, David Pendlebury and Martin Szomszor,
Global Research Report: Subject diversity in research portfolios: what it is, how to index it and its role in innovation

Research diversity, in all its forms, is an engine of economic progress and stimulates innovation. Diversity of research contributes to stability, resilience and innovation in ecological and economic systems. It should be an equally valuable part of management planning in research systems, reflected in the subject spread of countries and institutions.

The Web of Science provides a practical and stable global reference baseline for subject diversity that reduces calculations to one of evenness of publication counts across journal-based subject categories, using the Gini index. Diversity analysis provides a forward-looking view of the opportunities for intellectual, technological and scientific evolution.

COVID-19 presented an unforeseen global research challenge. Countries with a diverse research base responded with a rapid and comprehensive range of innovative research – but most specialist countries did not. An exception, Brazil, has a narrow research base but one pre-adapted to this challenge.

Excerpts from the report executive summary. Full text of the report can be downloaded at: <https://bit.ly/3Bcv6el>



Agnieszka
Lipińska-
-Grobelny



Marta
Narska

Self-efficacy and psychological well-being of teachers

Abstract

Introduction: The aim of the presented research was to check whether there is a connection between teachers' self-efficacy and their psychological well-being from a holistic (hedonic and eudaimonic) perspective. **Method:** The study involved 100 teachers who were asked to fill in the following research tools with proven psychometric properties: the General Self-Efficacy Scale, the Satisfaction with Life Scale, the Positive and Negative Affect Schedule, and the Psychological Well-being Scale. **Results:** The obtained data confirm that there is a connection between self-efficacy belief, and hedonic and eudaimonic well-being. The degree of professional promotion grades modifies the relationships considered. **Conclusions:** The psychological well-being of teachers is significantly associated with their evaluation of efficacy, which may have a positive impact on the effectiveness of teachers' professional functioning and the achievements of their students.

Keywords: self-efficacy, psychological well-being, hedonic well-being, eudaimonic well-being, teachers

Introduction

Self-efficacy is an important personal resource shaping our actions in all areas of life. Researchers receive fairly consistent results that accentuate the importance of this variable for the efficacy of various professions, including teachers (Baka, 2017; Chomczyńska-Rubacha & Rubacha, 2013; Schwarzer & Hallum, 2008; Skaalvik & Skaalvik, 2007; Tschannen-Moran & Woolfolk Hoy, 2001). Analyses to date, conducted with the participation of the said group, focused mainly on the issues of stress and professional burnout (Hreciński, 2016; Korczyński, 2014; Ostrowska & Mazur, 2017; Pyżalski & Merez, 2010). According to the current state of knowledge, we know that eliminating negative factors does not necessarily promote efficacy or improve psychological well-being (Ryff et al., 2006). It is also important to remember that the work of teachers affects not only themselves but also their students, parents, and even society as a whole. By way of example, positive relationships have been confirmed between teachers' self-efficacy ratings and their job-related aspirations, work engagement, teaching effectiveness, maintaining classroom discipline effectively, students' achievements as well as their self-esteem and prosocial attitudes (Muijs & Reynolds, 2002; Skaalvik & Skaalvik, 2007).

Teachers' belief that they can influence the school success of their students, even the weaker and less motivated ones, is not unrelated to their overall assessment of life quality (Kulawska, 2017). Therefore, the purpose of the presented research was to examine whether teachers' self-efficacy is related to their psychological well-being. The holistic approach to well-being, which is most often analyzed in terms of pleasure and fulfilment, i.e. in hedonic categories, is a novelty in the conducted analyses. In this study, the hedonic approach is complemented by the eudaimonic approach, which describes well-being as a pursuit of self-development and self-improvement by cultivating important aspects of life. The eudaimonic account of psychological well-being is extremely valuable. It assumes that not all fulfilled desires or achieved goals result in positive effects for the person, being only a source of pleasant sensations. This means that well-being cannot be considered only in terms of pleasure, but also in terms of living according to one's own value system.

Self-efficacy and psychological well-being – conceptualization

The following will conceptualize the key variables in the research conducted – self-efficacy and psychological well-being. The theoretical basis for self-efficacy is Albert Bandura's social learning theory (1997), which uses a model of triple determinism. It assumes an interaction between three factors: the environment, person, and behavior. Events taking place in the environment affect a human being's cognitive and emotional functioning as well as their behavior. But more importantly, people are capable of self-reflection and self-regulation. With cognitive abilities, they can control events in the environment, which in turn affects their emotions and biological states. According to Bandura, self-efficacy is an individuals' conviction that they have the ability to organize and take actions toward a specific goal. When its level is high, individuals take on challenging tasks, spending a lot of time and effort to see them through to completion. They are accompanied by a sense of control over the situation, and they find tasks as something that motivates them (Schwarzer & Hallum, 2008).

Bandura (2007) defines self-efficacy through the lens of three specific characteristics, i.e. magnitude, generality, and strength. Magnitude refers to the extent of perceived efficacy – whether it includes only simple tasks or difficult and complex ones, too. Generality refers to the relatively generalized stability of beliefs regarding various aspects of life. Strength, in turn, describes the persistence of self-efficacy despite experienced setbacks. The level of motivation, affective states and behavior relate more to the belief in one's abilities and capabilities than to the competences actually possessed. As a result, people's behavior and even psychological well-being can be predicted more effectively by learning their perspectives on how they evaluate their abilities to take goal-directed actions (Bandura, 1997; Chomczyńska-Rubacha & Rubacha, 2013; Juczyński, 2000).

The second key variable in the research presented is psychological well-being. Deci and Ryan (2008) define psychological well-being as a positive state associated with experienced emotions and a formulated evaluation of one's existence. There are two approaches that determine how this concept is conceptualized and operationalized. The hedonic perspective describes well-being in terms of the cognitive and emotional appraisal of one's life (Diener et al., 2008). This means that the essential component of hedonic psychological well-being assumed in this study includes: (1) experiencing high levels of positive emotions and low levels of negative emotions, and (2) having high levels of life satisfaction. The eudaimonic perspective, on the other hand, assumes that a person is happy when they live in accordance with their values and have the opportunity for personal development. In this view, it is not about the pleasure derived from life but about its meaningfulness, purposefulness and value. A theory applied in this study that directly relates to

eudaimonic well-being is the multidimensional model of happiness by Ryff (1989). Ryff and Singer (2006) describe well-being as the resultant of six different aspects of human self-fulfilment: (1) autonomy (acting in accordance with individual standards, values and beliefs); (2) ability to cope with the surrounding world (environmental control); (3) opportunities to enrich personal potential (self-growth); (4) positive relationships with others; (5) goal orientation (ability to find purpose in life), and (6) self-acceptance (self-awareness, positive attitude toward oneself).

In reviewing the research, it is worth remarking that building a sense of agency in students is an important task of every teacher. If an educator thinks he or she is incompetent and unable to deal with difficult students (low self-efficacy), their students will begin to believe that they can do nothing, and they have no better prospects. On the other hand, school staff who promote positive values and encourage students to achieve success make children and young people – despite educational difficulties – show interest in learning and try to broaden their knowledge. Therefore, teachers' self-efficacy influences their students' attitude toward the educational process and, consequently, contributes to the improvement of teaching quality (Achurra & Villardón, 2012).

Moreover, there are analyses in the literature on the relationship between self-efficacy and eudaimonic well-being. During the 7th International Conference *Edu World 2016*, results which describe the relationship between self-efficacy, professional burnout and eudaimonic well-being were presented. A total of 217 teachers aged 22 to 58 years were surveyed. A positive correlation was found between the teachers' self-efficacy appraisal and all six dimensions of psychological well-being as defined by Ryff et al. (Bentea, 2017). The positive relationships of self-efficacy and well-being were also confirmed by a study conducted in India with 100 students, including 50 women and 50 men (Siddiqui, 2015).

For the hedonic approach, most empirical reviews on self-efficacy focus on the cognitive dimension of well-being. Results published in *International Education Studies* showed that this belief is related to life satisfaction as measured by the *Satisfaction With Life Scale (SWLS)*. The higher the level of self-efficacy of the respondents, the stronger they experienced life satisfaction. The study group comprised 405 young adults. It is worth mentioning that no gender differences were observed in the perceived efficacy and life satisfaction levels (Çakar, 2012). Similar results were obtained for 150 Turkish female teachers for whom a positive relationship between the variables considered was also confirmed (Alipour & Taghvaei, 2016).

The emotional dimension of hedonic psychological well-being appears in Chinese research on positive affect, self-efficacy perception, the role of personality, and life satisfaction (Zhang, 2016). It was proven that students with high belief experience more positive emotional states, which positively correlates with higher life satisfaction.

Purpose of research

Taking into account the results mentioned above, the role of self-efficacy in the group of teachers and considering the holistic approach to psychological well-being, a decision was taken to verify whether the described personal resource was related to their psychological well-being in the hedonic and eudaimonic approach. Furthermore, following the research conducted by Kulawska (2017), who confirmed that contract teachers were characterized by higher self-efficacy than appointed and chartered teachers, a decision was made to enrich all analyses with the level of professional promotion. The following research hypotheses were formulated:

- H1. The higher the level of self-efficacy of the teachers, the stronger the level of their psychological well-being:
 - H1.1. in eudaimonic terms: in all its dimensions (autonomy, environmental control, self-growth, positive relationships with others, purpose in life, and self-acceptance).
 - H1.2. in hedonic terms: H1.2.1. experiencing high levels of positive emotions and low levels of negative emotions, and H1.2.2. having high levels of life satisfaction.
- H2. A teacher's professional promotion grade modifies the relationships considered in hypothesis one.

Method

Study group and procedure

The research was conducted on a group of 100 teachers in central Poland in cities with population over 100,000. This is the first part of a research project conducted with the participation of the above-mentioned professional group. The respondents were invited to participate in the study between September 2019 and January 2020. Prior consent was obtained from the facilities taking part in the study and the respondents themselves. The entire procedure was performed in accordance with the principles of the Declaration of Helsinki. This means that the subjects were informed about voluntary participation in the study. They were given information about the purpose and procedure of the study and were assured of anonymity as well as of the fact that the results would be used for scientific purposes only. Respondents were asked to complete the questionnaires and seal them in envelopes, which were subsequently collected by the researcher.

Regarding gender, there were 76 women and 24 men, from primary and secondary schools. This gender distribution is due to the feminization of the teaching profession in Poland. The age of the examined individuals ranged from 25 to 67 years ($M = 44.26$; $SD = 9.46$). The average age of the women oscillated around 43 years ($SD = 9.33$), while the average age of the men was 47 years ($SD = 9.51$). Primary school teachers accounted for 49% of all the respondents,

while secondary school teachers accounted for 51%. The average length of service was almost 18 years (in the case of women – 17 years ($SD = 9.8$) and men – 20 years ($SD = 12.32$)). Taking into account professional promotion grades, the largest group of the respondents were chartered teachers (56%), then appointed teachers (19%) and contract teachers (15%). Trainee teachers were the smallest group (10%).

Measures

Paper-and-pencil instruments with proven and satisfactory psychometric properties were used to conduct the study. They included: *General Self-Efficacy Scale*, *Satisfaction With Life Scale*, *Positive and Negative Affect Schedule*, and *Psychological Well-Being Scale*. The questionnaires were preceded by a survey the aim of which was to collect basic demographic data.

The *General Self-Efficacy Scale (GSES)*, developed by Jerusalem and Schwarzer (1992), was used to measure the strength of a person's general belief in the effectiveness of coping with difficult situations and with obstacles. GSES is composed of 10 statements and respondents are asked to indicate the extent to which they agree with the given statements on a four-point scale. *Cronbach's alpha* in our study was 0.86.

The *Satisfaction with Life Scale (SWLS)* by Diener et al. (1985) was used to determine hedonic psychological well-being in the cognitive dimension. SWLS comprises five statements and is used to measure overall life satisfaction. Using a scale from 1 to 7, respondents indicate to what extent they accept the content of a particular statement. The reliability of the questionnaire, tested in our study using *Cronbach's alpha*, was 0.82.

The *SUPIN* scale was used to examine hedonic psychological well-being in the emotional dimension. This is the Polish version of the *Positive and Negative Affect Schedule (PANAS)* by Watson et al. (1988), as adapted by Brzozowski (2010). It has two versions and each of them has two varieties: for measuring current emotional states (S20 and S30) and for measuring relatively stable affective traits (C20 and C30). The 30-item version (S30) was used in this study. The results obtained were calculated separately for the following two subscales: PE – positive emotions, and NE – negative emotions. *Cronbach's alpha* coefficients reached 0.91 for the PE subscale and 0.94 for the NE subscale in our own research.

The last tool was the *Psychological Well-Being Scale (PWBS)* which was applied to measure well-being from a eudaimonic perspective. This scale was developed by Ryff and Singer (2006), and its Polish adaptation was produced by Krok (2011). The respondents were asked to indicate, using a seven-point scale, the extent to which they agreed with each of 42 statements. The reliability as determined by *Cronbach's alpha* for each scale was satisfactory in our own research and totalled 0.7 for autonomy, 0.79 for environmental control, 0.75 for self-growth, 0.75 for positive relationships with others, 0.70 for purpose in life, and 0.86 for self-acceptance.

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Results

Statistical analyses were performed in version 25 of the SPSS software package. Table 1 contains descriptive statistics (minimum, maximum, mean – *M*, and standard deviation – *SD*) relating to all the examined variables. It shows that the surveyed teachers are characterized by higher than average self-efficacy, well-being in the hedonic perspective (positive emotions and satisfaction with life, lower than average negative emotions) and above average eudaimonic well-being in all six scales.

Verifying the research hypotheses, Pearson's correlation coefficients confirmed statistically significant relationships (moderate to high) between teachers'

self-efficacy and psychological well-being. Higher levels of self-efficacy are associated with higher levels of their psychological well-being in eudaimonic terms in all its dimensions (autonomy, environmental control, self-growth, positive relationships with others, purpose in life, and self-acceptance), (hypothesis H1.1. confirmed), (see Table 2). Furthermore, moderate correlations occurred between GSES and the cognitive dimension of hedonic well-being (satisfaction with life), (hypothesis H1.2.2. confirmed), as well as positive emotions (hypothesis H1.2.1. partially confirmed). The only statistically insignificant relationship was found for self-efficacy and negative emotions (see Table 3).

The coefficient of determination ($r^2 * 100\%$) is 33.64 for autonomy, 32.49 for self-acceptance, 27.04 for en-

Table 1

Statistics describing self-efficacy and well-being in hedonic and eudaimonic terms

Descriptive statistics (<i>N</i> = 100)	Min.	Max.	<i>M</i>	<i>SD</i>
Self-efficacy (GSES)	19	40	30.67	3.95
Positive emotions (PANAS)	19	70	44.75	10.74
Negative emotions (PANAS)	15	56	25.82	11.24
Satisfaction with life (SWLS)	8	34	22.94	5.26
Autonomy (PWBS)	17	45	34.72	6.19
Environmental control (PWBS)	18	48	34.63	6.45
Self-growth (PWBS)	18	49	36.95	6.06
Positive relationships with others (PWBS)	23	49	39.95	5.47
Purpose in life (PWBS)	22	48	37.11	5.65
Self-acceptance (PWBS)	17	49	35.45	7.32

Note. *M* – mean, *SD* – standard deviation, GSES – General Self-Efficacy Scale, PANAS – Positive and Negative Affect Schedule, SWLS – Satisfaction With Life Scale, PWBS – Psychological Well-Being Scale.

Source: authors' own work.

Table 2

Self-efficacy and psychological well-being in eudaimonic terms

	Psychological well-being in eudaimonic terms					
	Autonomy (PWBS)	Environmental control (PWBS)	Self-growth (PWBS)	Positive relationships with others (PWBS)	Purpose in life (PWBS)	Self-acceptance (PWBS)
Self-efficacy (GSES)	0.58***	0.52***	0.43***	0.30**	0.38***	0.57***

Note. ***p* < 0.01; ****p* < 0.001.

Source: authors' own work.

Table 3

Self-efficacy and psychological well-being in hedonic terms

	Psychological well-being in hedonic terms		
	Positive emotions (PANAS)	Negative emotions (PANAS)	Satisfaction with life (SWLS)
Self-efficacy (GSES)	0.21*	<i>ns</i>	0.41***

Note. **p* < 0.05; ***p* < 0.01; ****p* < 0.001; *ns* – statistically insignificant.

Source: authors' own work.

Table 4*Self-efficacy and psychological well-being of teachers taking into account professional promotion grades*

Correlation coefficients <i>r</i> Pearson (<i>N</i> = 100)	Self-efficacy (GSES) trainee teacher	Self-efficacy (GSES) contract teacher	Self-efficacy (GSES) appointed teacher	Self-efficacy (GSES) chartered teacher
Positive emotions (PANAS)	<i>ns</i>	<i>ns</i>	0.49*	<i>ns</i>
Negative emotions (PANAS)	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>
Satisfaction with life (SWLS)	<i>ns</i>	0.46 ^	<i>ns</i>	0.45**
Autonomy (PWBS)	0.78**	<i>ns</i>	0.82***	0.55***
Environmental control (PWBS)	0.77**	0.45 ^	0.49*	0.51***
Self-growth (PWBS)	0.68*	<i>ns</i>	<i>ns</i>	0.47***
Positive relationships with others (PWBS)	0.85**	<i>ns</i>	<i>ns</i>	0.24 ^
Purpose in life (PWBS)	0.65*	<i>ns</i>	<i>ns</i>	0.37**
Self-acceptance (PWBS)	0.88**	0.56*	0.48*	0.57***

Note. GSES – self-efficacy; ^ $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; *ns* – statistically insignificant.

Source: authors' own work.

vironmental control, 18.49 for self-growth, 16.81 for satisfaction with life, 14.44 for purpose in life, 9.0 for positive relationships with others, and 4.41 for positive emotions. This means that self-efficacy explains most of the total variation in autonomy (almost 34%), self-acceptance (almost 33%), and environmental control (27%), i.e. the dimensions of eudaimonic well-being. For the cognitive evaluation of life (the hedonic well-being dimension), this predictability is almost 17%. The emotional rating of hedonic well-being (positive emotions) is the lowest and totals about 5%.

Regarding the second hypothesis, professional promotion grades modify the considered relationships between the key variables (hypothesis H2. confirmed), (see Table 4).

Self-efficacy in trainee teachers co-exists strongly with eudaimonic well-being, especially: (1) self-acceptance, (2) positive relationships with others, (3) autonomy, and (4) environmental control. The coefficients of determination (r^2 * 100%) are, respectively: 77.44, 72.25, 60.84, and 59.29, which means that GSES predicts between 59% and almost 78% of the variability in the said dimensions. For contract teachers, only self-acceptance has a strong relationship with GSES (the coefficient of determination takes the value of 31.36). As for appointed teachers, their self-efficacy appraisal improves the positive affect and selected dimensions of self-fulfilment such as self-acceptance, environmental control and sense of autonomy (highest coefficient of determination – 66.24). However, in the case of chartered teachers (the most numerous group), their self-efficacy translates into both a high level of satisfaction with life and living in accordance with professed values, standards and beliefs, most importantly self-acceptance. The coefficients of determination in this case range from 13.36 (purpose in life) to 32.49 (self-acceptance).

Discussion

The aim of this study was to examine whether teachers' self-efficacy is related to their psychological well-being in hedonic and eudaimonic terms. Previous analyses have only been conducted from one research perspective (Alipour & Taghvaei, 2016; Bentea, 2017; Çakar, 2012; Zhang, 2016). A holistic approach to well-being was chosen in this study since the knowledge gained can be helpful in formulating an emotional and cognitive evaluation of one's own life or in searching for its meaning; and the work of teachers affects not only themselves but also students, parents, and even the whole society.

To sum up, the teachers surveyed were characterized by higher than average self-efficacy and levels of psychological well-being – both in hedonic and eudaimonic terms. This means that they positively evaluated their ability to act in a goal-oriented manner. Moreover, they were accompanied by higher than average levels of positive emotions and satisfaction with life and by lower levels of negative emotions. In addition, living in accordance with their values along with the possibility of self-growth and self-improvement were another source of their well-being. Different outcomes were obtained by E. Kulawska (2017) who surveyed 44 teachers of early childhood education. The vast majority (68%) described their efficacy as average and only 16% as high. This discrepancy may be caused by the specificity of the respondents as well as by the educational reform of 2017.

Second, the research hypotheses formulated earlier were confirmed. High levels of teachers' self-efficacy were accompanied by their high ratings of psychological well-being. This remains consistent with previously cited data (Alipour & Taghvaei, 2016; Bentea, 2017; Çakar, 2012; Siddiqui, 2015; Zhang, 2016), in which

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the relationships presented above were considered from only one perspective. Based on the obtained coefficients of determination, it can be concluded that self-efficacy explains to a greater extent the total variation in various dimensions of eudaimonic well-being compared to hedonic well-being (satisfaction with life). Self-efficacy appraisal has a poor relationship with the emotional dimension of hedonic well-being (positive emotions).

Furthermore, it is important to consider well-being not only in terms of pleasant sensations or tasks accomplished and successes achieved (hedonic approach). It turns out that self-efficacy is more important for eudaimonic measures. It was Aristotle who first wrote about the authentic spirit-self of man, while contemporary precursors of eudaimonism (Maslow, Rogers, Frankl, Allport) mentioned living in accordance with the true Self (Ryff & Singer, 2006). Such a man (self-fulfilling) is internally free, does not yield to external influences, and has a coherent system of norms and rules (values that cannot be overestimated in the teaching profession).

The third conclusion that emerges from the research is the differentiating role of professional promotion in the relationship between key variables. This requires further analysis due to the size of each group. It is worth stating, however, that the self-efficacy for trainee, appointed and chartered teachers was particularly important in terms of the eudaimonic concept of well-being (both internal and external dimensions). It is about self-acceptance, autonomy (the inner aspects of self-fulfilment) and environmental control, as well as positive relationships with others (the outer dimensions of happiness). The introduction of professional promotion grades into the analyses resulted in insignificant interactions of GSES with hedonic well-being – although with two exceptions, namely: self-efficacy predicted 24% of the positive emotional evaluation of the lives of appointed teachers and 20% of the cognitive evaluation of the lives of chartered teachers.

In conclusion, self-efficacy is an important personal resource that determines the extent to which teachers are able to use their skills and abilities. It is also strongly linked with their psychological well-being. For that reason, it is very important to pay more attention to the development of these competences in the training of future teaching staff. It is an empirically verified view that self-efficacy can be taught and developed on the basis of carefully prepared training programmes, which are applicable in business, but should also be used in education at all levels.

The authors are aware that the study has some limitations. Therefore, it is recommended that further studies be performed involving larger groups of teachers, especially after taking into account professional promotion grades. This may offer further insight into how the training programmes should be best formulated. Future research should also adapt a holistic approach to psychological well-being in the hedonic and eudaimonic approaches. It is

feasible that the most direct path to happiness and well-being is not only seeking positive hedonic experiences, but also engaging in meaningful pursuits and the development of one's strengths – a request of special interest in a group of teachers. Therefore, the above research should be considered as a first step for further analysis.

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Motives, benefits and difficulties in online collaborative learning versus the field of study. An empirical research project concerning Polish students

Abstract

As a result of universities' growing interest in online learning, largely due to the COVID-19 pandemic, it is necessary to adapt online learning methods to students' professional preferences. The learning environment should accordingly be designed so as to ensure the highest possible engagement levels from the participants. This article discusses the value of collaboration in online learning along with its determinants. It highlights the need to include the crucial activities in the remote education of university students while taking into account their individualization and diverse motives. The analysis reveals that students cannot be treated as a homogeneous group; the preferences and abilities represented by them – which are associated with their field of study – determine their functioning in the remote learning environment. Based on their empirical study, the authors propose recommendations that may be helpful for educators in online collaborative learning.

Keywords: distance learning, collaboration, field of study, digital skills, motives

Introduction

With the COVID-19 pandemic – resulting in the decision to move university classes online – academics are currently facing new challenges such as switching from in-person to online instruction. Not only do they need to quickly acquire the knowledge and skills needed to handle the remote technologies but, perhaps first and foremost, they have to re-evaluate their educational views and concepts, along with the methodology of online teaching. The problems (e.g. preparing online classes while taking into account individual motives), discussed in the article have already been acknowledged; however, the present scale of using the online learning solutions has clearly exacerbated them. One of the challenges is to convince educators that preparing online classes should not be limited to merely sharing the course contents online. Instead, remote education should be a constantly monitored, comprehensive and student-orientated process rather than a teacher's one-off action. Distance learning has proved to be a dramatic change for many academics, taking up a lot of their time and effort. For example, developing teaching materials in a form that is attractive to learners requires a significant amount of staff time, knowledge, skills, and motivation (Hiltz & Shea, 2005; Palloff & Pratt, 2005; 2007).

They have to modify the way they think about remote education and shift from correspondence-based teaching to interactive learning that is engaging both for students and teachers. One of the many challenges is to use modern technologies to create a unique learning environment adapted to the students' needs. Moreover, it is important to encourage both students and teachers to use collaborative tasks. Research shows that some students, in order to work effectively in a group, need more support (e.g. detailed instructions, monitoring their activity) in carrying out collaborative tasks (Hämäläinen, 2012).

Distance learning: toward commitment and individualization

One of the challenges is to select the right education forms and tools to be used by the participants of the online learning process. Diversification of the curricula and requirements in different fields of study allow future students to choose from a wide range of academic offers and find the discipline that best suits their predispositions. Depending on the field of study, classes can differ not only in terms of content and learning outcomes, but also in form. The principle of individualization in online education is most often implemented through the possibility of learning at one's own pace, with diversified materials, appropriate activating methods, and defining objectives that are achievable and motivating (Simonson et al., 2015, pp. 42–43). However, one cannot forget the technological constraints that often enforce a certain unification of materials or the reluctance of the academic staff to introduce new teaching methods. The latter may be caused by increased workload due to remote teaching, i.e. the need to prepare, moderate and evaluate the course and the teaching materials. Taking into account individual motivations in online learning seems to be just as important as in offline settings (i.e. in-person classes). Involving students in joint educational activities is not an easy process, as each member of the group may have different personal motives, personality traits, unique skills and predispositions. Further challenges may result from differences in priorities, expectations, individual styles of work, communication and socialising patterns, as well as cultural differences, etc. So far, research shows that factors that are crucial for ensuring effectiveness and achieving course outcomes in online collaborative learning include: communication activities, teachers' support, as well as taking into account individual traits (e.g. level of digital skills, presented learning styles and strategies, motivation, time management and organization, perceived need of class participation, personal engagement and willingness to take part in classes) (Blau et al., 2020; Kwiatkowska, 2016; Lee & Yang, 2020; Morris et al., 2005; Romano et al., 2005; Sarja et al., 2018). Harasim (2000), while speaking of the role of collaboration, shows that teamwork strengthens the relationships among learners, engaging and motivating them to participate. Collaborative learning seems to be gaining particular interest in the current contexts of online education on a large scale. Hence, it seems worthy to present its main assumptions and characteristics.

Collaboration in distance learning

Four main theoretical approaches to collaboration in online learning can be identified: behaviorism, social constructivism, situational learning, and connectivism. The first is particularly important for technical and organizational reasons and for monitoring the collaboration process. Planning, clear presentation of individual stages and tasks, requirements, expecta-

tions and the purpose of the teacher's actions also fall within the behaviorist approach. Tests and exams allow students to demonstrate what they have learned, while teachers can assess the efficiency of their work. Such evaluations also seem to be inspired by behaviorism (Kwiatkowska, 2018). The second approach has been derived from the works of Bruner (1971, p. 28), Papert (1993, pp. 176–195), Piaget (1981; 2005), and Vygotsky (1978, p. 42), whose ideas have become the source of many teaching methods based on learners' activity, learning by doing, and social presence. These principles can also be successfully applied to the virtual learning environment and the development of further methodological solutions (Harasim, 2012, pp. 68–73; Kwiatkowska, 2018, pp. 33–34). The third perspective refers to the concept of situational learning put forth by Lave and Wenger (1991), who argue that the learning process is context-dependent and as such it entices active learning through experiencing problems in real situations. Learning online occurs in different conditions and work organization contexts; its participants come from various kinds of environments and cultures, while they also differ in terms of knowledge, skills, motivation, and individual predispositions. This concept was developed by Illeris (2006), who proposes different spaces and frameworks for learning situations, such as learning from everyday life, through practice, at schools and other educational institutions, in the workplace, and collective learning. In his works, he highlights learning through collaboration (collaborative learning), as it inspires activity, generates common emotions, motivates people to expand their knowledge, and strengthens relationships in the group. According to Tapscott and Williams (2008), innovative ways of acting and collaborating will allow us to make better use of human skills, creativity, and intellect. Kazmer (2007) agrees with them and argues that contemporary learners contribute their knowledge, skills, experience, values, and cultural norms to online groups where they share them with other participants. Learners engage in relationships, share ideas, support each other and collaborate, both online and offline, to achieve the predefined objectives. Kazmer speaks of the interpenetration of both spheres of life (virtual and physical).

Online collaborative learning can also be analyzed from the perspective of connectivists, who highlight that people navigate the Web and thus learn from the experiences of other Internet users. We cannot experience everything personally, but we can help ourselves to the knowledge, ideas and actions of other people by socializing, sharing, learning and gaining recognition from others (Siemens, 2005). Consequently, Siemens integrates the dual nature of independent learning and community learning; he focuses on the discourse of online communities whose participants pursue similar interests and share their opinions and experiences (Kwiatkowska, 2018, p. 39). Connectivism places learning in the context of continuous expansion and creation of information (Tschofen & Mackness, 2012). To meet these challenges, learners must have

the information skills that will facilitate their functioning in the contemporary world.

Collaboration in an online course is conditioned by the specificity of indirect contact via digital technologies and the individual predispositions of the students and the teacher, the purpose of the action, the organization of the collaboration process, the course resources, and the intensity of interactions. Therefore, there are many factors that are relevant to online collaboration. Some of them have been the subject of research, with scientists using experimental methods in order to prove better outcomes of collaborative learning. Unfortunately, the controlling of various factors in many cases turned out to be impossible and unreliable. Nevertheless, numerous variables have been analyzed, such as the composition of the group, the characteristics of the task, the context of collaboration, and the medium of communication (Ahern et al., 2006; Rovai & Wighting, 2005, p. 108). Such studies show that focusing on collaboration in distance learning is of great importance, not only for achieving the predefined learning outcomes, but, above all, for engaging the learners and developing a sense of responsibility in them. In her study, Kwiatkowska (2018) shows that some students feel that achieving learning outcomes depends on their engagement; hence collaboration in online learning allows them to be more active and more responsible for their learning process. Those students value flexibility and freedom to make their own decisions regarding the education process (e.g. working at their own pace). However, some students feel overwhelmed by the responsibility for their own learning process. This group seems to need more support and guidance.

Based on the research presented above, it seems that the learning community of young adults is not a homogeneous group. Taking all these facts into consideration, the study presented below seeks to fill a gap in the research on the relationship between online collaborative learning and students' personal preferences manifested in their choice of a specific field of study. This paper contributes to the growing literature on collaborative online learning among Polish students and the role of students' motives, as well as the perceived benefits and challenges in the process. The results obtained can support dialogue between academics and learners and help them understand the importance of collaboration. We hope that the conducted research is seen as a contribution to the scientific discussion on this issue. What is of particular importance is the need to build the theoretical foundations of e-education and improve the quality of academic classes carried out remotely. Therefore, undertaking research in this area, in the context of the development of views on teaching and learning, as well as remote education methodology, seems justified.

Material and method

The main cognitive objective of this research was to investigate whether the field of study has any impact on the students' selected preferences in collaborative learning.

Study design and data collection

Our study took place at the Nicolaus Copernicus University in Poland. The research was conducted online. Students received a link to a questionnaire via the University's Survey Research System. Before answering the questions, the respondents received information about the purpose of the research, its structure, and data processing. They had to express their consent to participate in the study. The study was anonymous and could be interrupted at any time. The opening website of the research was displayed over 570 times, with less than 400 people eventually taking part. A total of 393 questionnaires were filled in, of which 153 were complete and could be admitted for further analyses. The research was conducted in May and June 2020, i.e. after approximately 2–3 months of exclusive distance learning (online) at the university.

Non-probability sampling was applied, and participation in the university's remote classes was set as the basic criterion. The diagnostic survey method was employed. To this end, a questionnaire was prepared that featured four groups of questions:

1. Socio-demographic data: gender, age, field and current year of study, place of residence.
2. Assessment of one's own skills and competences in online learning prior to the COVID-19 pandemic and currently (on a 5-point Likert scale).
3. Personal and social motives taken into account in online collaborative learning. The respondents could choose any number of motives and could also add their own.
4. Benefits and difficulties faced by the respondents in online collaborative learning. A nominal scale was used, and the respondents could choose any number of answers.

Verification of the research tool and the research procedure were performed in a pilot study, which ensured the identification of errors, shortcomings and ambiguities. Based on the information obtained, some items in the survey form were redrafted, changed, or deleted.

Characteristics of the groups

Assuming that the choice of the field of study is dictated not only by one's abilities and interests but also by individual predispositions to collaborative learning (e.g. digital skills or motives to take action as part of a team), the research group was divided into four subgroups depending on the field of study and related areas of education. The following groups were identified (Table 1):

1. Exact Sciences – 30 respondents, which accounted for 20% of the entire study group; over one third of them were aged between 18 and 20. As many of them lived in the city as in the countryside (40% each). This was the only group in which males constituted the majority (70%).
2. Economics – 23 respondents (15% of the entire study group). Nearly half of them lived in the

city (47.8%) and over 90% were between 21 and 30 years old. Females constituted the majority in this group (78.3%).

3. Education Sciences – 66 respondents (43% of the entire study group). In this group, the gender disproportion was the highest (98.5% of females vs. 1.5% of males) as these

fields of study are more frequently chosen by women. Nearly half of the respondents lived in the countryside.

4. Humanities – 34 respondents (22% of the entire study group), most of whom lived in towns (29.4%) or cities (50%). The gender ratio was fairly equal (41.2% males vs. 58.8% females).

Table 1
General information about the respondents in the respective groups

		Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)	
		N	%	N	%	N	%	N	%
Gender	M	21	70	5	21.7	1	1.5	14	41.2
	F	9	30	18	78.3	65	98.5	20	58.8
Age group	18–20	11	36.7	2	8.7	22	33.3	11	32.4
	21–30	19	63.3	21	91.3	44	66.7	23	67.6
Current year of study	1	10	33.3	–	–	27	40.9	14	41.2
	2	9	30.0	4	17.4	16	24.2	6	17.6
	3	3	10.0	11	47.8	14	21.2	8	23.5
	4	4	13.3	5	21.7	1	1.5	1	2.9
	5	4	13.3	3	13.0	8	12.1	4	11.8
Place of residence	Countryside	12	40.0	8	34.8	31	47.0	7	20.6
	Towns	6	20.0	4	17.4	18	27.3	10	29.4
	Cities	12	40.0	11	47.8	17	25.8	17	50.0

Source: authors' own work.

The respective fields of study in each group are presented in Table 2.

Table 2
Fields of study in each group

Group	Field of study	N	%
Exact Sciences (N = 30)	Internet of Things Application	1	3.3
	Astronomy	4	13.4
	Automation and Robotics	3	10
	Biotechnology	1	3.3
	Physics	6	20
	Information Technology	15	50
Economics (N = 23)	Economics	8	34.8
	Finance and Accounting	15	65.2
Education Sciences (N = 66)	Psychology	4	6.1
	Speech Therapy	3	4.5
	Pedagogy	41	62.1
	Pre-school and Early School Education	12	18.2
	Special Education	6	9.1

Group	Field of study	N	%
Humanities (N = 34)	English Philology	1	2.9
	Applied Linguistics	10	29.4
	Polish Philology	6	17.7
	History	9	26.5
	History of Art	2	5.9
	Law	1	2.9
	Scandinavian and Baltic Studies	3	8.8
	Military Studies	2	5.9

Source: authors' own work.

Motives, benefits and difficulties in online collaborative...

Results

The analysis was conducted in PS Imago Pro Academic 6 (SPSS for Windows, Version 26). The first step was to identify whether the level of online learning skills has changed over the course of distance learning. A basic descriptive analysis was performed in the identified groups. Then, to look for differences between groups, non-parametric tests (U-Mann Whitney test, chi-square test and Cramér's coefficient) were used.

The first area of interest was the one of students' self-assessed digital skills. The results are presented in Table 3.

The data shows that the respondents (in all groups) assessed their skills and competences in online learning as average, both before the pandemic and currently. The differences (in changes between groups and within the same group) were not statistically significant. However, the direction of changes turned out to be surprising, with the average level

of skills reported as lower in as many as two groups (Table 3).

Following this, an analysis was conducted of the personal and social motives that the respondents found important in online collaborative learning. The results are presented in Tables 4 and 5.

The data in Table 4 shows that students from the identified groups differed in the personal motives that they considered important for online collaborative learning. With respect to two of them, self-efficacy and desire to share, the observed differences turned out to be statistically significant. Consequently, no statistically significant relationship seems to exist between the field of study and the importance of the remaining individual motives. Nevertheless, several conclusions can be drawn based on the obtained results. While the motives related to the feeling of acquiring new knowledge, competences or skills and obtaining information were the most frequently selected in all groups, the frequency of these responses differed

Table 3

Changes in online learning skills

Skills and competences in distance learning	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)		p
	M	SD	M	SD	M	SD	M	SD	
Prior to the COVID-19 pandemic	3.10	0.76	3.26	0.54	3.36	0.82	3.44	0.86	0.311
Currently	3.03	0.96	3.30	0.77	3.32	0.95	3.56	0.82	
Direction of changes	↓		↑		↓		↑		
p	0.592		0.796		0.759		0.363		

Note. Non-parametric tests were used to look for differences.

Source: authors' own work.

Table 4

Personal motives relevant to online collaboration

Motive	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)		χ^2	V_c
	N	%	N	%	N	%	N	%		
Sense of satisfaction	7	33.3	8	34.8	32	48.5	12	35.3	5.972	0.198
Self-efficacy	8	26.7	7	30.4	36	54.5	11	32.4	9.687**	0.252
Feeling of acquiring new knowledge, competences or skills	20	66.7	15	65.2	42	63.6	17	50.0	2.497	0.128
Sense of obtaining information	18	60.0	18	78.3	39	59.1	20	58.8	3.017	0.140
Desire to share	14	46.7	10	43.5	36	54.5	6	17.6	12.662**	0.288
Desire to be better than others	3	10.0	2	8.7	6	9.1	4	11.8	0.219	0.038
Need for domination	1	3.3	–	–	2	3.0	2	5.9	2.138	0.100
Need for control	6	20.0	5	21.7	14	21.2	8	23.5	0.126	0.029

Note. **p<0.01.

Source: authors' own work.

across the groups even by as much as 20%. Similar differences were found with respect to other motives; for example, the sense of satisfaction and self-efficacy were chosen by half of the students from the Education Sciences group (48.5% and 54.5%, respectively) compared with only one third of the respondents in the remaining groups (Table 4). Conversely, the willingness to share turned out to be important for 17.6% of the Humanities students, while the respondents in the other groups indicated this motive over 2.5 times more frequently. The responses were the least varied for the willingness to be better than others and the need for control.

Students could also add their own personal motives. The following were identified: sense of duty, willingness to exchange information, need to get the points for a completed task, perfectionism and utilitarianism, task execution, effective memorizing, and desire to graduate.

Next, social motives important for online collaborative learning were analyzed (Table 5).

The analysis of the data in Table 5 reveals that the students from the respective groups differed not so much in what motives they found important, but in how important they were. The data shows that motives related to being a part of community (i.e., working together, learning from others, and participation for the common good), were the most important in all groups; however, although these three community-related motives were indicated most frequently (in a different order in the Exact Sciences group than in other groups), the frequency with which they were selected was highly varied across the

groups. The observed differences were statistically significant for three motives: participation for the common good, need for support, and learning from others. More specifically, the motive of the common good was important for nearly three fourths of the students of Economics and Education Sciences, half of the respondents from the Humanities group, and slightly more than one third from the Exact Sciences group. A significant diversification was also revealed for the other two motives, e.g. the motive of support was important only to every fifth student of the Humanities group, every third of the Exact Sciences and Economics groups, and almost every second student of the Education Sciences group, while learning from others was important to one third of the students of the Humanities group and over half of the students in the remaining groups.

Similarly to personal motives, the respondents could add their comments and own motives. One person decided to do so; it was an interesting comment regarding the social motives behind collaboration: "If people are willing to collaborate and are truly engaged, ideas, solutions and motives emerge that I would never come up with alone. The group creates an atmosphere of excitement and creativity, which helps us to learn the content."

Another analyzed aspect concerned the respondents' actions taken as part of the online collaborative learning process (Table 6). The students were asked to indicate one option.

When working online, the respondents from the Humanities and the Economics groups focused primarily on finding and collecting information. For the

Table 5
Social motives relevant to online collaboration

Motive	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)		χ^2	V_c
	N	%	N	%	N	%	N	%		
Need to belong	9	30.3	8	34.8	23	34.8	8	23.5	1.49	0.099
Willingness to meet other people	3	10.0	4	17.4	15	22.7	7	20.6	2.27	0.122
Need for support	10	33.3	7	30.4	29	43.9	6	17.6	7.09*	0.215
Participation for the common good	11	36.7	17	73.9	50	75.8	17	50.0	16.95***	0.333
Prestige	–	–	1	4.3	1	1.5	1	2.9	1.52	0.10
Respect among others	5	16.7	2	8.7	8	12.1	3	8.8	1.19	0.088
Desire to succeed	6	20.0	10	43.5	25	37.9	11	32.4	4.03	0.162
Learning from others	16	53.3	13	56.5	38	57.6	10	29.4	7.79*	0.226
Working together for mutual benefit	19	63.3	16	69.6	44	66.7	16	47.1	4.42	0.170
Expecting reciprocity	8	26.7	3	13.0	20	30.3	7	20.6	3.15	0.144

Note. * $p < 0.05$; *** $p < 0.001$.

Source: authors' own work.

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Table 6

Actions taken while learning online

Online learning efforts aimed at:	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)	
	N	%	N	%	N	%	N	%
Finding and collecting information	14	46.7	13	56.5	29	43.9	21	61.7
Interpreting information (reading and understanding it)	15	50.0	6	26.1	26	39.4	7	20.6
Sharing information	1	3.3	4	17.4	6	9.1	2	5.9
Creating information	–	–	–	–	5	7.6	4	11.8

Source: authors' own work.

students of the Exact Sciences and Education Sciences groups, this action was just as important as reading and understanding data. The groups varied considerably in terms of sharing information; this option was most frequently selected by students of the Economics group and least frequently by those from the Exact Sciences group. In addition, only the respondents from the Education Sciences and Humanities groups admitted to creating information when learning online.

The respondents were also asked whether they felt a greater responsibility for the published group task (Table 7).

When performing group tasks, most of the respondents (regardless of the group) had a feeling of greater responsibility for their work at the stage of its publication. However, the analysis also shows that approximately a quarter of the students from the Exact Sciences and Humanities groups, and one fifth of the students from the Education Sciences group were unable to assess whether or not such an increase occurred in their case.

Another issue addressed in the study was that of the benefits from, and difficulties in, online collaborative learning faced by the respondents (Tables 8 and 9). As in the case of the personal and social mo-

tives, the responses to these questions also differed across the groups. Most respondents admitted that online collaboration allowed them to improve their teamwork and communication skills. While these two options were marked by the highest number of the students regardless of the group, the differences between the groups were significant, reaching 40%. The respondents varied considerably with reference to improved time management or negotiation skills; these responses were indicated by only 10% of the students from the Exact Sciences (both answers) and Economics (negotiation skills) groups. Enhanced technical skills turned out to be the only predefined benefit for which no statistically significant differences were found.

Despite their considerable diversity, the only responses regarding the difficulties (Table 9) in online collaborative learning that turned out to be statistically significant were the lack of a person coordinating the work of the group and the lack of involvement from the participants in a joint project. The former problem was reported by about one fifth of the students from the Exact Sciences and Economics groups, and by nearly twice as many in the remaining groups. The latter difficulty, i.e. lack of engagement, concerned

Table 7

Increased responsibility after publishing a group task according to the respondents

Response	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)	
	N	%	N	%	N	%	N	%
I strongly disagree	2	6.7	–	–	2	3.0	2	5.9
I do not agree	4	13.3	3	13.0	10	15.2	3	8.8
I have no opinion	8	26.7	2	8.7	13	19.7	9	26.5
I agree	14	46.7	16	69.6	28	42.4	16	47.1
I definitely agree	2	6.7	2	8.7	13	19.7	4	11.8
<i>M</i>	3.33		3.74		3.61		3.5	
<i>SD</i>	1.03		0.81		1.06		1.02	
<i>p</i>	0.45							

Source: authors' own work.

Table 8

Collaborative learning – benefits reported by the respondents

Benefits from learning	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)		χ^2	V_c
	N	%	N	%	N	%	N	%		
Improved negotiation skills	3	10.0	8	34.8	19	28.8	3	8.8	10.046*	0.256
Improved teamwork skills	16	53.3	20	87.0	44	66.7	16	47.1	10.918*	0.267
Improved communication skills	15	50.0	17	73.9	51	77.3	19	55.9	9.414*	0.248
Improved time management	3	10.0	15	65.2	36	54.5	19	55.9	22.072***	0.380
Enhanced technical skills	11	36.7	9	39.1	29	43.9	8	23.5	4.041	0.163

Note. * $p < 0.05$; *** $p < 0.001$.

Source: authors' own work.

Table 9

Collaborative learning – problems reported by the respondents

Problems	Exact Sciences (N = 30)		Economics (N = 23)		Education Sciences (N = 66)		Humanities (N = 34)		χ^2	V_c
	N	%	N	%	N	%	N	%		
Increased ambiguity in communication	7	23.3	5	21.7	18	27.3	10	29.4	0.585	0.062
Extended waiting time for a response	16	53.3	14	60.9	48	72.7	22	64.7	3.710	0.156
Lack of a person coordinating the work of the group	6	20.0	4	17.4	26	39.4	13	38.2	6.504*	0.206
Assessment of the participation in, and contribution to, a task	4	13.3	7	30.4	23	34.8	11	32.4	4.828	0.178
Technical problems	13	43.3	11	47.8	34	51.5	20	58.8	1.638	0.103
Lack of involvement from the participants in a joint project	4	13.3	10	43.5	39	59.1	18	52.9	18.127***	0.344
Using someone's idea without his/her consent, or the fear of this	1	3.3	1	4.3	6	9.1	2	5.9	1.468	0.096
Need to adapt to others	4	13.3	6	26.1	23	34.8	11	32.4	4.073	0.180
Reluctance to take responsibility for the final result	6	20.0	3	13.0	15	22.7	13	38.2	5.581	0.191

Note. * $p < 0.05$; *** $p < 0.001$.

Source: authors' own work.

only one in 10 students in the Exact Sciences group while in the remaining groups it was reported over three up to nearly five times as frequently.

Furthermore, most respondents in each group struggled with difficulties such as extended waiting time for a response, or technical problems. On the other hand, the problem of assessing the participation in, and contribution to, a task, concerned fewer students of the Exact Sciences group, while reluctance to take responsibility for the final result was reported by fewer students from the Economics group.

Discussion

The analysis of the obtained results shows that a collaborative learning group should not be treated as homogeneous, while presenting such a group with the same educational tasks, regardless of the field of study, seems to be a misunderstanding. The groups analyzed in this study differed not only in terms of their place of residence (which may, for example, determine their access to broadband Internet) and the gender ratio, but above all in their approach to

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online collaborative learning. When summarizing and discussing these results, several important issues should be highlighted.

Firstly, it is surprising that, despite several months of distance learning, no (statistically significant) increase has been observed in digital competences. In fact, according to some students, their skills have declined. Two explanations for this result seem probable and worth further study. The first assumes that the online courses were of a poor quality – rather than teach new skills, they were based on a few selected activities, giving the students the feeling of a lack of progress. The second explanation may be that, while studying online, the students have realized their own digital shortcomings, despite the fact that they use modern technologies on a daily basis. The situation of isolation and distance learning has forced them to familiarize themselves with previously unknown systems and applications, thus verifying their actual competences. The everyday use of modern technological solutions, including social media, is not a guarantee of having the necessary online learning skills, as in the study by Josefsson et al. (2015). Their research showed that there are three main roles while using social media: the student, the private, and the professional roles. Based on these findings, Allan (2016) encourages universities to show students how to use technology for learning. Moreover, researchers (Allan, 2016; Josefsson et al., 2015) believe that caution is needed while assuming that students' off-campus digital skills will be sufficient for studying. It seems very interesting to investigate further the reasons behind the decline or the lack of increase in digital skills among students.

Secondly, the majority of the students felt a greater responsibility for a group task after its publication – most likely because this is when their activities are no longer anonymous. However, in each of the identified groups, there were also students who either disagreed with this statement or had no opinion on the issue. It can be assumed that this applies to people who either engage in group activities at every stage (feeling equally responsible for them throughout the project), or, on the contrary, do not identify themselves with the currently developed solution and push the responsibility onto others.

To sum up, when considering the problem of collaboration in education – regardless of its form (in-class or online) – two types of associations come to mind. On the one hand, it is all about a new challenge, joint creative work, group integration, new quality in education, learning through experience, and getting to know the participants of a task or a project better. Secondly, it is connected with organizational requirements, the need to moderate the collaboration process, unequal participation and engagement, problems with shared responsibility, and difficulties in assessing the contribution and content created by learners. Participants of online courses are more prone to feeling misunderstood, isolated and lonely. Therefore, if a collaborative learning experience is

to be satisfactory, it is essential to deal with the said requirements and limitations.

Learning online should become a process of constructing knowledge together, wherein collaboration, communication, and digital skills are used and improved as part of learners' personal development. Naturally, this is not an easy task, and it requires dedication, time, willpower, and persistence from all actors involved; nevertheless, it is worth the effort to make online learning meaningful and valuable. In addition, online teaching is becoming an integral part of educational institutions and generally the life of learning communities. Therefore, it is necessary to acknowledge its different conditions, methodologies, and outcomes (Kwiatkowska, 2018, p. 16).

Changes in academic education will be determined by the attitude of lecturers who will promote the culture of collaborative learning, and accept and implement present-day teaching and learning technologies, thus responding to the needs of the modern world. Undoubtedly, teachers and academics play a vital role in initiating online collaborative learning and engaging people in this experience. Their effort and knowledge of the necessary tools and practices can contribute to the successful achievement of the learning objectives, greater efficiency and more complete outcomes. Research shows that without teachers' moderation, learners do not engage in a discussion, skip important stages of work, are not sufficiently involved in the project, and do not use their own knowledge and skills (Gillies, 2016, p. 44).

By applying the principle of collaboration in learning, based on dialogue and teamwork, teachers contribute to establishing and strengthening the relationships among learners, thus engaging and motivating their students to undertake further work. To this end, teachers need to know how to use the technology and need to be participants of the virtual world to which they introduce their criticism, reflection, and extensive experience. Research by Bellal and Nader (2014) confirms that online learning requires learning skills, communication skills, collaborative skills, and digital skills. Promoting and fostering a culture of teamwork (sharing, collaboration, acting together) can motivate online learners to share their insights and experiences with others.

Naturally, the research presented in this article is not without its limitations. Firstly, a large number of questionnaires were incomplete and there were many people who did not decide to take part in the study. It is possible that some of them were tired of isolation, constant remote work, and the lack of face-to-face contact. The study was conducted in a period of constant changes when it was not clear if and when students would return to regular classes. Secondly, this research focused on selected aspects of collaboration in distance learning; there are many more to be explored. Furthermore, some of the questions (e.g. regarding the actions taken in online learning – Table 6) could be asked in a form that enables, for example, the ranking of responses. It is

also worth looking for other, e.g. personality-based, factors that determine students' preferences in online collaborative learning.

Last but not least, a larger sample with representatives of more fields of study could provide statistical confirmation of the presented results. The study could therefore be repeated on a group of students at different levels of education. It would also be worth including the qualitative paradigm. With a larger sample size, any possible differences with respect to the year of study could also be verified.

Conclusions

The current study contributes to the growing body of literature on online collaborative learning. The results demonstrate that students from four areas (Exact Sciences, Economics, Education Sciences and Humanities) differ in how they work in online courses requiring collaboration. The main differences were associated with the personal and social motives that were important to them. Our findings may prove important to authors of academic online courses who should focus on developing the said competences, preparing tasks that require teamwork, and improving collaboration in project work.

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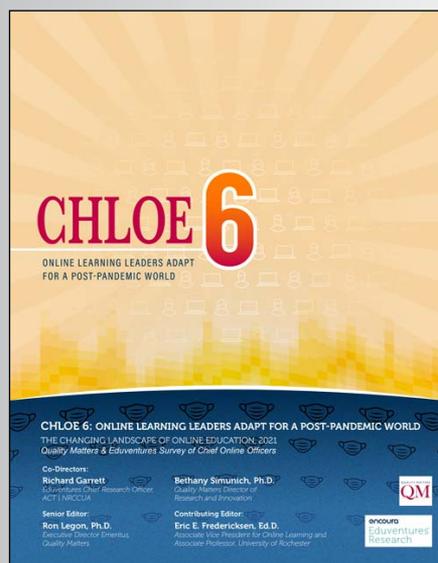
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WE RECOMMEND

CHLOE 6 report: Online Learning Leaders Adapt for a Post-Pandemic World



The 2021 report, authored by Quality Matters and Eduventures® Research, tracks how institutions are reassessing their priorities related to online learning and shifting focus to ed tech enhancements, faculty professional development and online quality. The report was compiled from responses from 422 chief online officers (COO) representing 2- and 4-year colleges and universities.

More than half of the survey respondents (57%) across all sectors of higher education, including predominantly in-person institutions, indicated that, going forward, the pandemic experience is leading to a positive reassessment of institutional priorities related to online learning. Key survey findings from the 69-page report include:

- An elevated commitment to online learning quality assurance goals, including having courses meet quality standards, supported by a commitment to faculty professional development.
- An average 10-15% increase across institutions in online professional development and student orientation to online study to serve formerly in-person faculty and students.
- The largest yearly increases ever in ed tech investment in 2020 and 2021 across all sectors of higher ed.

Future CHLOE reports will track whether the momentum stimulated by the pandemic has lasting effects.

From the official Quality Matters website, the report can be downloaded for free at: <https://www.qualitymatters.org/qa-resources/resource-center/articles-resources/CHLOE-6-report-2021>



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Challenges of administering university examinations remotely during the COVID-19 pandemic

Abstract

The article presents the results of a research questionnaire conducted among students and lecturers after the first, and repeated after the second, exam session during the pandemic crisis as this was the first time the examinations were conducted by distance education at The Maria Grzegorzewska University (Warsaw, Poland). Lecturers see the advantages of remote examination in the technological possibilities of conducting examinations (automation in checking and assessing the tests and archiving the results), time savings (immediate availability of results, flexibility of examination dates), and organizational improvements. Students indicate the comfort of writing the exam in a friendly environment, which reduces stress, and appreciate the possibility of obtaining results quickly and the need to spend less time on the exam itself. In the case of disadvantages of remote exams, lecturers indicate a lack of control over the independence and integrity of students, and students complain about the stringent time constraints, distractors and stress, as well as the level of the exam (both higher and lower compared to the level of traditional exams) and the adequacy of the grades obtained. Both groups consider technical problems that arise during the exam to be severe. Twenty percent of students admit to using unauthorized assistance during tests and exams. Academic teachers try to reduce the dependence of students by choosing an appropriate form of the exam (problem tasks, oral exams, open-ended questions, test variants), using special strategies (comparing students' work, control questions, looking for parts of final papers on the Internet), and using technical solutions (requirement of turning on the camera, checking the metadata of files, the need to document work). The search for an effective and appropriate method of verification of learning outcomes is ongoing.

Keywords: crisis remote education, remote examinations, COVID-19, e-learning, higher education

Introduction

The SARS-CoV-2 coronavirus pandemic has forced the introduction of emergency remote education among many colleges and universities throughout the world (Romaniuk & Łukasiewicz-Wieleba, 2020c). On the basis of the applicable legal solutions¹, despite the systemic weaknesses (Kobylarek, 2020), universities in Poland developed principles of conducting classes, and organized technical support and training for lecturers (Romaniuk & Łukasiewicz-Wieleba, 2020a). Academic teachers adapted the classes to the remote mode of conduct (Romaniuk et al., 2020), using many modern

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¹ Until the pandemic, the implementation of online classes and exams was regulated by the Regulation of the Minister of Science and Higher Education of September 25, 2007, on the conditions that must be met for teaching higher education classes to be conducted with the use of distance learning methods and techniques. This act stipulated that the university must ensure ongoing monitoring of progress, verification of knowledge and skills, including in the form of examinations, in a manner that is consistent with the education standards for the given field of study. At the same time, tests and examinations should take place at the university's premises. The Act of July 20, 2018, Law on Higher Education and Science, Art. 76a (amended by the Act of 19 June 2020 on interest subsidies for bank loans granted to entrepreneurs affected by COVID-19 and on simplified proceedings for approval of an arrangement in connection with the occurrence of COVID-19), allows for tests and examinations, including diploma exams, using electronic means of communication.

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solutions (Czerski, 2020) and applications (Pokrzycka, 2021). Students faced a maturity test in the form of independent learning and systematic work (Romaniuk & Łukasiewicz-Wieleba, 2020b). Crisis remote education, despite its introduction shortly after the outbreak of the pandemic and putting teachers and students in a completely new role (Wyrwa et al., 2020), was sufficiently refined and was based on previous e-learning experiences (Romaniuk, 2015b) and knowledge about the level of IT competences of students, adequate to participate in this form of learning (Romaniuk, 2015a).

The experience of the first semester of distance learning allowed for the development and implementation of recommendations and actions that increased the quality of classes and the level of education in the next semester (Romaniuk & Łukasiewicz-Wieleba, 2020c), among others thanks to the evaluation of online classes (Dobińska & Okólska, 2020). Many solutions that had a positive impact on the remote education process (Para, 2021), student activation (Rybalko et al., 2020), and the sense of community (Dougherty & Shinozaki Dougherty, 2020) were successfully implemented. At this point, we have two semesters of distance learning behind us. It also means a lot of experience related to checking the achieved learning outcomes, i.e. the knowledge, skills and social competences of students. While various forms of exams conducted in the traditional way are imperfect and there has been a discussion for years about the superiority of one method of checking knowledge over another, remote examination on such a scale is something completely unprecedented (Kraśniewski, 2020).

During the research conducted so far, both lecturers (Romaniuk & Łukasiewicz-Wieleba, 2020a) and students (Romaniuk & Łukasiewicz-Wieleba, 2020b) have drawn attention to the problem of examining and passing the exams. The former were looking for an optimal way to check what the students understood from the classes, while the latter were afraid of unprecedented methods of controlling the resources of their knowledge and skills (Eltayeb et al., 2020). The problem of checking the learning outcomes concerns midterms, subject examinations at the end of the semester and diploma examinations at each university.

Remote examination at universities

Remote examination via the Internet is a multifaceted problem in which there are three very important categories of situations and behavior – the examiner, the exam and the examinee. The category related to the examiner includes the willingness to reliably test knowledge and skills, and the need to prepare an accurate exam on a specific material, provide understandable instructions on solving tasks, and give grades. The examination category includes the method of conducting the examination (e.g. simultaneously, in a specific time window, in the form of a project to be done), the method of checking knowledge (e.g. single or multiple-choice test, open-ended questions, oral

examination), checking the identity of the examinee and checking the independence and fairness of the exam process. The examinee category includes preparation for the remote exam, meeting the conditions for taking the exam, taking the exam, and receiving the results. Additional difficulties arise in the case of the necessity to conduct practical examinations.

When analyzing the possibilities that are associated with conducting online exams, several strategies are adopted. The first is to conduct the exams in the same way as in the stationary mode; it is a faithful reproduction of the examination procedure with the use of online tools. Another involves the use of online proctoring technology, in which the examiners while monitoring the course of the exam, stop it when they detect and identify student fraud. For this purpose, webcams and special software are used, thanks to which images from cameras and the computer desktop, sound or characters typed on the keyboard are collected. Their advanced versions, which allow for some automatism and the possibility of eliminating student dishonesty, have high technical requirements, especially a high-speed Internet connection, without which students cannot take the exam. These systems have been criticized for collecting a lot of data, including images of students. Moreover, this method of examination increases the level of stress in the examinees. The third strategy is to write exams that include permission to use books or other materials (open book exams), which in combination with, for example, the camera turned on or checking the work for plagiarism, gives good results and does not burden the system. The fourth strategy relates to rescheduling exams, i.e. postponing them until a more favorable epidemiological situation occurs, which is particularly important in the case of exams using, for example, specialized hardware or software. Recent strategies refer to changing the grading system or even canceling exams in a given six-month period (Puchkov et al., 2020).

Until recently, the level of digital dishonesty was lower than that of the analog one (Friedman et al., 2016), although other researchers indicated higher scores during unsupervised testing of students (Carstairs & Myors, 2009). Therefore, various methods of controlling the examination process are postulated. For example, checking the identity of the examinee can be done by logging in with a unique login and password, taking the exam synchronously with the camera turned on and after presenting the student ID, and even by using biometric authorization. A decade ago, introducing the necessary online examination control procedures was proposed, which included the requirement to take the exam as a whole group at one time; the ability to log into the exam only in a specific time window; randomizing the order of questions and answers; having to answer questions one by one, without going back to previous questions; limiting the time limit of completing exams; the possibility of logging in to the exam only once; the use of software that prevents the copying of examination content; and

changing a minimum 1/3 of questions for each exam date (Cluskey et al., 2011). Some propose the introduction of a continuous assessment of student progress, which may in some cases even lead to dropping the final exam while maintaining a flexible and inclusive approach to students (García-Peñalvo et al., 2021). Others propose cheating detection systems during remote examination using eye-tracking (Bawarith et al., 2017) or analyzing student behavior (Balderas & Caballero-Hernández, 2020). No way of examining, whether online or live, is completely immune to cheating (Tuah & Naing, 2021), so it is a constant battle between examiners and examinees.

Remote exams are more stressful for some students, due to the fear of possible technical problems, the limitation of time to write the exam and the method of navigating through tasks, but also the fear of whether the exam will cover the material from the classes and whether something unexpected will happen at home while writing the exam (Elsalem et al., 2020). Even open book exams raise doubts among students who, on the one hand, can legally search for information in books, notes and presentations during the exam, and on the other hand, do not know whether the examination questions will be extremely detailed and require not only basic knowledge but also break through the enormity of information in a short time (Jervis & Brown, 2020). Research indicates that there are no significant differences in the results obtained in open book exams compared to traditional exams, during which additional materials cannot be used (Brightwell et al., 2004). More recent analyses even suggest the use of a blended approach that includes both types of examinations (OBEs – open book examinations, CBEs – closed book examinations) (Durning et al., 2016), or prefer OBE as a solution that promotes critical thinking, is more engaging, requires structured thinking, is stimulating for work, reduces student stress, and develops cognition (Johanns et al., 2017). A significant increase in the number of searches for specific terms in Google correlating with the date and subject of the exam in a specific subject may, depending on whether the exam is OBE or CBE, indicate cheating or an attempt to provide better answers (Bilen & Matros, 2021). The latest data show that students who were not supervised during the exam obtained more than 11% higher results than students who were supervised. The effect was greater with live personal surveillance than with on-line monitoring of students (Vazquez et al., 2021). OBEs can be a viable alternative to CBEs if the questions properly assess the integration and synthesis of knowledge rather than recall it (Sam et al., 2020). Students rate OBEs as having a positive impact on their learning quality, which may lead to greater learning engagement and a deeper understanding of the content, rather than simply memorizing it (Johnston & O'Farrell, 2020). OBEs may allow for a better assessment of the understanding of the topic (Mohanna & Patel, 2016). To reduce the cognitive load of students taking the exam, all you need is solid instruction on the technical

layer of the exam and appropriate IT competences, as well as easily accessible and responsive technical support (Cramp et al., 2019). An additional advantage of remote exams, according to students, is the ability to get results immediately (Tilak et al., 2020).

Remote examination at The Maria Grzegorzewska University

The Maria Grzegorzewska University has developed guidelines for teachers and students relating to the examination process. Teachers can choose the form of the examination in such a way that they can adequately assess the learning outcomes. They can choose the form of oral or written exams, using the MS Teams and Forms applications. The tasks of teachers who want to use technical solutions during exams include: determining the method of access to the exam, its duration, the method of publishing the results, and informing students about the technical assumptions of the exam so that they can prepare for it. During the exam, the teacher should remind the examinees to keep an eye on the time so that they can submit the test before the system locks them out. Teachers are also expected to be available during the exam either on MS Teams or through the University e-mail to respond to difficult situations. The teachers also decide how to inform the students about the results (*Guidelines for academic teachers...*, 2020). It is worth noting that The Maria Grzegorzewska University IT and Media Department provides assistance to teachers, including helping to check the number and time of logging into the MS Teams or MS Forms application of individual students.

In the guidelines for students, attention is paid to the proper preparation of a computer or device with Internet access for the exam. The key is the ability to provide answers, including by selecting or entering text. It is recommended to limit the open applications only to those necessary for the exam, synchronize the device with Internet time, log in with an academic account, control the time allocated for responses in the case of time-limited tests in order to be able to send answers in advance, and keep the lecturer informed about technical problems (*Procedure for students...*, 2020).

Training materials and extended instructions for exams, including diploma exams, were placed in the Repository of auxiliary materials for The Maria Grzegorzewska University employees, available on the Internet.

Methodological assumptions

The conducted research concerned the experiences of students and academic teachers related to the preparation, process, and passing of remote examinations. The study aimed to compare the opinions on remote examinations from the perspective of the examiners and examinees. The subject of the research was the statements of students and lecturers

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regarding remote examinations. The legitimacy of the research is dictated by the lack of previous analyses of the raised issues.

The research used the diagnostic survey method. The research was carried out twice: first (1) in June and July 2020, after the end of the first semester of remote education, and again (2) in February 2021 – after the end of the next semester. Different questionnaires for students and lecturers were prepared for each study, but some of them had the same questions. The questionnaires consisted of closed and open-ended questions. Responses were collected using Google Forms. The presented results are part of a larger study because as a whole they had a more general-purpose related to investigating many aspects of the functioning of distance education in The Maria Grzegorzewska University. This article presents an analysis of respondents' statements related only to questions associated with online exams. The categorization of the data obtained in the open questions was carried out by two experts in line with the competent judges method.

Sample description

Two groups of students and two groups of lecturers from The Maria Grzegorzewska University took part in the survey. The first groups of lecturers and students participated in the study at the end of the 2019/2020 summer semester and consisted of 65 lecturers and 515 students. The second part of the study carried out at the end of the 2020/2021 winter semester and involved 77 lecturers and 496 students. In the first study, there were indications regarding different perspectives on the issue of remote knowledge assessment – this research provided the impetus to explore the topic further. The second study allowed us to capture the change, broaden the spectrum of searches and deepen our knowledge of the topic.

Findings

In the first study (1), lecturers were asked about the methods of checking the assumed learning outcomes. The respondents declared that in order to check the learning outcomes, they most often use homework (50 people, 76.9%), final assignments (45 people, 69.2%), an online written exam (27 people, 41.5%), and an online oral exam (14 people, 21.5%). At the same time, in the open question about the disadvantages of remote education, there were statements about the inability to reliably verify students' knowledge, and lack of independence of their work.

In turn, in the first study (1) among students, in the open question related to the advantages of remote education, there were single declarations about the possibility of taking online exams and the variety of forms of testing introduced by teachers. At the same time, however, in an open question about the disadvantages of this type of education, 45 people expressed critical comments about the exams. Also, 19 respondents (3.69%) stated that the conditions for

passing exams were unclear, 16 people (3.11%) indicated a high level of stress related to uncertainty during the exam (e.g. possibility of connection failure, too short time), 9 people (1.75%) considered the conditions for passing and examinations less favorable, and one person indicated difficulties related to credibility. In turn, in the open question about difficulties related to distance education, 21 students (4.08%) also referred to the verification of knowledge and skills. In this subset, 9 people (1.75%) considered that the examinations in this form do not check the actually acquired knowledge; 6 people (1.17%) said that the organization of exams is not transparent, and they are not credible, 3 people (0.58%) said that the organization was bad. Some of the students referred to the answer key during the tests (which was not understandable for them), the lack of appreciation of independence (so students felt "encouraged" to cheat during exams), and maladjustment to people with dyslexia. These critical statements of students are illustrated by the words "for me, it will not be a credible assessment of my substantive knowledge, but only a test of the efficiency of my equipment and IT competences, and an assessment of the quality of the Internet connection." The above information became an incentive to expand the topic related to the examination in the next semester.

The second study (2) explored the issues related to the remote examination. It is worth noting that although the questions were formulated generally (What do you think are the biggest advantages/disadvantages of examining and passing subjects remotely?), the answers focused mainly on the form of test exams, using the possibilities of MS Forms. Only a few respondents commented on other online examination options available to lecturers, such as oral exams or examining through an individual or group project.

And so, in an open question, the respondents (lecturers and students) were asked to mention the advantages of remote examination. The responses were categorized and are presented in Table 1.

For the surveyed lecturers, the most important advantages of online exams relate to:

- technological possibilities of conducting exams (54.55%), such as automation in checking and assessing tests, archiving results, organizing tasks in MS Teams, available MS Forms possibilities;
- time management (32.47%): achieving quick results, flexible examination dates and better time management;
- organizational improvements (32.47%): easier checking of papers, mobility, no need to print papers, better presentation of results, no need to book an exam room, better monitoring of students' work, greater comfort of conducting the exam;
- greater comfort (7.79%): no need to come to the university, less stress for students, comfortable exam conduct;
- level of the exam (6.49%): its transparency, objectivity of grades.

Table 1*Advantages of remote examination in the opinion of lecturers and students*

Response category	Lecturers		Students	
	N = 77	Percent	N = 496	Percent
use of technological solutions	42	54.55%	28	5.65%
time issues	25	32.47%	93	18.75%
organizational improvements	21	27.27%	11	2.22%
no advantages	14	18.18%	44	8.87%
greater comfort	6	7.79%	419	84.48%
exam level	5	6.49%	49	9.88%
no answer	3	3.90%	13	2.62%
no opinion	1	1.30%	19	3.83%
no differences between remote and traditional examinations	1	1.30%	7	1.41%
other	1	1.30%	3	0.60%
form of the exam	–	–	37	7.46%

Source: authors' own work.

The above categories are illustrated by the lecturers' statements: "Students do not have to wait for hours outside the classroom for an individual oral exam, they and I save time"; "Everything happens automatically in the case of tests, there is a summary of the points scored. Written works are stored on the computer. You don't have to stuff your documents into a small number of tiny cabinets"; "It is easier to perform both test and essay papers, it is easier to present and discuss the results."

The distribution of response categories among students is different. They consider the most important:

- comfort (84.48%): associated with being at home and writing an exam in a friendly environment, which reduces the stress usually associated with such events, better concentration, no need to travel, including no concern for delays in commuting to the university, greater peace of mind, no exposure to the "lecturer's eyesight" during the exam, no stress from other students, mobility, safety during illness, greater freedom, no pressure, more rest, the possibility of less workload for less important subjects;
- time management (18.75%): more time to prepare, faster exam results, more convenient dates, shorter duration, time savings;
- exam level (9.88%): easier exams and better grades, use of study scripts, notes and teaching aids, possibility to cheat;
- change of the forms of examining (7.46%): more favorable and accessible for students, replacement of oral exams with written assignments and projects, the possibility of passing the exam in the preferred form of a test, clarity of instructions;
- technological solutions (5.65%): the ability to work on a computer, easy way to work in MS Forms, students' works are easier to check for

lecturers, easier correction of errors, contact with the lecturer in case of problems, ability to turn off the camera or to record lectures;

- organizational improvements (2.22%): better organization, efficiency in conducting exams, no waste of paper, inability to rewrite work from other people, easier way of returning finished work, use of open book exams.

Examples of statements illustrating the above categories are as follows: "We have more time to prepare final papers due to the time saved on commuting. It is easier to arrange an exam date that is convenient for everyone because you do not have to book rooms at the university"; "We are not exposed to the lecturer's eyesight, which increases the stress level, which makes us forget a lot of material during the exam"; "Teachers often propose different activities to be exempted from the exam or change the form of exam. Instead of examinations or tests, papers to be prepared are often proposed, individually or in groups, on the basis of which grades are given."

A much higher percentage of lecturers (18.18%) than students (8.87%) do not see the advantages of online examination.

An open-ended question related to the disadvantages of online exams was developed in a similar way. The responses of the respondents were categorized and are shown in Table 2.

In this respect, there is a greater discrepancy between the categories perceived by lecturers and students. For lecturers, the most important disadvantages are:

- lack of control over the exams (77.92%), i.e. no control over the independence and honesty of students and the course of the exam itself;
- technical problems (14.29%): limitations resulting from the available technical solutions, including technical problems in general, logging

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Table 2

Disadvantages of remote examination in the opinion of lecturers and students

Response category	Lecturers		Students	
	N = 77	Percent	N = 496	Percent
no control	60	77.92%	–	–
technical problems	11	14.29%	320	64.52%
other	7	9.09%	–	–
no answer	1	1.30%	15	3.02%
no difference	1	1.30%	1	0.20%
time	–	–	177	35.69%
difficulties	–	–	127	25.60%
level of exams	–	–	99	19.96%
lecturer's attitude	–	–	58	11.69%
no defects	–	–	33	6.65%
hard to say	–	–	7	1.41%

Source: authors' own work.

in from accounts outside the university domain, cheating through software plugins, lack of good hardware and support, the need to prepare various versions of exams and limitations in creating tests by MS Forms, the need to archive works, differences in access to the network, hardware and software;

- others (9.09%), which include such elements as difficulty of checking knowledge, reproduction, ineffectiveness in group work, little time for oral exams, no personal contact, no objectivity, focusing students on the ability to solve tests.

Examples of teachers' statements about the disadvantages of online exams are as follows: "Awareness that some students cheat and get a higher score than they deserve"; "Inability to control the course of the exam (students cooperate, download answers from various sources, manipulate the lecturer by referring to technical problems)"; "Most of the exams (for lectures) are tests, and this is not the best way to verify the learning outcomes – most often it only verifies knowledge"; "I have the feeling that I am participating in an arms race – who will outsmart whom? I feel bad in this race. At the same time, I know that the cheating impediments that MS Forms propose are nonexistent, so I am in a losing position in this race."

For students, the most severe are:

- technical problems (64.52%): concerns about these issues, limitations of the Internet connection, hardware and software that are beyond the respondents' control, the need to be online during the exam, including having the camera turned on, not being able to view the exam, difficulties with verification of knowledge during such exams, "no mercy" in counting points by the computer and difficulty in passing the exam over the phone;

- time constraints related to completing and sending tasks within the time limit set by the teacher (35.69%);
- various difficulties, distractions and stress accompanying exams (25.60%), which include: a significant number of distractions, no separation between home and university, the need for (slower) typing using the keyboard, lack of skill in passing such exams, less motivation to learn (because you can cheat), lack of personal contact during the oral exam, feeling of constant surveillance, taking the exam time of focus by other students by interrupting the silence and asking questions, chaos during the exam, organizational difficulties, long waiting period for the oral exam, lack of equal opportunities, eye strain, lack of material repetition before the exam;

- level of exams (19.96%) – both lower and higher levels (respondents' answers are polarized) than during the traditional exams; the arguments discussed here are cheating, the injustice of grades, the inadequacy of the test form, fewer opportunities to pass oral exams, domination of memory-based exams, the mismatch between questions and the form of remote exams, greater number of written works, limited variety of questions and places for answers, lack of knowledge of the graduates in the future;
- attitude of lecturers (11.69%), which include: no direct contact, which in case of problems would allow for explaining difficulties, unfounded accusations, unclear or variable evaluation systems, low IT competences, lack of understanding, lack of feedback, lack of commitment, testing information that was not discussed during classes, long waiting time for exam results, treating students as objects, misleading students, untimely results, failure to take into account students' activity in the final assessment.

Examples of students' statements that illustrate problems related to their perception of online exams are as follows: "there is a possibility of the internet connection breaking and there is a risk that we will be logged out of the exam or that the answers will not be registered or will not be sent to the lecturer"; "Unfortunately, most lecturers believe that each student does not act honestly when writing an exam"; "The student learns alone or is taught by other students; the lecturer's task is to test knowledge and watch over, not to teach".

Systems for conducting written or test-based examinations that make it impossible to send work when the time has passed. Sometimes they cause great

stress for students because technical problems often cause delays. In the traditional form, it is not possible for the work to simply disappear, in the remote form it is very easy. The grades may also not accurately represent the knowledge of students, as some use additional aids when passing.

Among the lecturers, there are no people who do not see any disadvantages of this method of examination, while in the group of students 6.65% say that there are no disadvantages.

Subsequently, the students were asked whether they used unauthorized aids during tests and exams. This fact was only partially confirmed (95 people, 19.2%). The vast majority of students (401 people, 80.8%) declared that they approached the midterms and examinations honestly.

However, in the opinion of academic teachers, the lack of independence during exams is a significant problem. Therefore, many take special steps to limit or prevent students from resorting to unauthorized assistance. To this open question, 8 people (1.39%) answered that they did not check the independence of students, 7 (9.09%) that there was no such possibility, 3 did not answer, and one said that they did the same as in the case of stationary exams. On the other hand, the most important activities contributing to reducing the lack of independence of students during online examinations include:

- choosing an appropriate form of the exam (51; 66.23%), e.g. using problematic and reflective tasks, referring to one's own experience, oral exams, open questions, various test variants;
- using special strategies (19; 24.68%), such as: copying text fragments and searching for them on the Internet, comparing students' works, control questions addressed to students;
- application of technical solutions (17; 22.08%), incl. the requirement to turn on cameras and microphones, checking the editing time of the file and data about the author, the requirement to document, etc.

Some reflections on the online examination can also be found in the additional statements of lecturers and students that appeared in the last question of the survey, relating to other comments that the respondents wanted to share with the researchers. Among them, there were, among others, teachers' demands to return to stationary examination, but with the use of modern media, or suggestions of using more diverse software than from the Microsoft package, while leaving the implementation of subjects in remote mode. On the other hand, students pointed out that the lecturers' efforts preventing them from cheating, in particular limiting the time to answer and send the test, have the opposite effect, as they force them to quickly find the correct answer, not allowing reflection on the question. Students also proposed their own solutions related to examinations, e.g. they suggested using more independent projects instead of examinations, they appealed for more forbearance

from the lecturers, in particular extending the duration of examinations, but they also expected lecturers to take more effective measures to reduce cheating by other students.

Conclusion

The research showed a lack of clarity in the assessment of the examination process and its results by academic teachers and APS students.

It became evident that lecturers eagerly used the technological possibilities offered by online tests, perhaps not fully aware of how laborious it would be and to what extent this form would be adequate for checking the learning outcomes assumed in the subjects. Technical capabilities, such as time constraints for individual questions or the entire test, have become the dominant means of preventing cheating by students. Thus, the exam turned into a race between teachers and students, based on their technical efficiency. Teachers' actions even provoke students to use unauthorized help while passing exams, as students fear that they will not be able to answer questions on their own within the set time limit. The lack of previous experience in preparing and conducting online exams did not prepare the lecturers for the multitude of challenges they face, and the training conducted at The Maria Grzegorzewska University focused mainly on the availability of technical solutions within the selected MS Teams platform. The problem of student independence is important not only for The Maria Grzegorzewska University teachers. Each university has a group of lecturers who believe that remote examinations do not allow the verification of students' independence, and thus also the achieved learning outcomes. This is especially true as the very situation of the remote exam prompts students to cheat, because not only do they feel that they are not effectively supervised, they are also encouraged by their colleagues to use technological solutions to help each other. Hence, online exams generate more cheating opportunities than traditional exams, while forcing teachers to be creative in preparing exams and preventing cheating during them (Wahid & Farooq, 2020).

At the university under study, only one person declared using the open book exams strategy, in which questions are formulated in such a way that the student demonstrates the achievement of the assumed learning outcomes using various sources. This strategy is recognized as one of the most important in online examination (Puchkov et al., 2020). This finding confirms the lack of substantive preparation of teachers for this method of checking the learning outcomes. In the undertaken strategies, some lecturers try to select such methods and questions that refer to the knowledge processed by students, making them think and analyze, and not recreate. Such actions did not generate critical comments from students. However, such special strategies as conducting oral examinations consume more of the teachers' time.

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Faced with the advantages of new technologies and the encouragement of the university technical team, the lecturers succumbed to the pressure to choose quick and simple solutions, which for many subjects proved to be inaccurate.

In turn, the students' statements are polarized – there is both a group that believes that exams are now more difficult, and other group that thinks exams are easier – but this method of verifying knowledge is considered a disadvantage in both cases. In addition, they emphasize that online exams or tests are associated with a certain unpredictability in the efficiency of the Internet connection, hardware or software operation. It is the technical factors that give rise to the most concerns and reservations. At the same time, however, research shows that during nearly a year of remote education, only a small group of students made an effort to improve the quality of their Internet connections or equipment (Romaniuk & Łukasiewicz-Wieleba, 2021b), which may indicate that they feel that both remote education and the related online exams are only temporary. At the same time, the Ombudsman, examining the university requirements related to the implementation of remote examinations, notes that the technical conditions expected by universities (including cameras, microphones, headphones, and access to broadband Internet) do not take into account students who cannot afford such solutions, which may limit their right to education (Rzecznik Praw Obywatelskich, 2020). In this situation, it is worth considering hybrid solutions that would allow the implementation of the subject online and impose on teachers, especially those teaching non-lecture subjects, the obligation to take exams in the traditional way. This solution, although it would deprive students of the comfort of working in the privacy of their home and the lack of the necessity to travel, would prevent any technical problems and related stress.

The presented research, although limited to one institution, shows the complexity of the problem and demands not only further analyses in the field of assessment of the examination methods used at universities, but also has a practical dimension, related to the search for effective and appropriate methods for the remote learning process to verify the effects of education.

The most important recommendations that emerge from research on the online examination process during a pandemic include:

- training courses conducted by university didactic and technical teams in the field of technical and methodological solutions for conducting examinations;
- training courses tailored to learning using the available online knowledge verification strategies;
- testing unique solutions, exchanging experiences and sharing creative ideas for formulating questions and tasks in teams of teachers conducting similar subjects;

- encouraging lecturers to develop examination solutions based on the open book strategy;
- testing and implementing technical solutions related to the protection of personal data, recording exams, preventing dishonesty of students, and enhancing the transparency of exams;
- creating an atmosphere of fairness in the university and building an online work culture, in particular, mutual trust of students and lecturers toward each other, guidelines on standards related to taking exams (i.e. clothing, environment during the online exam, honesty toward oneself and others);
- introducing the possibility of conducting online classes and stationary exams for selected subjects;
- verifying, detailing and updating the procedures and examination process, based on experience and legal acts concerning remote examinations;
- adjusting the form and time of exams to the specifics of the students;
- considering an online proctoring service such as ProctorExam, ProctorU or PRUEFSTER.

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WE RECOMMEND

Resilient Teaching Through Times of Crisis and Change, a course offered by Michigan Online

The screenshot shows the course page on Michigan Online. At the top, there is a navigation bar with the Michigan Online logo, an 'EXPLORE' dropdown, a search bar, and 'LOG IN' and 'SIGN UP' buttons. The main header features the course title 'Resilient Teaching Through Times of Crisis and Change' with 'NON U-M ACCESS' and 'FREE ACCESS' buttons. Below the header, there is a 'Description' section with a small image of a person at a computer. The description text reads: 'Resilient teaching is the ability to facilitate learning experiences that are designed to be adaptable to fluctuating conditions and disruptions. This teaching ability can be seen as an outcome of a design approach that attends to the relationship between learning goals and activities, and the environments they are situated in. Resilient teaching approaches take into account how a dynamic learning context may require new forms of interactions between teachers, students, content, and tools. Additionally, they necessitate the capacity to rethink the design of learning experiences based on a nuanced understanding of context.' To the right of the description, there is a 'Rating' section showing five stars and 'based on 15 ratings', and a 'Subject' section with a 'EDUCATION' tag.

Resilient teaching is the ability to facilitate learning experiences that are designed to be adaptable to fluctuating conditions and disruptions. This teaching ability can be seen as an outcome of a design approach that attends to the relationship between learning goals and activities, and the environments they are situated in. Resilient teaching approaches take into account how a dynamic learning context may require new forms of interactions between teachers, students, content, and tools. Additionally, they necessitate the capacity to rethink the design of learning experiences based on a nuanced understanding of context.

The course is designed with higher education faculty, lecturers, and graduate student instructors in mind, but may also be applicable to educators in a wide variety of instructional environments. The

course is aimed at participants who may be asked to rethink how they teach in the immediate or near future due to the ever-changing circumstances of the current COVID-19 pandemic. While the creation of this course is motivated by the current crisis, its authors expect it will remain relevant to instructors who are faced with disruptions and change to their teaching for any number of reasons and must quickly adapt their course designs.

More information about the course at: <https://bit.ly/3611eBT>



Eugenia
Smyrnova-
Trybulska

Development of prospective preschool and primary school teachers in the area of ICT use in education

Abstract

The study was intended to examine the evaluation of the development of students' and future teachers' preparation in the area of digital preschool and primary school education, supported by information and communication technology (ICT). In this article, the author studies the concept and the curriculum of the "Information technology in the education of children of preschool and primary education" course implemented in the pedagogy program bachelor specialization referred to as "Preschool and primary school education," with active e-learning support, particularly in the form of distance courses, applications, Internet sources, websites, and digital resources. The author analyzes details of the curriculum of the course, the concept of each task, criteria of their assessment, the learning outcomes, and examples of projects. A review is provided of a course based on some evaluative materials. Moreover, the author discusses selected results of surveys of students' opinions about specific tasks, particularly the evaluation criteria of didactic applications and educational websites, self-reflections on course achievements, and fulfillment of their expectations.

Keywords: preschool and primary school education, prospective teachers, information and communication technology (ICT), multimedia, e-learning, assessment

Introduction

The 21st century requires of people new, innovative, and alternative thinking as well as activity and group-wide targeted actions. It requires much greater professional and geographical mobility than ever, and systematic and effective learning throughout life. The motto "lifelong learning" has become obligatory, and according to some futurologists, the basic condition of human existence. Being a modern citizen, a specialist should follow the four educational principles, in particular, they should: be able "to learn to know," "to learn to act," "to learn to live together," and above all, "to learn to live" (Delors, 1996).

Digital competences are the key elementary competences of people nowadays, and the acquisition of such competences determines their future. Preparation of the young generation for the application of new means, tools, and methods related to information and communication technologies is possible only if all teachers at all levels of education have appropriate preparation and knowledge in the field of the use of ICT in all school subjects and the didactic process (Sysło, 2002; Sysło & Kwiatkowska, n.d.).

Nowadays, the development of teachers' digital competences is based on the "UNESCO ICT competency framework for teachers" (UNESCO, 2018), and "European framework for the digital competence of educators – DigCompEdu" programs (Redecker & Punie, 2017). DigCompEdu responds to the growing awareness among many European member states that educators need a set of digital competencies specific to their profession to be able to seize the potential of digital technologies for enhancing and innovating education (Redecker & Punie, 2017).

This topic is the focus of many researchers' studies. Some advanced experience of developing teachers' digital competence, described by Henseruk (2019), Skvortsova and Britskan (2018), examines training for future primary school teachers in learning apps in teaching mathematics. Students' opinions and teachers' perspectives on IT Tools in the E-learning Environment of a University were researched by Smyrnova-Trybulska et al. (2015a). Other authors present their long-standing experience in preparing future

teachers for the use of modern educational technologies in Slovak schools (Stoffova & Horvath, 2019). They emphasize that the “ICT in education” subjects create space for students to learn about current trends in educational technologies and thus to complement and expand their knowledge in modern pedagogy (Stoffova & Horvath, 2019). Selected aspects of the effective use of distance learning technology in preschool and primary school teacher training and some criteria for assessing the quality of an educational website were described by the author (Smyrnova-Trybulska, 2016; 2018).

This article aims to examine the concept and the curriculum of one of the modules – “Information technology in the education of children of preschool and primary education” – as implemented in the Pedagogy program, within the specialization called Preschool and primary school education, with active e-learning support, e.g., distance courses, applications, Internet sources, websites, and digital resources. Moreover, the author discusses selected results of a survey and research into students’ opinions about some tasks and evaluation criteria with the support of ICT.

Main aims of the *Information technology in the education of preschool and primary education children module.*

One of the subjects, which is actually implemented at the first level of teaching Pedagogy, specialization Preschool education and primary education with the active support of a distance course, is *Information technologies in teaching preschool and school children* (30 hours of practical training). The course has a modular structure available on the Faculty Distance Learning Platform (n.d.), and it is constantly updated.

The main objectives of the course include:

- familiarization of students with resources, tools, teaching methodology for students at primary school age, and basic skills in the field of information and communication technologies, including the search for, and the use of information;
- providing examples of evaluation criteria, analysis and comparative characteristics of the available educational projects (curricula, textbooks, teaching materials, educational, multimedia, websites, etc.), teaching computer science, and information and communication technologies;
- formation of theoretical knowledge and practical skills for the preparation of own multimedia electronic educational resources, such as didactic videos, including videos;
- digital storytelling, tutorials, multimedia tests prepared through, for example, the Kahoot, and Hot Potatoes programs;
- designing the educational process (preparation of abstracts and scripts for classes) using ICT and an interactive whiteboard;
- formation of competencies in the field of e-learning by participating in at least one distance learning course.

Core content of the program and criteria of its evaluation

The module aims to familiarize the students with the means, tools, and methodology of shaping the skills of using information and communication technologies in preschool and early school-age pupils.

The objectives of the first category of tasks in this module (tasks: 1. Analysis and comparative characteristics of the available training packages; 2. Classification and evaluation criteria of multimedia educational computer programs; 3. Review of Internet resources, assessment of educational sites, portals, etc.) consist in familiarizing oneself with the assessment criteria, analysis, and comparable characteristics of the available didactic projects (curricula, textbooks, methodological materials, exercises, multimedia cases, websites, etc.) for teaching computer science and information technology, and designing the didactic and educational process with the use of resources available on the educational market and the Internet.

Additionally, the aims of the first category of tasks include the development of social skills, digital skills, development of some mental skills and qualities, such as analysis, synthesis, comparison, generalization, classification, perceptiveness, and the ability to formulate conclusions.

The objectives of the second category of tasks in this module (tasks: 4. Development and recording of a didactic video; 5. Development of a digital story; 6. Development of quizzes/questionnaires; 7. Development of tests; 8. Development of a game in Scratch) include shaping of theoretical knowledge and practical skills to prepare one’s own multimedia, electronic educational aids in the form of a didactic video, a test package in the Hot Potatoes software and displaying them using an interactive board, as well as designing the didactic and educational process with the use of designed ICT means.

The purpose of this chapter is to present and analyze the core content of the program. Examples of tasks and projects prepared by students will be discussed, accompanied by comments and reflections.

Among the main outcomes of the learning and teaching of this module are the following: students develop a knowledge of the concepts and principles related to the protection of intellectual property and copyright; they have the ability to use information technology in a diversified way in pedagogical and research work; they are aware of the need for constant self-improvement.

Task 1. Review and comparative analysis of the available training packages in the field of teaching computer science and information technology in elementary schools

Criteria for assessment of ICT projects (tasks book and other components, from 1 to 5 points):

- access to project websites (Internet websites);
- multimedia version of a task book or project;
- assessment and evaluation criteria for students’ knowledge and skills;

- tools for assessing and evaluating students' knowledge and skills;
- practical exercises for students;
- teaching/didactic materials;
- methodological support;
- integration of IT content with other subjects;
- curriculum.

Projects such as European Informatics, Computer Adventure, Computer stories, Meetings, and Computer Science are available on the Polish market. In addition to quantitative assessment, students should provide a detailed justification for the assessment of each project. The students should also describe their own teaching

experience in Information Technology in integrated and pre-school education (curriculum, teaching materials, methodology, organizational conditions, equipment, Internet access, etc.) and plans for the near future in teaching and using IT in professional work (Figure 1).

Task 2. Classification and evaluation criteria of multimedia educational software

This task includes: the classification and evaluation criteria of multimedia educational software; review of educational programs available; designing an educational process using the multimedia programs selected by the student in the form of a scenario (Figure 2).

Figure 1

Evaluation of an educational program on ICT according to selected criteria. Quantitative assessment, completing a questionnaire

Kwestionariusz ewaluacyjny Drukuj puste

1. Imię i Nazwisko

2. Ocena projektu *Informatyka Europejszyka*

	1	2	3	4	5
Program nauczania	<input type="radio"/>				
Integracja treści informatycznych z innymi przedmiotami	<input type="radio"/>				
Wspomaganie metodyczne	<input type="radio"/>				
Materiały dydaktyczne	<input type="radio"/>				
Ćwiczenia praktyczne dla uczniów	<input type="radio"/>				
Kryteria oceny i ewaluacji wiedzy i umiejętności uczniów	<input type="radio"/>				
Narzędzia oceny i ewaluacji wiedzy i umiejętności uczniów	<input type="radio"/>				
Obudowa multimedialna	<input type="radio"/>				
Dostęp do serwisów internetowych	<input type="radio"/>				

3. Szczegółowe uzasadnienie oceny projektu *Informatyka Europejszyka*

Source: author's own work based on data from the Moodle system.

Figure 2

Portion of a distance course. The task involves the evaluation of an educational multimedia program according to the criteria proposed

Temat 2

Temat 2: Wykorzystanie TI w procesie edukacyjnym.

1. Ocena multimedialnego programu edukacyjnego.
2. Opracowanie scenariusza lekcji z uwzględnieniem wykorzystania edukacyjnego programu multimedialnego bądź aplikacji komputerowej lub witryny internetowej.

Materiały podstawowe

- Ocena programu komputerowego

Ćwiczenia i zadania praktyczne zaliczeniowe

- Zadanie 2.1.: Ocena programu

Materiały podstawowe

- Przykład oceny programu i scenariusza lekcji
- Szablon scenariusza lekcji

Ćwiczenia i zadania praktyczne zaliczeniowe

- Zadanie 2.2.: Scenariusz lekcji

Source: author's own work based on data from the Moodle system.

Development of prospective preschool and primary school...

Criteria collected in an assessment form are developed based on an improved model offered by Topol (1988) and Kopienka (2000) based on an assessment model (Klopfer, 1984, 1986). The criteria were divided into three main groups: substantive value, didactic value, and technical quality. Each global group of measures contains five detailed criteria characterizing the components of an excellent interactive teaching multimedia program. Depending on the degree to which a given condition has been met, between 0 and 3 points are awarded. The approximate overall rating on obtaining the highest scores from each criterion – 3 – is a total of 45 points (Annex 1 – available online). The requirements were gradually improved. In January 2020, 51 students completed the questionnaires and assessment each criterion on scale from 1 to 5 points (1 – minimum, 5 – maximum). The results are described in the “Methodology, results and discussion” section.

In the next edition of the course, the assessment sheet will consider the survey results and students’ proposals concerning criteria for didactic multimedia program assessments.

Task 3. Review of Internet resources, assessment of educational sites, portals, etc.

The reasons for a comprehensive evaluation of the quality of information that appears on the web and the criteria for evaluating Internet information resources were investigated in particular by Bednarek-Michalska (2002), Clausen (1999), Smith (1997), Ciolek and Goltz (1996), Boklaschuk and Caisse (2001), Froehlich (2000), and Harris (2020).

Given the specifics of educational sites, one can refer to the research of other authors. In a study by Yang & Chan (2008), evaluation criteria for English learning websites were set. These criteria can assist English teachers/web designers in designing effective websites for their English courses (Yang & Chan, 2008, p. 403). Additional proposed criteria can also guide English learners in screening for appropriate and reliable websites to use in increasing their English ability (p. 403).

The authors from the National & Kapodistrian University of Athens discuss some of the uses of educational sites. In particular, they emphasize that among the goals of using educational sites, one can distinguish: “supplementing and supporting English courses; supporting the development of various competencies (linguistic, communicative, etc.); increasing student motivation; promoting student autonomy; promoting interactive learning (using interactive whiteboard education sites (IWB)).” (*When theory meets practice: evaluate, adapt and design*, n.d.).

The next tasks include evaluating the educational website selected, analyzing and evaluating one of the sites according to specific criteria (qualitative and quantitative assessment), and developing lesson plans using the Internet website selected. After that, the students assessed the criteria for evaluating educational sites on scale from 1 to 5 points (1 – minimum,

5 – maximum) by filling in a Google form. The results are shown in Figure 6 in the “Methodology, results and discussion” section.

Task 4. Development and recording of didactic video

Students perform this task using Hypercom, Camtasia, and similar applications, or another program with appropriate functionality. Additionally, the types of video (Smyrnova-Trybulska et al., 2015b), using various development methods, tools, and ICT technologies, are comprehensively analyzed.

The list below presents the proposals of an overview of different representations of video:

clip/fragment (YouTube), Khan Academy (covering a specific subject), feature film/documentary, live lecture capture (technician or student recording), live lecture capture (automatic recording, or iPad Swivl), web lecture (pre-recorded studio lecture, covering several topics, 10–45 min.), knowledge clip (pre-recorded studio lecture, covering one topic, 5–10 min.), micro clip (pre-recorded studio lecture, covering one topic, 1–5 min.), self-made web lecture (pre-recorded lecture by teacher, e.g. using MyMediasite, from teacher’s own computer), screen cast (with audio and visual, does the teacher need to be in view?, showing mouse clicks, on screen action), webinar (live streamed discussion, recorded), Google Hangouts (live streamed discussion, instantly available on external server, e.g. YouTube), Skype/FaceTime (can be recorded), virtual classroom, student-generated video content, and video recording of students (by students/lecturer). (Woolfitt, 2015, p. 18)

For example, tasks involving importing a video from a presentation, recording a voice commentary, and a musical accompaniment using Sound Recorder were added to the project.

All tasks and projects are evaluated on a scale from 0% to 100% by the teacher and students from the same group in a peer-to-peer assessment procedure on the Discussion forum.

Task 5. Development of digital story

Digital storytelling is the modern expression of the ancient art of storytelling. Throughout history, storytelling has been used to share knowledge, wisdom, and values. Stories have taken many different forms. Stories have been adapted to each successive medium that has emerged, from the circle of the campfire to the silver screen, and now the computer screen. (Matthews-DeNatale, 2008, p. 2). Various definitions of storytelling were highlighted and cited by Espada et al. in their research (2017). In particular, “digital storytelling can be defined as storytelling with support for multimedia elements (images, audio, music, text, etc.) and their actions (transitions, accelerations, etc.) (Chung, 2007),” (Espada et al., 2017, p. 99).

Among the main types of digital storytelling are:

- sound,
- photos,
- infographics,
- mind maps,
- timelines,
- animations,
- comics,
- screencasts,
- digital video storytelling,
- interactive videos (Świątecka, 2013, pp. 65–100).

It is the video-based medium that is the most universal multimedia mode of digital storytelling.

Some task performance criteria:

- the nature of a computer story – educational;
- form of presentation of the content: multimedia;
- volume: minimum 15 slides/scenes/screens;
- on the first slide, the title of the computer story and the author's name should be given, while on the last one, the bibliography (list of printed and electronic sources used).

There are different approaches to the structure and concepts. "Every story told has a base or structure. The structure of a more basic story is "start, something happens and finishes." However, the structure may be complex; for instance, according to Lambert (2006), in agreement with PIXAR, there are seven elements of a digital narrative. They are:

1. Point of view: Outlines the story's point and the perspective from which the story is told.
2. A dramatic question: Sets the tension of the story by identifying issues to be resolved.
3. Emotional content: Engages the audience through common emotions and themes (love, pain, humor).
4. The gift of your voice: Helps the audience to make meaning of images.
5. The power of the soundtrack: Sets the mood of the story.
6. Economy: Balances the auditory and visual tracks of meaning.
7. Pacing: Sustains the attention of the audience by establishing and modifying the rhythm of the story" (Portugal, 2018, pp. 215–216).

Useful ICT tools for the development of digital storytelling include Powtoon, Biteable, Animaker, Camtasia, and Hypercom.

These tasks and projects are also evaluated by teachers on a 0–100 % scale; they can also be assessed on a peer-to-peer basis by students on the discussion forum attended by the same group on the e-learning course supporting the module.

Tasks 6. Development of quizzes/questionnaires

Other skills and tasks focus on developing quizzes/questionnaires/games for children and using them on mobile devices. One of the well-known

apps is Kahoot! (www.kahoot.com). "Kahoot! is an application developed by Morten Versvik, Johan Brand, and Jamie Brooker in a joint project with the Norwegian University of Science and Technology (NTNU). At present, this application is available for Android and iOS" (Madej & Studniarek, 2019, p. 23), and is very popular among users and learners worldwide. They use Kahoot! in lessons, as well as in extracurricular activities. By January 2020, Kahoot! had been downloaded from Google Play more than 10 million times. "The creators of Kahoot! also cooperate with such knowledge leaders as Britannica and organizations such as National Geographic, which create quizzes whose content relates to the information they share" (Madej & Studniarek, 2019, p. 23).

The Kahoot! application as an educational tool fulfills multiple didactic functions through active methods and interactive activities for students of every age, but mostly from primary school as it allows different multimedia to be added from a rich database of pictures and videos, to create various types of tests and quickly share them with an auditorium via mobile phones. This app adapts to the dynamic development of the mode of learning of a digital society and contemporary education.

The Kahoot! App and its didactic potential, and the students' perspectives using this tool were studied by researchers, for example, by Basuki and Hidayati (2019). A literature review of the effect of using Kahoot! for learning was described in Wang and Tahir (2020).

Students' attitudes to the use of gamification in lectures by applying the Kahoot! tool was identified by Pilař et al. (2020). LearningApps (Skvortsova & Britskan, 2018), Socrative, Nearpod, and Padlet are similar applications and websites.

The theoretical literature and research background, as well as practical experience, prove the multifunctional didactic potential of Kahoot! in motivating the learners, inspiring them, involving them in active learning, developing their collaborative skills, and supporting feedback and assessment. Practical skills in using this App are necessary, along with specific digital competences of contemporary students and prospective teachers.

Task 7. Development of Tests

The seventh task involves developing various types of tests, including interactive ones, using multimedia, and integration with a presentation. During the course, popular applications are introduced – namely Hot Potatoes (<https://hotpot.uvic.ca/>).

Preparation of five types of tests by students is required. Two tests must receive passing grades for the whole task to be given a passing grade. The tests are uploaded to the course via the Moodle system, presented as projects on the forum, and subject to peer-to-peer assessment. The five types of tests for study are Jmatch (drag&drop questions), Jcross (interactive crosswords), Jmix (streamlining sequences),

Quiz (multiple/single choice question, open question), and Close (interactive dictation).

Additional criteria which should be fulfilled are: using (adding) a timer, adding multimedia, ensuring color balance, good interface mapping, the inclusion of sequences of several tests in a single test project, development of the ability to distribute HP tests in different ways: by posting on websites, by adding to an LMS Moodle course, sending to email addresses, and by saving to external storage (e.g. a pendrive).

The students can then use the created tests during their pedagogical practice at schools.

Task 8. Development of Game in Scratch

Computational thinking in programming with Scratch in primary schools is one of the priorities of contemporary basic education (Fagerlund et al., 2020). The methodology and evaluation of teaching concurrent programming concepts using Scratch in primary school were examined by Fatourou et al. (2018). The lessons with educational robotics and coding learning were included in the curriculum for the specific educational levels (Smyrnova-Trybulska et al., 2016).

The internationally recognised Hour of Code event (<https://hourofcode.com/>; <https://code.org/learn/>), and its Polish equivalent, Godzina Kodowania w Polsce (Hour of Code in Poland) involved thousands of children around of the world.

Students develop their games in Scratch (<https://scratch.mit.edu>) within the module framework, test them, upload them to the course via the Moodle system, and present them on the forum for discussion during classes. Additionally, students' peer-to-peer assessment on the discussion forum from the same group on the e-learning course is supported by the module, and motivates the sharing of the best project and getting high scores and positive opinions from colleagues.

Methodology, evaluation of results and discussion

The study was intended to examine the evaluation of development of students' and future teachers' preparation in the area of digital and preschool and primary school education, supported by information and communication technology (ICT).

In the previous section, the author studied the concept and curriculum of the "Information technology in the education of children of preschool and primary education" course implemented in the pedagogy program bachelor specialization referred to as "Preschool and primary school education," with active e-learning support, particularly in the form of distance courses, applications, Internet sources, websites, and digital resources. The author analyzed details of the curriculum of the course, the concept of each task, criteria of their assessment, learning outcomes, and examples of projects.

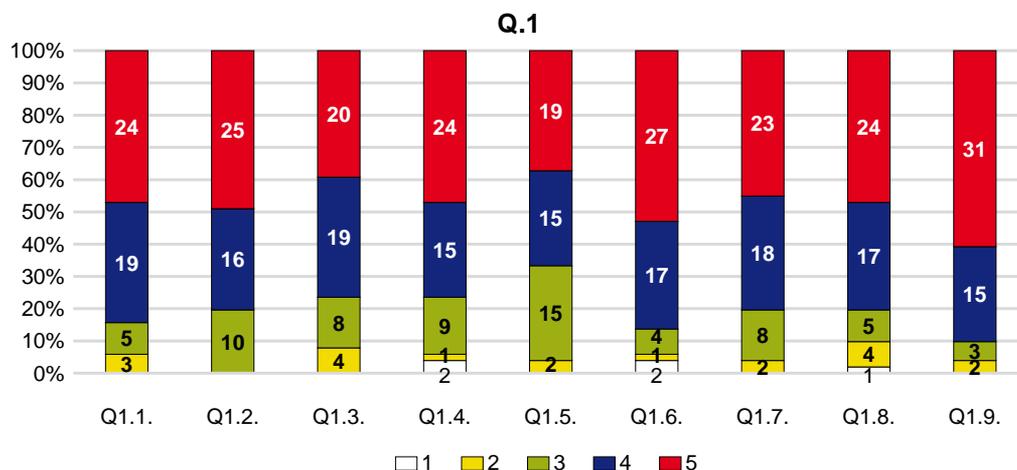
The author conducted some preliminary research both during the course and after its completion. The research methodology included survey methods and questionnaire tools, using a five-point Likert scale (where 1 indicates the minimum and 5 the maximum), and a Google survey form.

Presented below are selected results of surveys of students' opinions about specific tasks, and in particular, criteria of didactic applications and educational websites as well as self-assessments and self-reflections on the usefulness of e-learning courses and the extent to which such courses meet the students' expectations.

Figures 3, 4 and 5 show the distribution of answers to questions concerning the score of each criterion on the assessment form according to the students' opinions and viewpoints as well as experience relating to the evaluation of didactic programs.

Figure 3

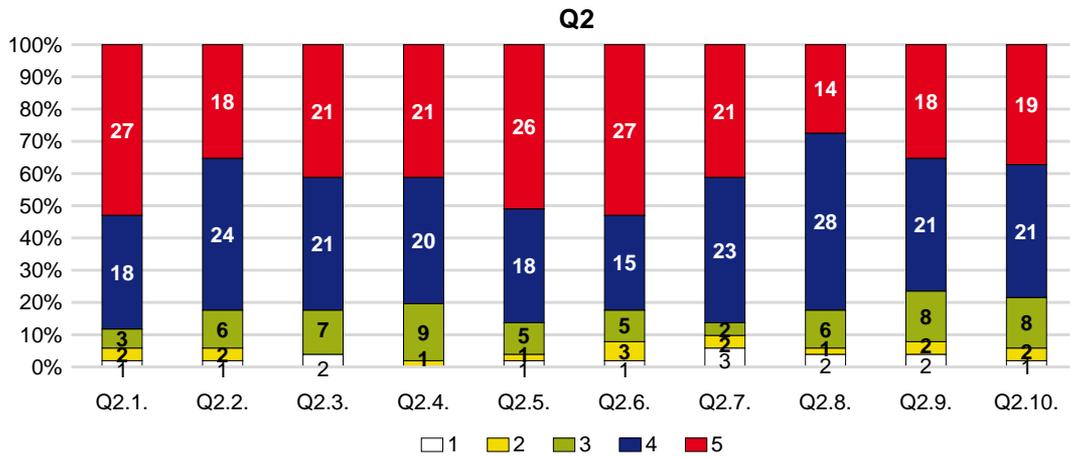
Survey results: distribution of assessment, according to substantive correctness criteria, of a didactic multimedia program by respondents on a scale from 1 to 5 points (1 – minimum, 5 – maximum) (Annex 1 – available online)



Source: author's own work.

Figure 4

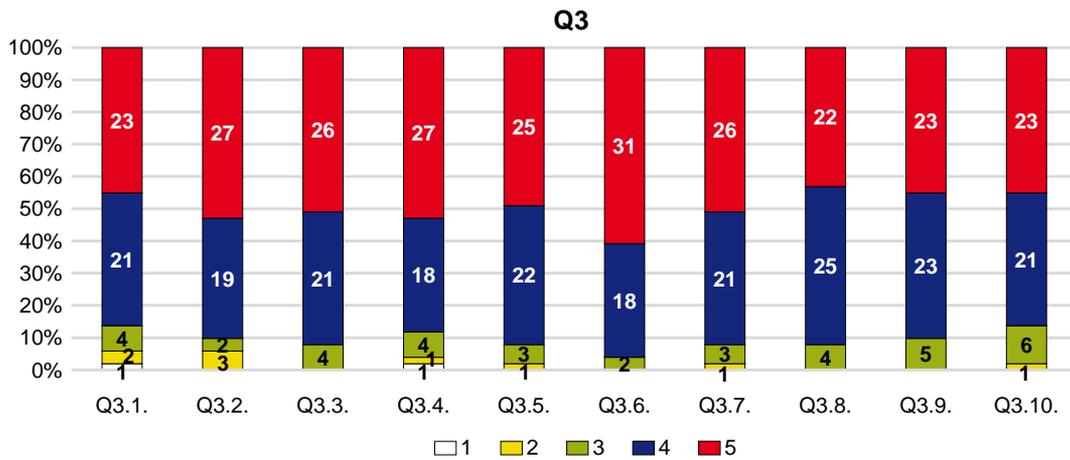
Survey results: distribution of assessment by respondents, according to Didactic correctness criteria, of a didactic multimedia program on scale from 1 to 5 points (1 – minimum, 5 – maximum) (Annex 1 – available online)



Source: author's own work.

Figure 5

Survey results: distribution of assessment, according to Technical correctness criteria and quality criteria, of a didactic multimedia program by respondents on scale from 1 to 5 points (1 – minimum, 5 – maximum) (Annex 1 – available online)



Source: author's own work.

As we can see, for the fulfilment of all proposed criteria, students were assigned four or five points. The students themselves suggested additional criteria, such as:

1. Substantive correctness:
 - application security,
 - program available in other languages,
 - integration of educational subjects,
 - creativity.
2. Didactic correctness:
 - constant ability to monitor progress,
 - interesting educational exercises,
 - interesting didactic exercises.
3. Technical correctness, quality:
 - return to the Start screen at any time,
 - accessibility on the website,
 - accessibility of the mobile version.

In the next edition of the course, the assessment sheet will consider the survey results and students'

proposals concerning criteria for didactic multimedia program assessments.

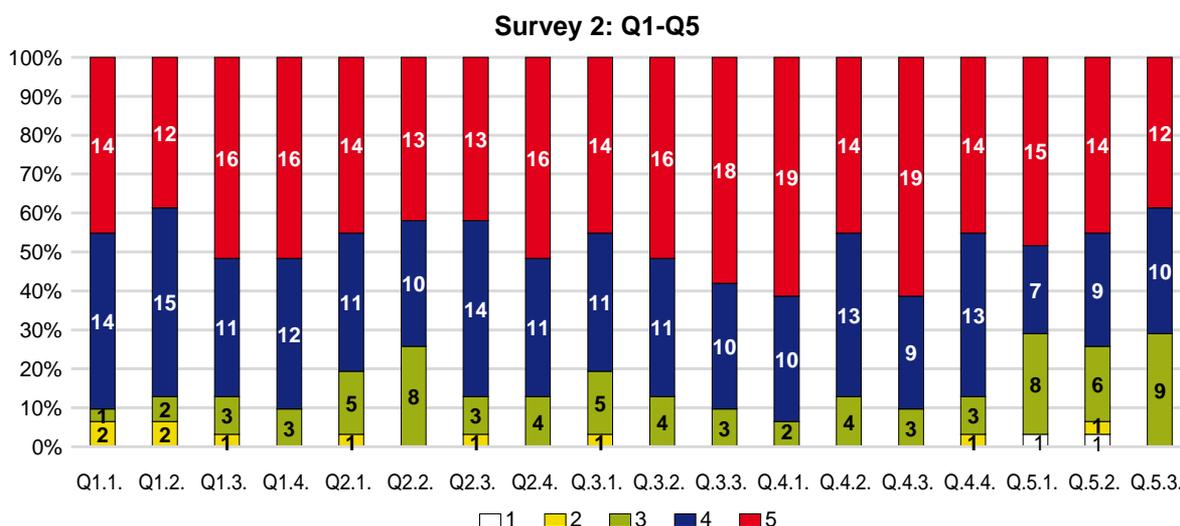
The other assessment by students concerns the tasks that include evaluating the educational website selected, analyzing and evaluating one of the sites according to specific criteria (qualitative and quantitative assessment), and developing lesson plans using the Internet website selected. After that, the students evaluated the criteria for assessing educational sites (Annex 2 – available online) on scale from 1 to 5 points (1 – minimum, 5 – maximum) by filling in a Google form. The results are shown in Figure 6.

If we analyze and evaluate an online educational site, it is rational to pay attention to reliability, relevance, interactivity, feedback, and other qualities, as is the case with traditional sources of information. Earlier, when the network parameters and characteristics were evaluated when sending and distributing messages, attention was paid to the document flow

Development of prospective preschool and primary school...

Figure 6

Survey results: distribution of assessment, according to substantive, didactic, technical, graphic, and general criteria, of the educational website by respondents on scale from 1 to 5 points (1 – minimum, 5 – maximum)



Source: author's own work.

rate, amount of data, information traffic, and search tools. Still, there were fewer requirements for the network's quality of data. Now the problem of redundant data must be faced, so we begin to analyze their quality more often.

Our research shows that all proposed criteria were assigned four and five points.

The criteria are listed below.

I. Substantive criteria:

- 1.1. Substantive criteria (purpose of creating the website);
- 1.2. Substantive criteria (quality: quantity of information);
- 1.3. Substantive criteria (the content of the content);
- 1.4. Substantive criteria (scope, content: logical, chronological, thematic, other).

II. Didactic criteria:

- 2.1. Didactic criteria (user, preferences, help, usefulness, friendliness);
- 2.2. Didactic criteria (reviews: evaluation of new content, pages);
- 2.3. Didactic criteria (interactivity: are there interactive websites, chats, forums, blogs, etc.);
- 2.4. Didactic criteria (personalization: possibility to set up an account).

III. Technical criteria:

- 3.1. Technical criteria (links and navigation);
- 3.2. Technical criteria (search engine);
- 3.3. Technical criteria (loading speed).

IV. Graphic criteria:

- 4.1. Graphic criteria (structure and appearance of pages, organization of content: departments, sections, etc.);
- 4.2. Graphic criteria (graphics and multimedia: audio, video);

4.3. Graphic criteria (aesthetic impression: colors, layout, format);

4.4. Graphic criteria (originality of graphics and professionalism).

V. General:

- 5.1. General (price: paid, payable, partly paid);
- 5.2. General (contact with the administrator: email, instant messaging, telephone, other);
- 5.3. General (scalability on mobile devices).

Other criteria that are important for website evaluation and, also, criteria put forward by students are:

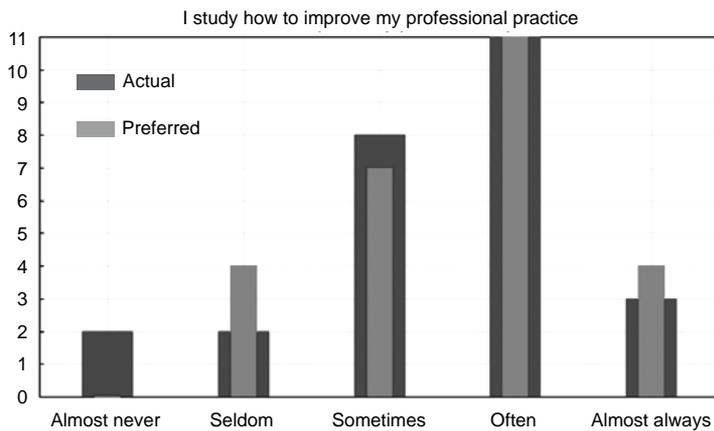
- age range;
- target group;
- putting knowledge into practice;
- preparation for the profession in practice;
- accessibility for the child and the parent;
- website language change available.

On completing participation in the module, the students expressed their opinions about the subject, the distance course, their involvement in the course, and their activities by filling out an evaluation questionnaire. Some results of questionnaires in the Moodle system are shown in Figures 7, 8 and 9.

Students demonstrate frequent and active involvement. They use the e-learning course to improve their professional competencies. They also often observe and follow the good models of discourse and critical self-reflection presented by their tutors.

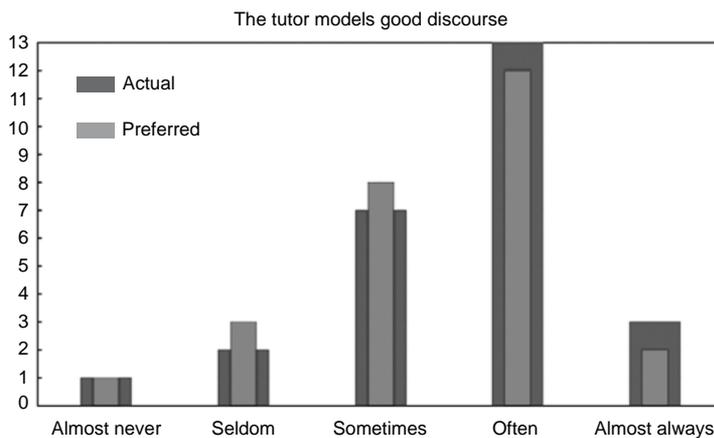
The role of digital technologies in life and educational practice is steadily increasing, and the mastery of ICT tools allows the modern teacher to work with information more effectively and shape students' digital competence. In this regard, the search for tools for the formation and determination of the level of ICT competencies and using them in the educational process of school teachers is already taking place (Boronenko et al., 2018).

Figure 7
 Survey results. Questions concerning students' use of e-learning to improve their professional skills



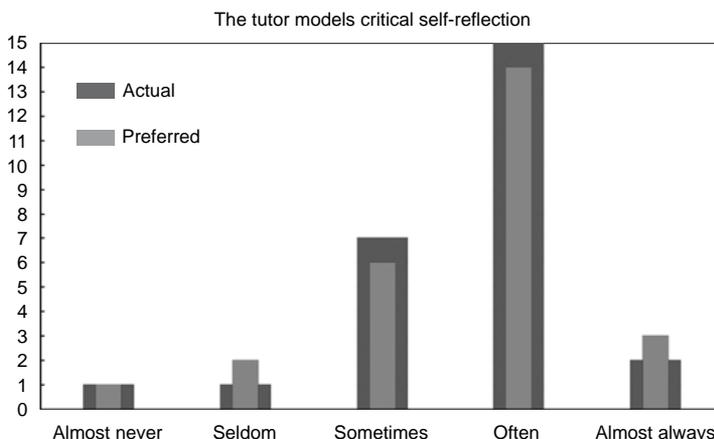
Source: author's own work based on data from the Moodle system.

Figure 8
 Survey results. Questions concerning tutor model discourse



Source: author's own work based on data from the Moodle system.

Figure 9
 Survey results. Questions concerning tutor support models in the context of critical self-reflection



Source: author's own work based on data from the Moodle system.

Suggestions have been put forward on how to extend the selected approach to other modules. They involve the students more actively in the evaluation process and critically evaluate the tools they can use in their future careers. The ideas suggested include more frequent use of activating methods: project-based learning, problem-based learning, inquiry-based learning (IBL), gamification, and peer-assessment of all tasks. Additionally, the quality of the assessment of educational material using information systems helps us to understand the volume of quality work performed by the student, which (s)he was able to complete using a software product, taking into account the needs of the educational process and contributing to the achievement of learning goals. The evaluation process can be divided into two components, with both playing a specific role. The first component focuses on the assessment of the application of knowledge to solving problems. The other component evaluates the applied data following the effectiveness of the results (Kamenez, 2020, p. 348).

Dynamic development is observed in ICT technology and Web 3.0 because the tools and applications used for the support and performance of each task are constantly changing and updating. The next edition of the course will include some changes and improvements. Simultaneously, the main aims will remain the same.

It is important for teachers to have a feedback link with their students and to research their opinions about the course and its content. Teachers should constantly modify and update the content, sources, criteria and tasks, adapting them to new teaching trends, the latest research results, and taking into account students' suggestions.

Both in-service and prospective teachers should always remember to launch innovations in education, enhancing and updating their digital skills and skills in the area of ICT use in education, and implement updated and improved content.

Conclusions

This article considers the concept and the curriculum of one of the modules run in the Pedagogy program specialization called Preschool and primary school education, 2nd year, referred to as "Information technology in the education of preschool and primary education" (30 hours). The module is supported by various activities such as e-learning, distance courses, different IT applications, Internet resources, web-services, and digital resources. The curriculum is aimed at introducing activities that can develop students' and prospective teachers' digital competences. It focuses on design, theoretical knowledge, and practical skills, enabling the successful use of ICT tools and e-learning in preschool and primary school pupils' education. The skills developed within the framework of the module and their implementation into the educational process favor increasing students' learning motivation, their interest in learning, as well the quality of learning results, knowledge, skills, creative thinking, innovative approaches to learning, intellectual development, improving young students' key competencies, and soft skills.

The limitations of the study include the special ICT tools, applications, Internet websites used in preschool and primary school, and limited depth of questions and challenges associated with the methodology of the use of new technologies in child education as well as future teachers' digital skills and specific competences in this area, which is changing at a fast pace. Future research could focus particularly on the use of MOOCs, other e-learning courses, training, workshops and selected Internet websites and services (e.g., YouTube) to permanently develop and update students' and future teachers' digital competences and pedagogical skills.

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Transactional and transformational leadership in the context of perceived organizational justice and its dimensions. Identification of the interdependencies

Abstract

The authors of this article analyzed the phenomenon of the interdependence between transactional/transformational leadership style and perceived organizational justice (and its dimensions). In the first part of the article, the necessity to conduct detailed research on aforementioned subject is presented. Next, a literature review was carried out in order to examine the possibly toothcombing links between organizational justice and transactional/transformational leadership (taking into consideration the multidimensionality of those subjects). Leadership style and perceived organizational justice are linked to many organizational aspects such as organizational citizenship behaviors, work commitment, job satisfaction, knowledge-sharing, willingness to share knowledge, and burnout. The authors of this publication attempted to present research scope as having growth potential for future studies.

Keywords: interdependencies, leadership, perceived organizational justice, transformational leader, transactional leader

Introduction

For several decades, the phenomenon of perceived organizational justice has been of interest to a significant number of organizational behavior researchers working on aspects of organizational culture (De Cremer & Blader, 2006; Greenberg, 1993; Olkkonen & Lipponen, 2006). This problem has been raised many times recently. The issue of justice is closely related to the social exchange theory introduced by Peter Blau (1964) and Georg Homans (1958) who mentions the concept of *quid pro quo* (from Latin: *something for something*).

Blau's considerations introduced the notion of a norm of fair exchange. The imbalance between the amount of work and the gratification received, the same as the disproportion between the costs and profits, may cause negative emotions that may lead to the disturbance of the relationship between employees and superiors. The same, such inequities may cause counterproductive (negative, purposeful) work behaviors directed toward coworkers, employer and/or the organization as a whole (Blau, 1964).

Perceived justice has a huge impact on the functioning of various institutions (Rawls, 1958). It is one of the most significant and crucial elements of an organizational culture that shapes people's attitudes and behaviors. James Clawson (1999) recognized it as one of the virtues of an ideal leader, which is no less important than his/her truthfulness and trust. Both a reliable leader and an atmosphere of justice constitute the rock-solid foundation of contemporary organizations.

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A superordinate plays an important role in motivating employees (Bass & Riggio, 2006) enhancing their efforts and reducing the level of staff turnover (Olkonen & Lipponen, 2006). A strong leader enhances (positive, purposeful) organizational citizenship behaviors (OCB) (Ehrhart, 2004; Podsakoff et al., 2000) and reduces the level of occupational burnout (Oklay & Uslu, 2015; Shanafelt et al., 2015). The leader's approach and inspiring leadership style influence the attitudes of employees toward the organization, which corresponds to their efficiency and workplace commitment (Reb et al., 2019; Tziner & Shkoler, 2018).

Smart leadership practices effectively support and strengthen the perception of positive emotions in the workplace, which contributes to the development of the organization and increases its income (Ozcelik et al., 2008).

Strength and direction constitute a critical element of managerial problems. This is one of the reasons why the relationship between perceived organizational justice and leadership style may be a potentially absorbing topic worthy of further analysis.

The employees' work attitudes also constitutes a significant factor shaping the final organizational success. This is why this problem should be raised by top management members and insightfully discussed during board meetings.

The authors of this paper undertook a bibliometric analysis using the SCOPUS database due to its high credibility in the field of social sciences and management as it contains articles from reliable peer-reviewed journals.

A search process was conducted using the words "transactional/transformational leadership" and "organizational* justice" in the article title, abstract and keywords. It was limited to the scientific documents published in the field of social sciences and business, management and accounting, written in English, and resulted in 75 articles published in the period of 1999–2021. Most of them (52 articles) were written in 2013–2021. This shows that the mentioned problem has been taken up relatively often in the subject literature, but has not been excessively exploited, and its popularity is still growing over time.

After reviewing the abstracts and contents, the authors of this article narrowed their search to 19 publications clearly pointing out the relation between organizational justice (and its dimensions) and transactional/transformational leadership. In most of them, quantitative research was conducted. The authors mainly used exploratory factor analysis (EFA) confirmatory factor analysis (CFA), multiple regression, path analysis and/or structural equation modeling (SEM). Organizational justice (as well as its dimensions) and leadership styles were treated as mutually interrelated variables (Ehrhart, 2004; Gumusluoglu et al., 2013).

Many authors (Alamir et al., 2019; Deschamps et al., 2016; Zhang et al., 2014) noticed and analyzed the correlation between the assessment of leadership style, the dimensions of organizational justice

and other variables such as, for instance, motivation, innovation, attachment to the organization, and challenge stressors.

Taking the above into consideration, the authors of this paper adopted a method based on a critical analysis of the subject literature. The research was undertaken in order to determine the fundamental relations between the type of justice perceived by an employee (i.e. distributive, procedural, interpersonal, and informational justice), and a leadership style. Although various leadership styles are discussed in the scientific articles, transformational and transactional approaches, announced by Burns (1978), seem to be deeply embedded in managerial practices and commonly known. Thus, particular emphasis was placed on the transactional and transformational styles (Alamir et al., 2019; O'Reilly & Roberts, 1978; Tichy & Ulrich, 1984; Tziner & Shkoler, 2018).

Considering this potentially promising and scientifically useful directorial trend, the authors of this article have attempted to indicate further research directions in the field of relations between the perceived organizational justice and the type of organizational leadership. For this purpose, the aforementioned literature review was conducted.

Characterization of perceived organizational justice

Nowadays, perceived organizational justice constitutes a significant part of organizational behavior studies. Over the years, the aforementioned concept has been brought up relatively often in the works of researchers, such as John Rawls, John Thibaut, Laurence Walker, Russel Cropanzano, Jerald Greenberg, Robert Folger, Jason Colquitt, Brian Niehoff, Robert Moorman, Daniel Skarlicki, and many others. *The theory of justice* by John Rawls (1999) is often perceived as the basis of distributive justice. Rawls raised the subject of the *greatest equal liberty principle*, followed by the *equal opportunity principle* and the *difference principle*. He brought up an important psychological aspect of perceived organizational justice based on the socially just goods distribution (Rupp et al., 2014). The aforementioned theory of justice signaled the need to examine the balance between the contribution of the individual (how much an employee contributed to the organization) and the result obtained (the actual profit of the individual) (Cropanzano et al., 2007).

John Thibaut and Laurence Walker (1975) defined the procedural justice system, suggesting a focus on the distribution process rather than on the final result itself (Greenberg & Folger, 1983). Employees sometimes tend to accept the unfavorable results of the distribution of funds. This is because they attach greater importance to the process itself, leading to the allocation of these resources. In line with the fair process effect (Folger et al., 1979), people often focus primarily on the decision-making process and its correctness, rather than on the further

result. Gerald Leventhal (1980) introduced six main principles relating to procedural justice. These rules concern: *representativeness* (respecting the interests of all involved parties), *consistency* (process equivalence across persons and time), *bias suppression* (excluding any decision-maker's private interests), *accuracy* (acting on possibly the most reliable way), *correctability* (allowing for the possibility of decision correction), and *ethicality* (respecting moral principles) (Cropanzano et al., 2001; Leventhal, 1980). Peculiarly, Thibaut and Walker perceived procedural and distributive justice as a separate context, meanwhile Leventhal considered procedural justice as the base of goods allocation (Colquitt & Shaw, 2005).

Robert Bies and Joseph Moag (1986) introduced another important level of perceived organizational justice: the interactional dimension that can be seen as the human aspect of the decision-making process. It reflects the relationship between the decision-maker and his/her subordinates who are the subject of the decision (Bies, 1987). Jerald Greenberg (1993), examining the subject of interactive justice, suggested separating interpersonal and informational justice (Colquitt et al., 2001). Interpersonal justice is directly related to the way the decision-maker treats the employees. It is important that the employee is respected and treated with human dignity (Ambrose & Schminke, 2009). Research on organizational behavior has proved that interactional justice is a reliable antecedent of employees' attitudes and behaviors (Colquitt et al., 2001). Moreover, informational fairness reflects the correctness of informing employees about the applicable procedures.

Appropriate time is also extremely important, in which the employer honestly informs subordinates about obligatory procedures and employees' rights (Bakhshi et al., 2009). The spirit of interactional justice is one of the most important elements of organizational law and order. Namely, a decreased sense of interactional justice may cause violent behaviors in the workplace. It is a predictor of verbal aggression directed toward colleagues and superordinates, acts of sabotage as well as a decline in organizational engagement. It is also a source of counterproductive work behaviors, which are very harmful for every organization (Brimecombe et al., 2014; Cohen-Charash & Spector, 2001).

The belief of fair treatment generates enhanced work engagement and confidence in one's supervisor, which may ultimately result in greater employee productivity (Masterson et al., 2000; Tyler, 2010).

An unfavorable atmosphere may lead to employees' depression, sadness, distrust, insecurity, lack of motivation, or anxiety (Cohen-Charash & Spector, 2001; Fox et al., 2001). Similarly, employees who are worried about being uninformed while working, may provoke detrimental behaviors (e.g. excessive absences and/or chronic lateness and/or sloppiness/neglect). Those beliefs are consistent with the cognitive theory of emotions (Bandura, 1977; Hlupic et al., 2002).

Significance of leadership

Leadership is one of the most discussed subjects in the field of resource management (Cascio & Aguinis, 2008; Karam et al., 2019). Its common definitions are often contradictory or inconsistent (Avery, 2004). One of the most widespread and universal approaches suggests that leadership refers to the personal ambitions and motivations of subordinates to achieve the long-term goals of their organization (Prentice, 2004).

Leadership is usually considered in the context of the group relations, and leaders are perceived as people who influence the behavior of other group members. The leader is a person stimulating workers to undertake common and effective actions in the business scope of the enterprise they belong to. Thus, leadership can be described as a process in which an entity may motivate the group and encourage its members to achieve organizational goals and obligations (Avery, 2004).

The quality of the leader-follower relation shapes employees' work experiences and behaviors (Piccolo & Colquitt, 2006). Moreover, a clever leader thinks about the firm's goals, but also takes care of subordinates' needs and requirements. The leader encourages subordinates to participate actively in the decision-making process and carefully listens to their remarks and comments (Yukl, 2010). Such a responsible and friendly behavior is a good sign of organizational justice, particularly the interpersonal and informational one.

Each leader possesses a unique and personalized leadership style. However, one of the classifications includes style-oriented behavior (Blake & Mouton, 1981). The aforementioned behavioral style is characterized by either task- or relationship-orientation. The American management theorists Robert Blake and Jane Mouton (1981) introduced a managerial grid model that became popular and useful in management science. The concept of those researchers is related to the phrase: *The power to change*. The model is based on two dimensions related to the leader's behavior: concern for people (a friendly, flexible leader devoted to his/her employees), and concern for production (keeping strict formal rules). Both dimensions may be presented on the grid with various intensity, which creates multiple leadership styles.

Another popular approach deeply discussed in the literature is the situational approach. It demands a flexible and responsive leader, followed by a conscious follower. Both the leader's and subordinate's behavior must be well accommodated to the current situation (Hersey & Blanchard, 1988).

Many styles of leadership have been considered in the subject literature (Blake & Mouton, 1981; Clawson, 1999; Den Hartog et al., 1999). However, the most widespread styles are the transactional and transformational ones (Sfantou et al., 2017).

According to Bass (1985) the transactional leader operates within the present system or culture, avoids risk, skillfully manages the time and efficiency, and

monitors the procedures to maintain the control. Such a leader prefers stable, predictable environments where progress control constitutes a successful strategy. In this approach, the tasks must be well-defined, and an employee should be aware of the given obligations and possible rewards (Evans, 1996). The approach presents two possible paths: reward and punishment. The roles of every employee should be well-defined to verify the subordinate's scrupulousness, and to discipline them if needed. It is an instrumental act that provides clear rules and responsibilities. It avowedly presents possible penalties for ones' insubordination. According to Bass and Avolio (1990), transactional leadership constitutes rather a starting point for effective leadership. Transactional leadership does not consider raising employees' potential and motivation. A raw transactional approach concerns merely requirements and tasks.

Although the transformational leader may be considered as distinct from the transactional leader (Burns, 1978), both leadership approaches are somewhat overlapping (Bass, 1990). Another significant approach is the transformational leadership style. Those styles may be perceived either as supplementary or disparate.

The transformational leader highly appreciates the human factor and articulates a vision of the future (Burns, 1978), presents charisma, intellectual stimulation, and individual consideration (Bass, 1990). He/she should be concentrated on employees' needs and values. His/her followers are usually motivated and engaged in collaboration by a friendly and respectful organizational atmosphere. Employers tend to spread the values and visions among people and encourage them to be creative and devoted to their work. Such a leader has to present a respectful and moral attitude to the organization. His/her actions are inspiring and really motivating and he/she must be fully responsible for the determined goals (Avolio & Bass, 1990; Cho & Dansereau, 2010). The leader efficiently directs his/her employees to the determined goal by showing the correct path and carefully supporting their actions. Inspiring leaders stimulate employee satisfaction, and self-reported effort and job performance (Bryman, 1992; Podsakoff et al., 1996).

There are no perfect leadership styles. However, the reasonable and clever superordinate should use both (or more) of them to accommodate to certain conditions. A smart leader should present both the transactional, as well as transformational approach (Bass, 1999).

Organizational justice and its dimensions in relation to transactional/ /transformational leadership

The authors of this paper took the effort to analyze the relations between the perceived organizational justice and leadership style presented in an organization. The literature review and opinions gathered in the analysis suggest a significant relation between

these aspects. There are manifold researches in the field of organizational behavior concerning human factors. The aspects of common relations, interpersonal treatment, quality of relations, personal behavior, and common attitudes are often mentioned in the literature (Furman, 2012; Reb et al., 2019; Zeffane, 1994). The specific type of intraorganizational relations are leader-member links and issues. Although various leadership styles have been distinguished, mainly the transactional and transformational approaches are examined. A great variety of leadership styles suggests the need for further and more complex research, including less popular styles, e.g. the Fiedler model, and the situational approach by Hersey and Blanchard (1988) and Blake and Mouton (1981).

The authors of this paper conducted an analysis of the most accurate researches considered in the mentioned publications. The results are presented in the Table 1, arranged alphabetically by the author's name.

Analysis of the data gathered among Turkish teachers pointed out the significant positive relationships between transformational leadership, organizational justice, organizational support, and quality of work life perceptions. Further path analysis revealed that teachers' perceptions about the presence of transformational leadership behavior among school administrators had a significant, indirect and positive effect on teachers' perceptions of organizational justice (Akar & Ustuner, 2019).

Research undertaken among Syrian higher education employees proved that transformational leadership has both a direct and indirect impact on work engagement (mediated by interactional fairness), while transactional leadership has an impact on work engagement (through distributive fairness) (Alamir et al., 2019).

Carter et al. (2009) analyzed about 240 subordinate-supervisor dyads. They noticed the relation between in-role task performance and extra-role organizational citizenship behavior through the reciprocal relationship between subordinate and supervisor and interactional justice.

In addition, research among Korean banking sector workers showed the impact of perceived organizational justice on both the individual and group levels on the relationship between transformational leadership and OCB (Cho & Dansereau, 2010).

Dai et al. (2013) undertook an analysis of 358 valid responses from Taiwanese hotel workers. The gathered data showed that the transactional and transformational leadership styles affect procedural and distributive justice significantly and positively. Transformational leadership positively affects organizational commitment through distributive justice and trust, while transactional leadership enhances organizational commitment through distributive justice.

Research among 253 Canadian healthcare managers showed the positive impact of transformational leadership on motivation. The relation is mediated by some dimensions of organizational justice. The

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Table 1

Presentation of the research results described in the chosen publications

	Author	Influence of	Characteristic of the relation	Influence on	Mediating factor	Method	Examined group	Country
1.	Akar & Us-tuner, 2019	transformational leadership behavior	significant, indirect and positive effect	perceptions of organizational justice		SEM	658 Teachers, school administrators	Turkey
2.	Alamir et al., 2019	transformational leadership and transactional leadership	direct and indirect impact	work engagement	interactional fairness and distributive fairness	SEM	502 higher education employees	Syria
3.	Carter et al., 2009	transformational leadership	positive	followers' job performance	interactional justice	CFA	243 subordinate and 237 supervisor	USA
4.	Cho & Dansereau, 2010	transformational leadership behaviors	significant	OCB	individual and group level justice perceptions	mediated regression, SEM	159 banking sector workers	Korea
5.	Dai et al., 2013	transformational and transactional leadership	significantly and positively	procedural and distributive justice		CFA	700 employees of international tourist hotels	Taiwan
6.	Deschamps et al., 2016	transformational leadership	positive	employee motivation	organizational justice	multiple regression and path analysis, SEM	253 healthcare managers	Canada
7.	Gumusluoglu et al., 2013	transformational leadership	positive	organizational commitment	procedural justice	CFA	445 R&D employees	Turkey
8.	Katou, 2015	transformational leadership	positive	organizational growth	procedural justice	SEM	1250 employees	Greece
9.	Khaola & Rambe, 2020	transformational leadership	partially mediated	affective commitment	organizational justice	SEM and process macro techniques	300 university employees and 122 employees from public and private sector organizations	Lesotho
10.	Kim & Kim, 2015	transformational leadership	positive	affective organizational commitment	procedural leadership	CFA	1200 full-time employees of local governments	Korea
11.	Kirkman et al., 2009	transformational leadership	positive	procedural justice		CFA	560 followers and 174 leaders	China, USA
12.	Le & Lei, 2017	transformational leadership	positive	Knowledge-sharing behavior	distributive justice, procedural justice, trust in leadership	SEM	353 employees of manufacturing/ service companies	China
13.	Pillai et al., 1999	transformational leadership	indirect effect	OCB	procedural justice and trust	EFA	192 leaders and 155 subordinates	USA
14.	Pillai et al., 2011	transformational leadership	positive	procedural justice		CFA	476 employees	China, Singapore, Taiwan

Table 1, continue

	Author	Influence of	Characteristic of the relation	Influence on	Mediating factor	Method	Examined group	Country
15.	Sánchez et al., 2020	transformational leadership	negative	work-family conflict	interactional justice	CFA	466 employees	Colombia
16.	Song et al., 2012	procedural justice	positive	OCB	transformational leadership	SEM	182 employees	Korea
17.	Strom et al., 2014	distributive and procedural justice	positive	employee engagement	transactional leadership	hierarchical regression analyses	356 employees	USA
18.	Tziner & Shkoler, 2018	transformational leadership	positive	commitment	organizational justice	SEM	260 employees	Israel
19.	Zhang et al., 2014	challenge stressors	reduce the negative effect of hindrance stressors on job performance/ /foster a positive link between challenge stressors and perceived justice	job performance	transactional/ transformational leaders	CFA	339 employees and their supervisors	China

Note. The table contains the nineteen most relevant interdependencies selected by the authors of this paper.

Source: authors' own work.

results indicate that while transformational leaders influence each type of organizational justice, followers' motivation is enhanced mostly by procedural and interpersonal justice and little by distributive justice (Deschamps et al., 2016).

Research done among Turkish R&D workers outlined the significant impact of transactional leadership on work engagement through interactional fairness. The researchers showed that transformational leaders enhance perceived procedural fairness in the case of a narrow span of control, and in the case of a wide span control, transformational leadership has a significant positive effect on supervisor engagement, but has no significant impact on employee engagement (Gumusluoglu et al., 2013).

A survey among 1250 Greek employees at three hierarchical positions shed light on transformational leadership having a positive influence on organizational growth. The impact is mediated by procedural justice, trust, and organizational commitment (Katou, 2015).

A random survey of employees from Lesotho was used to examine the serial mediating roles of organizational justice and affective commitment in transformational leadership – OCB relationship. A significant relation between transformational leadership and organizational justice was observed. Perceived organizational justice and affective commitment appeared to be serial mediators between transformational leadership and OCB (Khaola & Rambe, 2020).

A Korean cross-level study showed the partial mediation of procedural justice on the relationship between transformational leadership and affective commitment (Kim & Kim, 2015). The results appeared to be consistent with previous studies (cf. Avolio et al., 2004; Walumbwa & Lawler, 2003).

A cross-level, cross-cultural examination undertaken in the USA and China showed that procedural justice mediated the link between transformational leadership and power distance orientation with followers' organizational citizenship behavior. Although there was no significant difference between the American and Chinese interviewees, there was a suggestion to repeat the research on larger and more diverse sample (Kirkman et al., 2009).

In turn, Le and Lei (2017) noticed the problem of knowledge-sharing behavior. Their research proved that distributive justice, procedural justice and trust mediate the relationship between transformational leadership and knowledge-sharing behavior. Moreover, transformational leadership and procedural justice have more significant effects on knowledge collecting, but trust and distributive justice have more significant effects on knowledge donating.

Pillai et al. (1999) examined MBA students, members of the Chamber of Commerce in the USA and employees of Australian companies. They shed light on the problem of the influence of perceived organizational justice, job satisfaction, and the leader-fol-

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lower relation in shaping the sense of procedural and distributive fairness.

The research conducted in the Confucian Asian Cluster showed that procedural and distributive justice support the trust in the transformational leader. Taiwanese transformational leaders develop the sense of procedural justice, commitment and trust (Pillai et al., 2011).

Sánchez et al. (2020) involved the problem of work-family conflict. They showed the positive influence of transformational leadership on the work-family balance, as long as the leader promotes organizational justice.

The Korean research discusses the influence of procedural justice on transformational leadership and OCB. Moreover, transformational leadership positively affects OCB. The results suggest that transformational leadership partially mediates the relationship between organizational procedural justice and OCB (Song et al., 2012).

Distributive and procedural justice enhancing engagement would be more pronounced among workers encountering low transactional leadership than in the case of high transactional leadership. Researchers suggest that a low transactional leadership style elicits uncertainty about one's social self in the workplace. Uncertain employees tend to leave their job to find one where there is the atmosphere of justice (Strom et al., 2014).

A survey administered to young-to-adult Israeli workers showed that both transformational and transactional leadership associate positively with organizational justice. In the case of older workers, transformational leadership associates positively with organizational justice; but transactional leadership is linked to it negatively (Tziner & Shkoler, 2018).

Research conducted on follower-leader dyads tested the influence of leadership and justice in the stressor-job performance relationships. Transactional leaders reduce the negative effect of hindrance stressors on job performance. In turn, the transformational approach develops the positive effect of challenge stressors on job performance as they stimulate a positive link between challenge stressors and perceived justice (Zhang et al., 2014).

A further review of the analyzed articles points out the possible direction of the examined issues. Namely, especially transformational leadership is presented as a trigger of organizational citizenship behaviors, organizational commitment and work motivation. The aforementioned factors are catalyzed by organizational fairness in the general context. Especially, interpersonal and interactional justice enhances positive employee behaviors toward an organization.

Distributive justice is also considered as a stimulating factor in the relation between leadership style and employees' attitudes toward their organization. Other important catalysts influencing the relation between leadership style and employee commitment are: commitment to the supervisor, self-efficacy, and an atmosphere or procedural justice. Further, a col-

lective identity shapes the employees' approach to an organization. In addition, it is worth mentioning the employees' behavior-forming role of the perceptions of justice both at the individual, as well as at the group level (Cho & Dansereau, 2010), which may constitute a future research direction.

Conclusions

The authors of this paper attempted to outline the complex and elaborate problem of the interrelation between leadership style and perceived organizational justice. The literature review was undertaken in order to close the gap on the link existing between the abovementioned issues. Moreover, these aspects may play a mediating role in the relationship involving OCB, work commitment, sense of job satisfaction, knowledge sharing, willingness to share knowledge, and intention to quit the job. What is more, both perceived justice and leadership shape the employee's motivation, innovation, readiness to work, and creativity. These issues play an important role in the whole management process, which results in the improvement (or the falloff) in organizational performance.

The relationship between leadership style and organizational equity has been analyzed many times in the subject literature, however, this topic has not been fully exploited yet. This is why these problems should be further examined. These issues should be insightfully analyzed, as they are multidimensional and multi-faceted, and they differ over time. Owing to the fact that both organizational justice as well as leadership styles are not unambiguous and include various subtypes, further examinations should be conducted.

The analyzed phenomena refer to the empirical research conducted among medical personnel, bank employees, and academic staff. It may be useful and interesting to test the employees working in other types of organizations. Leaders involved in every single organization should be aware of the significance of their attitude toward their employees. Namely, through a more accurate approach and proper work style and support, leaders may influence employees' work effectiveness and organizational performance.

Each specific dimension of perceived organizational justice may support the leader's ability to guide his/her subordinates' actions. Advanced research on leadership effectiveness may shed some light on justice dimensions, as factors enhancing the relations between leadership effectiveness and other factors, i.e. employees' motivation, job satisfaction, and knowledge sharing intention, etc. It brings out the moderating attribute of perceived organizational justice types.

The literature review undertaken by the authors of this paper may constitute a theoretical foundation to prepare and conduct future empirical research concerning the interrelations between perceived organizational justice and leadership style. Undoubtedly, the current state of knowledge demands further

insightful analysis and discussions on the points which may be raised in such research. Further testing of the relations may point to their potential direction and intensity, taking into consideration various economic sectors and cultural contexts.

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Albert
Tomaszewski

Can digital transformation be measured from a strategic perspective? Some evidence based on content analysis in the banking and clothing industries

Abstract

Digital transformation is widely recognized to be a key issue in contemporary management studies. The area is attracting increasing attention because of both the general trend of the growing importance which digital technologies play in the present society, as well as the ways companies are using digital technologies to improve their competitive advantage. As a result, digital transformation is a subject of a growing number of papers, research, and managerial publications. The main aim of this work is to propose and validate a method to measure the phenomenon and its role in companies' strategies, and to gather information on strategic directions for digital transformation in enterprises. This paper presents an overview of the literature discussion on digital transformation. A method to study directions of digital transformation in enterprises is demonstrated. It is based on the content analysis methodology and is used to study a choice-based sample of companies listed on the Warsaw Stock Exchange. The research carried out offers preliminary evidence supporting the conclusion that digital transformation is a phenomenon which can be measured with the content analysis framework. The findings also outline strategic directions for digital transformation and shed light on possible variables influencing the process.

Keywords: digital transformation, strategy, digitization, digital technologies, content analysis

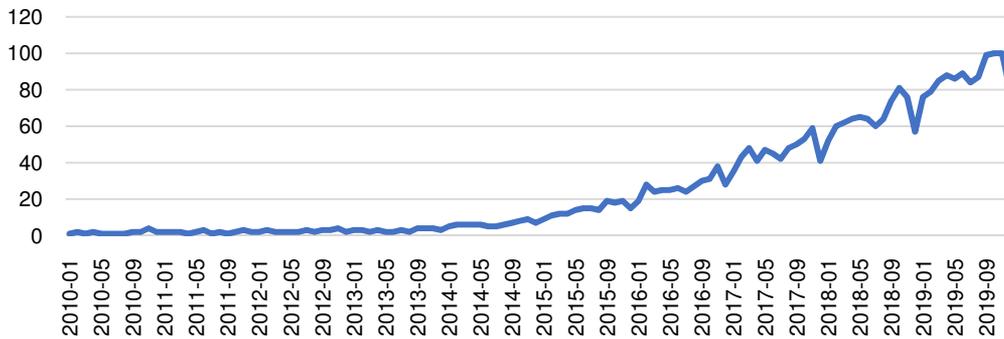
Introduction

Digital transformation is a relatively new concept that describes the process of changes in economic and social activities induced by the increasing use of digital technologies. The subject is met with the growing interest of the public and the scientific community. The first aspect is illustrated by the growing popularity of the search for "digital transformation" in the Google search engine. Over the last 7 years, interest in this term has grown rapidly. Details are presented in Figure 1.

A similar effect can be observed in academic interests. The problem of digital transformation is a vibrant research area in sociology (Enjolras & Steen-Johnsen, 2017; Fukuyama, 2018; Graham & Dutton, 2019; Hanna, 2016; Miller, 2020; Webster, 2014), economics (Barefoot et al., 2018; Bukht & Heeks, 2017; Popkova & Sergi, 2019; Schweer & Sahl, 2017; Tapscott, 2015), and management (as discussed more broadly in the paper). The last decade saw a significant increase in the number of scientific publications that deal with the issue of digital transformation of enterprises. According to the data in the Google Scholar database, fewer than 200 articles were published in 2010 and 2011 each on problems related to this topic. In the next years, this number grew slowly until 2015. Since then, the growth has been geometric. In 2019 alone, the number of published scientific texts related to the phrase "digital transformation" + enterprise exceeded 11,000. Details are presented in Figure 2.

Figure 1

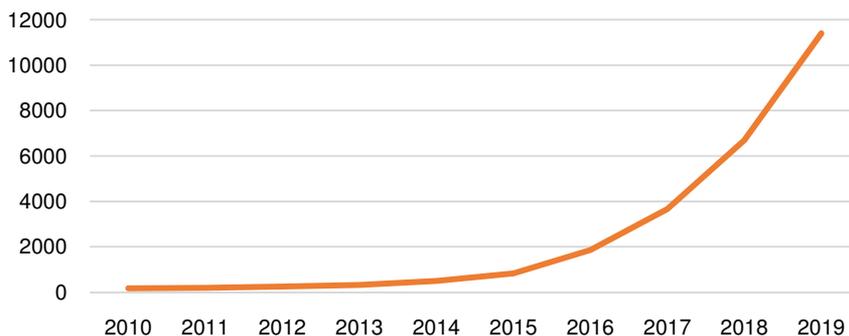
Trend of popularity of the phrase “digital transformation” in Google search engine in the years 2010–2019



Source: author’s work based on data on the query of “digital transformation” from Google Trends service.

Figure 2

Annual number of scientific publications on digital transformation of enterprises in 2010–19



Source: author’s work based on the results of searches on query of “digital transformation” + enterprise in Google Scholar.

The vitality of the subject can also be observed in the scope of the topics covered and the variety of opinions on many aspects of digital transformation of enterprises. Although in recent years there have been many attempts to synthesize research and theoretical considerations on the phenomenon (Haffke et al., 2017; Hanelt et al., 2020; Henriette et al., 2015; Karimi & Walter, 2015; Kossowski et al., 2020; Morakanyane et al., 2017; Pihir et al., 2019; Reis et al., 2018; Sebastian et al., 2017; Vial, 2019; Ziyadin et al., 2020), currently there is no general consent about the framework of the concept. The gap is especially evident in empirical studies with a strategic scope of analysis. Difficulties in measuring digital transformation may be an important obstacle hindering research and theory formulation.

This paper addresses this problem by seeking and proposing answers to the following research questions: (a) Can digital transformation be measured? (b) What are the strategic directions for digital transformation in enterprises? (c) Does the size of enterprises and their sectors differentiate the level of strategic commitment to digital transformation? The structure of the paper reflects the above points.

The first part consists of a literature review, the second explains the methodological approach adopted in the research; and the last presents and discusses the results.

The paper’s contribution is threefold: (a) it proposes a method which can be used to measure the digital transformation phenomenon at a strategic level; (b) it provides preliminary evidence on the method’s research legitimacy; and (c) it outlines strategic directions for digital transformation of the enterprises and sheds light on possible variables influencing the process.

Digital transformation – literature overview

Westerman et al. (2014) describe digital transformation simply as the use of technology to radically improve the efficiency and scope of an enterprise. For Matt et al. (2015), it is a transformation of key business operations, which affects products and processes, as well as organizational structures and management concepts. Legner et al. (2017) present a much narrower take – they identify digital trans-

formation as a use of information technologies to at least partially automate tasks. Kossowski et al. (2020), in turn, defines the process in more general terms – as a transformation of an organization in the era of digitization. It is common for researchers to propose their own definitions. In addition, in recent years several attempts to propose a synthetic definition of the digital transformation of enterprises based on a systematic review of the literature were published (Hanelt et al., 2020; Henriette et al., 2015; Li, 2018; Morakanyane et al., 2017; Pihir et al., 2019; Reis et al., 2018; Vial, 2019; Ziyadin et al., 2020). So far, there is no widely accepted definition of the term.

For most scholars, digital transformation is inextricably linked to new technologies and their use by enterprises. The popular concept of SMACIT associates the phenomenon with five key technologies: Social media, Mobile phones, data Analytics, Cloud computing, and Internet of Things (Sebastian et al., 2017). The Digital Transformation Scoreboard prepared for the European Commission lists nine technologies: social media, smartphones, cloud technologies, Internet of things, cybersecurity, robotics and machine automation, big data and data analytics, 3D printing, and artificial intelligence (Probst et al., 2018). Other researchers, such as Ustundag et al. (2018), supplement those lists with industrial technologies (i.e., intelligent sensors, actuators, RFID¹, RTLS², additive manufacturing).

Despite minor discrepancies in scholars' perceptions of the roles of individual technologies, the importance of the technological sphere in digital transformation is undisputed. Technologies enable different aspects of the digitization of previously physical tasks, which in turn brings benefits in many different areas of activity.

Most empirical studies show the impact of digital transformation in a fragmentary way. For example, in the context of internationalization, digital technologies change the determinants of competitive advantages, reduce transaction costs, reduce the importance of the specificity of location and resources, and affect the spread of outsourcing and offshoring (Wittkop et al., 2018). Digitization in startups has a positive effect on the professionalization of organizations (Murmann et al., 2020). According to Piccinini et al. (2015), the use of technology provides benefits primarily in the areas of improving customer experience. The use of digital technologies and the focus on developing new digital solutions cause profound changes in the approach to innovation management (Nambisan et al., 2017). Increased data availability and advances in data analytics are driving changes

by optimizing processes and services (Günther et al., 2017).

A distinct subset of studies focuses on the concept of Industry 4.0, which can be treated as a manifestation of digital transformation in manufacturing organizations. The essence of Industry 4.0 is to build Internet-connected solutions into industrial operations based on microsensors and artificial intelligence algorithms (Carvalho & Cazarini, 2020). Depending on the interpretation, a side effect or a measure used in implementing the ideas of Industry 4.0 is the emergence of cyber-physical systems (Singh, 2020; Zhou et al., 2016), i.e., those in which the flow of physical objects is accompanied by an in-depth and wide registration of digitally stored and processed information.

Based on these fragmentary studies, it can be argued that the term “digital transformation” in its primary meaning denotes a trend of converting originally physical processes into digital equivalents. This view does not call for any strategic approach to successfully manage digital transformation. It is a main discussion point for many authors (An, 2018; Hess et al., 2016; Kane et al., 2015; Rogers, 2016; Vial, 2019; Westerman et al., 2014), who posit that digital transformation is a strategic problem.

According to Rogers (2016), strategy is a key element that is essential in the digital transformation process. New technologies do not shape changes by themselves, and their adoption requires an appropriate strategy. As shown in numerous studies (Gobble, 2018; Ross et al., 2017), many organizations have developed digitization strategies to address the issue. Therefore, digital transformation can be viewed as a new area of strategic management (Loebbecke & Picot, 2015).

On the other hand, Sebastian et al. (2017) perceive digital transformation as a factor changing the rules of the game in sectors, i.e. creating opportunities and threats for existing enterprises. (Iansiti & Lakhani, 2015) show how technologies help to defend market positions against new entrants in the sector through better use of resources and partnerships with technology companies. According to Bell and Berman (2011), the essence of digital transformation is the shift in companies' value propositions toward digital services and products enriched with digital components. These examples show that the literature connecting digital transformation with strategic problems is also very diverse and concerns different levels of enterprises' activity. Rare attempts to describe the strategic directions of digital transformation take the shape of maturity models (An, 2018; Berghaus & Back, 2016; Gill & VanBoskirk, 2016;

¹ RFID = Radio-frequency identification

² RTLS = Real-time locating system

Kane et al., 2015; Rossmann, 2018; Teichert, 2019). However, while this perspective is very attractive for management practitioners, it is based on relatively little empirical data. Thus, the issue of a method which could help to gather evidence on digital transformation from a strategic perspective can be perceived as an important research problem.

Research objectives and method

The objectives of the study are twofold: (a) to propose and validate a method to measure digital transformation at a strategic level of consideration; (b) to gather information on strategic directions for digital transformation in the sample group. Both goals are closely related. The method can only be validated on the gathered information, and vice versa gathering the information requires designing a new method of research.

The new method is based on the content analysis methodology, which is adopted to standardize and interpret information available in annual reports of the sample companies. This approach brings to the fore methodological issues which need to be discussed.

Annual reports as a source of information about companies' strategy

Annual reports published by listed companies are a commonly used source of information on the activities undertaken by enterprises. In particular, standard practice is to use financial information for corporate evaluation. The advantage of this approach is the fact that financial data is highly standardized information. Stock exchanges and financial supervision institutions impose detailed financial reporting guidelines on listed companies.

Corporate reporting standardization guidelines also apply to non-financial information, although to an extent which varies for different management problems. For example, annual reports are often used to research capital group structures, levels of business diversification, and the level of internationalization. The study of these issues do not arouse major methodological discussions due to legal regulations that impose the need to publish information about capital ties, and the industrial and geographical scope of business activities.

Apart from the above, the annual reports published by companies listed on the Warsaw Stock Exchange also contain a lot of information imposed by less stringent regulations. They include, among others: information about development strategy plans and their implementation, and an overview of risk factors and threats, specifying the degree of exposure (Pachucki & Plutecki, 2018). In addition, larger listed companies are required to publish a description of the business model, key non-financial performance indicators and CSR policies (Pachucki & Plutecki, 2018). The above information, although standardized to a small extent, can also be a source of data on corporate strategies. The lack of standardiza-

tion of strategic information poses a challenge, which requires a more sophisticated research approach. In this respect, it is necessary to standardize the available information before its analysis.

Content analysis as a method to standardize information from annual reports

An effective way to study non-standardized information is to use the content analysis method as described by Saldaña (2014). The use of this approach in the social sciences has a very long history (Berelson, 1952) and can be associated with both qualitative and quantitative research (Krippendorff, 2004). In the field of management sciences, the first examples of its application can be traced back as early as to the 1970s. At that time, studies of the content of annual reports were carried out, in which this technique was used to analyze corporate strategies (Bowman, 1978, 1984). Nowadays, this approach is often used in the context of new management concepts (Amini et al., 2018; Garanina & Dumay, 2017; Guthrie et al., 2004; Santema et al., 2005).

In this method, the solution to the problem of insufficient standardization of input data is solved by a coding procedure (Krippendorff, 2004). This involves assigning descriptive terms to excerpts of source material. They can and often take the form of hierarchical categories, so the source text is represented in a structure that can be further analyzed (Saldaña, 2014).

A two-step coding procedure is used, especially in studies which analyze the extensive resources of input texts. In the first step, a dictionary of key words and phrases is created. The entries are used to search for excerpts of source materials related to the variables defined by the researchers. The terms are arranged into summary categories. In the processes of analysis, appropriate excerpts are marked with terms and categories. They are objects of further study depending on the research objectives.

In qualitative research, an in-depth interpretation of the contexts in which categories appear is performed. In quantitative research, it is possible to study the frequency of occurrence of individual categories and entries. Both approaches can be combined. A simplified diagram of the research procedure for the quantitative analysis of the content is presented in Figure 3.

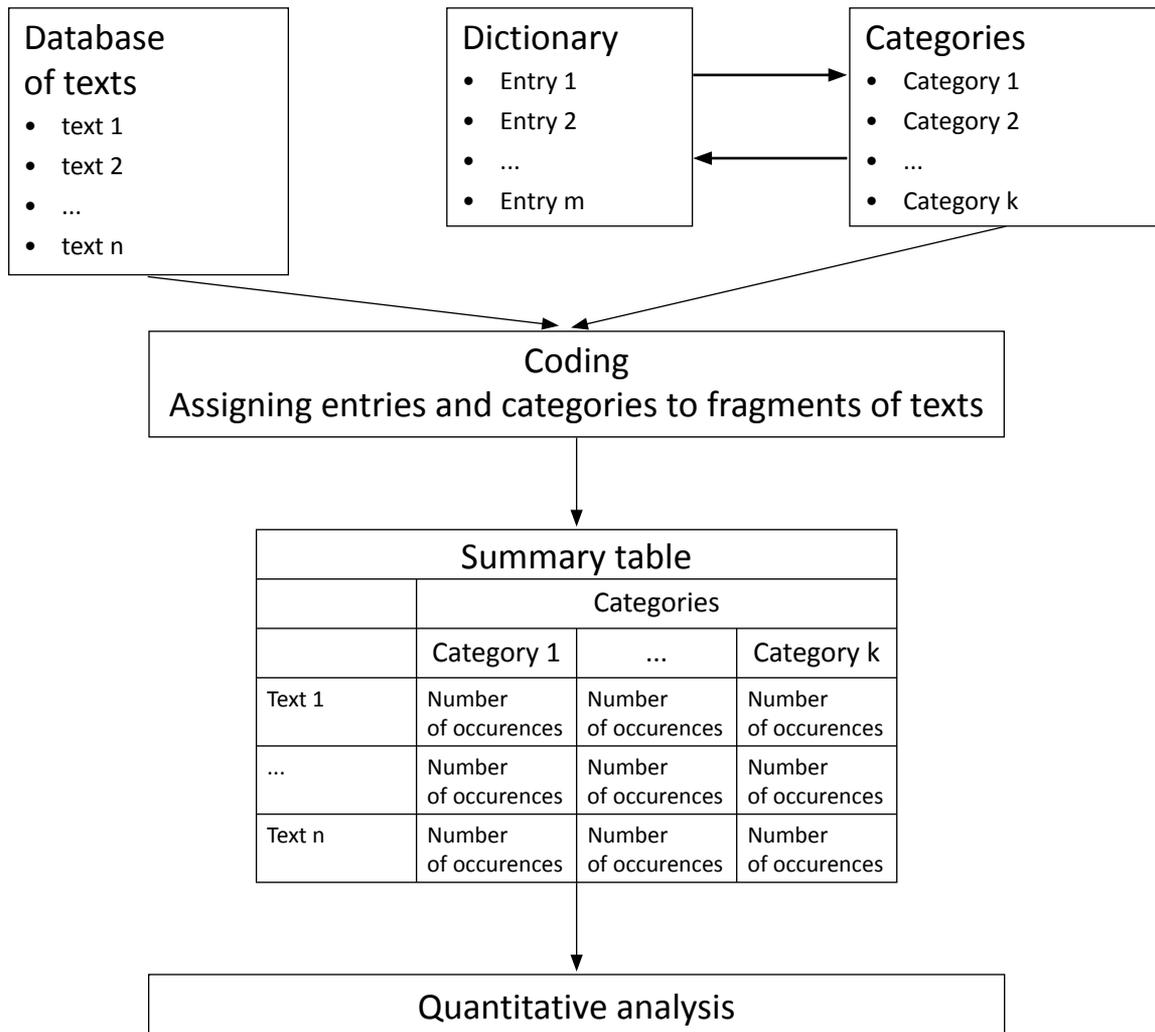
Research procedure

After consideration of the content analysis methodology, the research procedure was set to follow the stages of:

1. Sampling,
2. Selecting types of reports and the time frame,
3. Selecting categories for content analysis,
4. Creating a dictionary with entries assigned to the categories,
5. Coding reports using entries and categories,
6. Quantitative analysis,
7. Conclusions.

Can digital transformation be measured...

Figure 3
Quantitative content analysis research procedure



Source: author's work based on MAXQDA manual: <https://www.maxqda.com/help-mx20-dictio/dictionary-based-content-analysis/schematic-course>.

Research sample

Choice-based sampling was used, which is justified by the exploratory nature of the study. The sample was selected from the population of enterprises listed on the Warsaw Stock Exchange (GPW). The focus was on enterprises whose main market is Poland. Then it was decided to focus on companies in two sectors. After analyzing the information provided by the GPW, a decision was made to focus on companies grouped in the stock indices of WIG-Banki (banks) and WIG-Odzież (clothing). Detailed analysis of the information of the companies grouped in the indices led to the selection of 24 entities: 12 banks and 12 clothing companies. Selection was based on a size criterion. As a result, the sample included companies of various sizes in terms of market capitalization at the end of 2019: 7 companies with a valuation below PLN 100 million, 6 with a valuation ranging

PLN 100–1,000 million, 5 with a valuation of PLN 1–10 billion and 6 companies with a valuation that significantly exceeded PLN 10 billion. The details of the sample are presented in Table 1.

Selecting types of reports and time frame

The studied sample consists of companies listed on the Warsaw Stock Exchange, which are subject to reporting obligations regulated by the Polish Financial Supervision Authority (UKNF). Annual reports, as periodic reports, contain financial data and descriptive information that present the activities and business environment of a given company in the reporting period (Pachucki & Plutecki, 2018) as discussed above. Descriptive information on the company's strategy is included in the reports of the management board. These full reports became the objects for the content analysis in the study.

Table 1*General information about the sample*

Sector stock index	Company name	Market capitalization (end of 2019) (PLN mln)	Size category
WIG-Banki	PKO BP	43,075	Very large
WIG-Banki	Santander Bank Polska	31,382	Very large
WIG-Banki	Bank Pekao	26,365	Very large
WIG-Banki	ING Bank Śląski	26,345	Very large
WIG-Banki	mBank	16,491	Very large
WIG-Banki	BNP Paribas	10,024	Large
WIG-Banki	Bank Millennium	7,097	Large
WIG-Banki	Bank Handlowy	6,768	Large
WIG-Banki	Alior Bank	3,744	Large
WIG-Banki	BOŚ	662	Medium
WIG-Banki	Getin Holding	316	Medium
WIG-Banki	Getin Noble	313	Medium
WIG-Odzież	LPP	16,338	Very large
WIG-Odzież	CCC	4,528	Large
WIG-Odzież	VRG	947	Medium
WIG-Odzież	WITTCHEN	224	Medium
WIG-Odzież	CDRL	142	Medium
WIG-Odzież	Monnari	91	Small
WIG-Odzież	Lubawa	87	Small
WIG-Odzież	Protektor	66	Small
WIG-Odzież	Intersport Polska	62	Small
WIG-Odzież	Wojas	60	Small
WIG-Odzież	ESOTIQ & Henderson	27	Small
WIG-Odzież	Sanwil	10	Small

Source: author's own work.

To take into account the dynamics of the digital transformation process in the surveyed companies, the analysis was carried out on report documents from three years of operation: 2017, 2018 and 2019.

Selecting categories for content analysis

The literature overview presented in the first part of the paper shows the broad scope of contemporary scientific considerations on digital transformation of enterprises. As outlined above, the perspective of digital maturity models synthesizes multiple directions of study with practical guidelines for companies. In this respect, the concept of An (2018) stands out against the models presented in the literature review with a high degree of detail and a strong embeddedness in the practice of implementing technological solutions in enterprises. For this reason, it was decided to base the dictionary category structure on the twelve areas of digital transformation proposed in this concept.

The categories are built around the main strategic directions for digital transformation of companies:

- Front office – client-related competencies:
 - Digital channel,
 - Digital commerce,
 - Digital marketing,
 - Social interactions,
- Back office – supporting competencies:
 - Digital intelligence,
 - Knowledge and content,
 - Customization and personalization,
 - Digital customer experience,
- Development competencies:
 - Digital development and operations,
 - Digital alignment,
- Infrastructure competencies:
 - Digital data,
 - Digital infrastructure.

From the practical point of view of the selection of the categorization framework, An's model has an advantage of specifying the technological solutions used in the categories. It means that basing the dictionary structure on the model creates a possibility for subsequent replication studies.

Creating a dictionary with entries assigned to the categories

The dictionary was created in several steps.

In the first step, entries (keywords) related to particular categories were selected from An's model. The keywords primarily include the names of technology solutions, electronic services and management techniques that relate to the capability areas assigned to the category. Over 150 keywords were selected.

In the next step, these entries were examined by analyzing the context in which these keywords appear on business and technological pages on the Internet. During this analysis, the list was expanded to include technologies and techniques not mentioned in An's model. Then, after translation into Polish, a similar procedure was performed. After this stage, over 200 items appeared on the list of terms.

In the next stage, the dictionary was expanded by adding to the list the conjugations³ of the entries in the Polish language, and commonly used synonyms and spelling variants. As a result of this step, there were over 350 entries in the dictionary.

In the next step, the keywords were input into the MAXQDA⁴ software together with ten annual reports from the sample. Using the software, excerpts with keywords were searched. The results were analyzed in terms of the compliance of the context in which the entries are used with the subject of digital trans-

formation. As a result, the list of dictionary entries was verified. Misleading entries were removed or adjusted to be precisely connected to digital transformation. Additionally, it was found that the reports include general terms such as digitization, digital transformation, etc. which needed to be added to the dictionary as a separate, general category. The final list of keywords consisted of 265 items, which were assigned to the previously defined twelve categories and the general one.

Coding the annual reports

Coding was conducted with the Dictio module of the MAXQDA software. The module automates the process of searching keywords in sets of documents and automatically codes categories based on the entries and a given dictionary structure.

A total of 72 corporate reports (24 companies, 3 years of operation), composed of a total of over 3.7 million words, were analyzed by the software. As a result, 6,951 excerpts were categorized in the documents. The keywords occurred in all documents over 9,000 times.

Quantitative analysis and inferring

The number of excerpts marked with codes allowed for a quantitative analysis. The excerpts were marked with categories. Information on the number of excerpts assigned to the categories in all enterprises were included in the summary table. The table includes information broken down for 2017, 2018 and 2019. For each annual report, the number of excerpts assigned to the categories were also presented in relative terms, as a frequency of occurrence compared to the general number of words in the report.

To establish a reference level to interpret the occurrence of the different categories, additional data was computed. The occurrence of phrases of strategy, business model, product, and innovation (entries were counted considering words conjugation in the Polish

language) was computed for each annual report of the research sample.

Based on the above data, the inference stage was carried out.

Results

Importance of digital transformation from a strategic perspective

The measurements of the frequency of occurrence of dictionary entries in annual reports show that the topic of digital transformation can be viewed as an important strategic subject. All the keywords assigned to the general category of digital transformation consist of approximately 0.04–0.06% of all words used in the reports. Compared to the reference categories widely associated with strategic problems (strategy, business model, product, and innovation), this result proves to be at a significant level. It is higher than the scores for the innovation and business model categories, but lower than the measurements for the categories of strategy and product. The detailed results broken down into years are presented in Table 2.

Strategic directions of digital transformation

The detailed results of categories representing strategic directions of digital transformation show that companies from the sample generally focus on client-related competencies: digital channel, digital commerce, digital marketing, and social interactions. Except for the digital customer experience and digital development and operations, in the remaining categories the keywords were counted at negligible levels. The results are shown in Table 3.

Differences among the sample group

The problem of digital transformation was represented in reports of enterprises to a varying degree. Details are presented in Table 4.

Table 2

Strategic importance of digital transformation compared to reference categories

Categories		Frequency measures		
		2017	2018	2019
Reference categories	Strategy	0.102%	0.103%	0.117%
	Business model	0.008%	0.010%	0.009%
	Product	0.151%	0.150%	0.152%
	Innovation	0.027%	0.024%	0.021%
Digital transformation – general category		0.043%	0.052%	0.060%

Note. The measures show the frequencies with which the defined keywords were found in the annual reports of the sample groups.

Source: author's own work.

³ The procedure was conducted due to specificity of Polish language grammar.

⁴ MAXQDA is one of the leading software packages designed for qualitative data analysis. The software contains the Dictio module, which is designed to automatically code excerpts of text based on a dictionary defined by the researchers.

Table 3

Strategic importance of digital transformation broken down into detailed categories

Categories	Frequency measures		
	2017	2018	2019
Front office – client-related competencies			
Digital channel	0.05%	0.05%	0.05%
Digital commerce	0.01%	0.01%	0.02%
Digital marketing	0.02%	0.02%	0.03%
Social interactions	0.01%	0.01%	0.01%
Back office – supporting competencies			
Digital intelligence	0.00%	0.00%	0.00%
Knowledge and content	0.00%	0.00%	0.00%
Customization and personalization	0.00%	0.00%	0.00%
Digital customer experience	0.01%	0.01%	0.01%
Development competencies			
Digital development and operations	0.02%	0.02%	0.02%
Digital alignment	0.00%	0.00%	0.00%
Infrastructure competencies			
Digital data	0.00%	0.00%	0.00%
Digital infrastructure	0.00%	0.00%	0.00%
General category	0.04%	0.05%	0.06%

Note. The measures show the frequencies with which the defined keywords were found in the annual reports of the sample groups.

Source: author’s own work.

The table shows high variation of the representation of digital transformation in the strategies of the sample companies. The highest value of the frequency ratio, i.e. 0.42%, was recorded in the reports of Alior Bank (2018), mBank (2018) and Santander Bank Polska (2017). The lowest value, over 40 times lower at 0.01%, was observed in the documents ESOTIQ & Henderson (2017 and 2018) and Sanwil (2017 and 2018).

The scope of these differences largely coincides with the sectoral division of the studied sample. Banks scored on average several times higher values of indicators than enterprises from the clothing industry. Details are presented in Table 5.

Table 5

Strategic importance of digital transformation broken down by industries

Industry	2017	2018	2019
Banking	0.25%	0.26%	0.29%
Clothing	0.05%	0.06%	0.09%

Note. The measures show the frequencies with which the defined keywords were found in the annual reports of the enterprises from the sample groups.

Source: author’s own work.

Table 4

Strategic importance of digital transformation shown by enterprises from the research sample

Company	2017	2018	2019
Alior Bank	0.33%	0.42%	0.41%
Bank Handlowy	0.26%	0.15%	0.29%
Bank Millennium	0.27%	0.30%	0.27%
Bank Pekao	0.18%	0.20%	0.20%
BNP Paribas	0.17%	0.23%	0.32%
BOŚ	0.04%	0.07%	0.07%
CCC	0.12%	0.14%	0.34%
CDRL	0.06%	0.06%	0.07%
ESOTIQ & Henderson	0.01%	0.01%	0.02%
Getin Holding	0.07%	0.10%	0.14%
Getin Noble	0.05%	0.16%	0.16%
ING Bank Śląski	0.34%	0.31%	0.35%
Intersport Polska	0.08%	0.07%	0.10%
LPP	0.08%	0.13%	0.20%
Lubawa	0.04%	0.05%	0.04%
mBank	0.32%	0.42%	0.39%
Monnari	0.03%	0.07%	0.06%
PKO BP	0.18%	0.25%	0.27%
Protector	0.02%	0.01%	0.03%
Santander Bank Polska	0.42%	0.38%	0.40%
Sanwil	0.01%	0.01%	0.03%
VRG	0.03%	0.02%	0.03%
WITTCHEN	0.07%	0.08%	0.09%
Wojas	0.08%	0.08%	0.08%

Note. The measures show the frequencies with which the defined keywords were found in the annual reports of the enterprises from the sample group.

Source: author’s own work.

Differences are also visible based on the size of the enterprises. The smaller the enterprise, the less the keywords related to digital transformation appear in the annual reports. However, it is worth pointing out that in all groups, there is a noticeable increase in scores in subsequent years. Details are presented in Table 6.

Table 6

Strategic importance of digital transformation broken down by size categories

Size of the company	2017	2018	2019
Small	0.04%	0.04%	0.05%
Medium	0.05%	0.06%	0.07%
Large	0.24%	0.23%	0.32%
Very large	0.28%	0.29%	0.31%

Note. The measures show the frequencies with which the defined keywords were found in the annual reports of the enterprises from the sample groups.

Source: author’s own work.

Conclusions and limitations

The information presented above show that: (a) digital transformation can be measured from a strategic perspective, (b) the main strategic directions for digital transformation in research group are linked to areas of interaction with clients, (c) the level of strategic commitment to digital transformation is differentiated by the size of enterprises and their sectors. Digital transformation-related terms were found in corporate annual reports at a frequency that is comparable to other keywords commonly linked to strategy. Additionally, a growing interest related to digital transformation was observed in the subsequent studied years. The increase was observed in all examined cross-sections.

Based on the presented data, it can be concluded that the digital transformation strategy in the sample companies focused mainly on areas of interaction with clients. The areas of digital channels and digital commerce stood out in the analysis. In connection with the above, it should be concluded that in the studied sample, digital transformation is not a comprehensive process, but concerns selected areas of business activities. The areas that affect establishing and maintaining relationships with the client are of particular importance.

The banking industry puts a stronger emphasis on digital transformation in its strategies compared to clothing companies. This may be related to a longer history of electronic services in Polish banks. E-banking, which was introduced in Poland 20 years ago, can be viewed as the first activity in which banking entities began to convert some of their processes to their digital equivalents. A similar trend in the clothing industry is to build their own branded online stores. This practice was started by industry leaders 10 years ago and is still in development. Not all clothing companies from the sample run their own online stores yet. Meanwhile, all researched banks provide electronic banking services and most of them also have banking applications for smartphones. The most advanced banks have an integrated platform in which, regardless of the channel (www, smartphone, telephone), most banking services are provided. In the clothing industry, the advancement of such solutions is at much lower levels. The obtained results reflect these differences.

Another factor that significantly differentiates the sample is the size of the enterprise, measured by capitalization. Enterprises classified as large and very large, i.e. those whose capitalization exceeded PLN 1 billion at the end of 2019, are much more focused in their strategies on topics related to digital transformation. Perhaps size (especially measured by valuation) means easier access to the financial resources which are necessary to implement digital transformation projects on a larger scale.

Based on the obtained results, it can be concluded that the designed method has proved successful. Nonetheless, the results were obtained on a relatively small, choice-based sample, which means they should be a subject of further studies. The developed method

proves that digital transformation can be measured from a strategic perspective but using it on a greater scale requires further development and verification on a larger sample.

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WE RECOMMEND

EDMO (European Digital Media Observatory) Week: United Against Online Disinformation



EDMO Week: United Against Online Disinformation (online)

The European Digital Media Observatory brings together fact-checkers and academic researchers with expertise in the field of online disinformation, and open to collaboration with media organizations and media literacy practitioners.

It promotes scientific knowledge on online disinformation, advances the development of EU fact-checking services and supports media literacy programs. EDMO also supports public authorities assessing the implementation of the EU Code of Practice on Disinformation.

Between 7–11 June, the European Digital Media Observatory brought together 500+ participants to celebrate its first annual conference, EDMO Week. The event gathered a wide range of stakeholders jointly working to tackle online disinformation, including academics, fact-checkers, media literacy experts, regulatory authorities, online platforms, civil society, and the policy sector.

Every afternoon EDMO Week set the scene for lively discussions with more than 50 speakers on a wide range of key topics: from the need for a multi-stakeholder approach in tackling online disinformation to fact-checking in the context of a global pandemic, and from the role of research and policy to media literacy and other local initiatives.

All recordings can be accessed on EDMO YouTube channel: <https://www.youtube.com/hashtag/edmoweeek>
More about EDMO and its activities at: <https://edmo.eu/edmo-at-a-glance/>



Robert
Pawlak

Implementation aspects of agile methods in large organizations

Abstract

The aim of this article is to analyze the challenges and success factors on organizations' path to agile transformation, as frequently discussed in the literature and encountered in business practice. The research conducted proved that large-scale agile transformations require a dedicated approach with set of tools and best practices in place. The implementation challenges and barriers have been categorized into method-, organization-, culture- and technology-oriented groups. As a result of an in-depth analysis carried on for the purpose of this paper, a dedicated methodology of agile transformation has been proposed to ease the implementation process.

Keywords: agile transformation, agile scaling, agile challenges and success factors, agile transformation methodology, agile in large organizations

Definitions of agile transformations in large organizations

Research interest in agile methods has been present in the literature for 20 years now. In the beginning, agile methods concentrated on single projects in small organizations, mostly, in the IT and ICT sectors. The next step in agile methods development was directed toward the introduction of a framework for the purpose of implementation in large organizations. Research on agile transformations in large organizations focuses mainly on specific aspects of organizations' operations (Rolland et al., 2016). In the first place, this term is used to describe the use of agile methods in large organizations. Secondly, agile transformation is perceived as the application of agile methods in large projects or large teams. Thirdly, this term describes the use of agile in multi-team environments. The final example is the application of agile rules and practices in the organization as a whole (Dingsøyr & Moe, 2014). For the purpose of this paper, the definition adopted describes the large-scale application of agile methods at the organizational level in multi-team environments (Dikert et al., 2016).

The very term transformation, in this context, means transfer from some traditional method into an agile way of thinking and working (Dikert et al., 2016). A large-scale agile transformation may take the form of a one-time shift to agile methods or may have an iterative character, in which pilot agile improvements are gradually scaled over the entire organization. In such a case, the agile scaling process is a rollout of initial agile implementations onto the remaining organizational structures or is a broader implementation of existing agile methods within the organization (Paasivaara et al., 2018).

Empirical research on agile transformations in large organizations focuses on case studies which, for example, analyze methods of multi-team cooperation (Scheerer et al., 2014). Additionally, specific methods supporting agile transformation with, for example, the use of communities of practice, are also found in the literature (Paasivaara & Lassenius, 2014). One of the studies describing a process of agile transformation in a large organization, from the lessons-learned perspective, is Maria Paasivaara et al.'s (2018) study on agile transformation in Ericsson.

Besides the academic research, there are multiple studies from practitioners and consulting companies offering methodological guidelines easing agile transformations and promoting agile scaling processes. These methodologies include, among other things, Scaled Agile Framework (Scaled Agile, 2017), Large Scale Scrum (LeSS) (Vodde & Larman, 2018) and Disciplined Agile Delivery (DAD) (Ambler & Lines, 2012). Despite the fact that these methodologies offer proper ways for conducting transformation

in an organization, they do not guarantee successful results of such a large-scale endeavor (Paasivaara et al., 2018).

For the above-mentioned reasons, a thorough study in the field of agile transformations in large organizations needs to be conducted and a research question formulated to examine the challenges and success factors of agile transformations in large organizations. Moreover, further detailed research in this respect is necessary to understand scaling processes and internal dependencies, as well as challenges linked to agile transformation especially in the context of digital disruptions. This article, based on a critical literature review, is theoretical in nature and focuses on two aspects of agile implementations. The first one is an analysis of the implementation factors of agile transformations in large organizations, and the second, a proposal of a methodology of agile transformation.

Characteristics and challenges of agile transformations

Organizations strive to apply agile practices in order to become more competitive, improve their processes and better manage change. In turn, these practices cause challenges linked with the integration of agile methods at all levels of organizations. Despite the fact that many organizations use agile methods, it is still not clear what conditions must be met for them to be successfully implemented (Lindvall et al., 2004). Furthermore, some researchers claim that agile is not the right direction of development for large, traditional organizations with complex hierarchical structures in place (Barlow et al., 2011; Boehm & Turner, 2005).

A predominant research topic in the literature on agile methods (Cao et al., 2009) deals with challenges resulting from agile scaling and transformation in large organizations linked to processes, customers and organizational culture. One of the main objectives of this research is to establish organizations' motivation and rationale behind adopting agile methods (Cao et al., 2009). Early works by Sridhar Nerur et al. (2005) report on issues with initial agile implementations at the project level, such as selection of the appropriate agile method or a lack of agile competencies among the developers. Also, present studies (Hekkala et al., 2017) reveal problems with transformation from the traditional to agile ways of working. These difficulties include a lack of understanding of agile rules and practices as well as inappropriate organizational structures to accommodate the agile values necessary for proper transformation and scaling. Additionally, large-scale transformations outrank agile implementations in small environments such as a single project team. Large scales involve challenges linked to issues with prioritization dilemmas between project teams within a single portfolio as well as merging diverse work cultures between traditional and agile teams (Scheerer et al. 2014; Zheng et al., 2011).

The main challenges of agile transformations stem from problems occurring at the organizational level in large companies. Table 1 illustrates various categories of challenges in agile transformations, the first of which is connected with multi-project and multi-team working conditions.

The main challenges uncovered during the literature review (Barlow et al., 2011; Rolland et al., 2016) arise from problems with the coordination of work between several agile project teams at a large organizational scale. A predominant challenge uncovered in

Table 1
Challenges of agile adoptions in large organizations

Category	Challenges
Multi-team and multi-project environment	Implementing self-organizing teams
	Coordination of several agile teams
	Different interpretations of agile among teams
	Managing and sharing knowledge with stakeholders
Organizational transformation/change	Change management
	Culture and leadership behavior change
	Specialized knowledge in silos
	Integrating non-development functions
	Integration of agile projects with the project environment's existing processes
Alignment of individual projects to enterprise business goals	Conflicts between agile projects and holistic enterprise architecture
	Integration of enterprise architecture frameworks and agile development
	Balancing between the agility of individual projects and the organization agility

Source: Dumitriu, F., Meșniță, G., Oprea, D., & Radu, L.D. (2019). Challenges of scaling agile at organization level. In *Proceedings of the 18th International Conference on Informatics in Economy, Education, Research and Business Technologies* (p. 341). <https://doi.org/10.12948/ie2019.05.06>

the literature research was bringing agility beyond a single team level and translation of the agile work style onto the organizational level, which may turn out not to be responsive enough toward agile changes (Paasivaara & Lassenius, 2016). Last but not least is the challenge with self-organizing teams, which is a fundamental cornerstone functionality of Agile methodologies (Barlow et al., 2011; Hobbs & Petit, 2017; Rolland et al., 2016).

Project work in large organizations entails combining heterogeneous project team cultures. In such cases, there might be discrepancies with respect to interpretation of agile rules and their application between the project teams involved (Dingsøyr et al., 2019). Another important difficulty with a multi-team environment is the knowledge-management and knowledge-sharing practices between the project stakeholders. These difficulties may touch on different points of view on the knowledge-sharing practices between the project teams. Some teams may share agile-specific knowledge only within the team, minimizing knowledge transfer outside the project team (Uludag et al., 2018). As a countermeasure, it is advised to emphasize the importance of retrospective practices in agile project management (Schwaber & Beedle, 2004) or introduce dedicated knowledge management systems in organizations (Duffield & Whitty, 2016).

Another category of challenges depicted in Table 1 encompasses the set of problems resulting from the transformation process itself. M. Paasivaara and Casper Lassenius (2016) underlined three major agile implementation barriers and challenges at the organization level. The first barrier is linked to cultural changes within the organization's management and deals in particular with middle level managers, whose role is

not clearly stated in agile methodologies. The second barrier is related to internal employee relocation problems inside the organization caused by traditional silo structures and knowledge specialization. The last barrier is caused by difficulties with the integration of agile functions with the traditional, non-developer ones within the organization. Moreover, integration of agile projects' way of working with existing processes also constitutes a serious problem for organizations (Lindvall et al., 2004). Another set of empirical research on large-scale agile implementations points out the lack of strategic directions for agile transformations within organizations and the incorrect way of introducing changes to the organizational culture and leadership (Karvonen et al., 2018).

The last category of challenges is linked to the alignment of individual projects' objectives to the organizations' business goals. Large organizations operate in line with structured processes and need to build a holistic enterprise architecture. Literature studies (Duijs et al., 2018) emphasize that the above-mentioned challenges may cause accumulation of technical debt, unnecessarily repeated project work and incoherent communication (Barlow et al., 2011). These situations introduce barriers in the integration of the organization's architecture with agile methods and disturb the equilibrium between the projects' and organization's agilities (Duijs et al., 2018; Gill, 2015; Persson et al., 2016).

Literature reviews (Hekkala et al., 2017) and empirical observations (Dikert et al., 2016; Gregory et al., 2015) in the area of challenges arising from the large-scale application of agile methods were also conducted by Christoph Fuchs and Thomas Hess (2018), who categorized the analysis findings as presented in Table 2.

Table 2
Proposed categorization of challenges of a large-scale agile transformation

Category	Explanation: challenges regarding...	Examples of challenges
Method-related	... the appropriate application of agile methods and the respective employment areas within organizations.	<ul style="list-style-type: none"> • Misunderstanding of agile methods • Poor customization of agile methods • Inappropriate application area of agile methods
Technology-related	... the infrastructural features of firms and the supporting structures of technological tools within firms.	<ul style="list-style-type: none"> • Inappropriate technological equipment • Inappropriate IT infrastructure
Organization-related	... the organizational structures, occurring coordination issues and organizations' overall management.	<ul style="list-style-type: none"> • Problematic coordination with other business units • Inappropriate organizational structures • Lack of top management engagement
Culture-related	... the social and overall cultural aspects of organizations.	<ul style="list-style-type: none"> • Inappropriate leaderships dynamics • Incompatible social structures
Ability-related	... the abilities of organizational members involved in the agile transformation.	<ul style="list-style-type: none"> • Lack of hard skills • Lack of knowledge transfer
Motivation-related	... the attitudes about and opinions on the transformation of organizational members involved in the agile transformation.	<ul style="list-style-type: none"> • Missing agile mindset • Fear of consequences

Source: "Becoming agile in the digital transformation: The process of a large-scale agile transformation", C. Fuchs & T. Hess, 2018. In Z. Wilimowska, L. Borzemski, & J. Świątek (Eds.), *Information Systems Architecture and Technology: Proceedings of the 39th International Conference on Information Systems Architecture and Technology. ISAT 2018* (p. 2360). Springer.

The first group of barriers and enablers was categorized as method-related and based on large-scale agile transformation practices (Dikert et al., 2016; Paasivaara et al., 2018; Rolland et al., 2016). As the next step, general hindrances in the application of agile methods were analyzed (Boehm & Turner, 2005; Gregory et al., 2015; Hekkala et al., 2017; Nerur et al., 2005), as well as challenges related to human resource management (Conboy et al., 2011). Most of the identified barriers to the application of agile methods dealt with a lack of understanding of agile rules and principles as well as inadequate application areas of agile methods in an organization – in the author's opinion not in line with the Cynefin model. Technological issues are linked with inappropriate IT equipment and infrastructure, the role of which is to support the transformation process. Organization-related problems stem from problematic coordination of work with other business units and inadequate hierarchical structures of the organizations. One of the most important aspects of successful agile transformation is management support, but as presented in Table 2, research findings (Fuchs & Hess, 2018) show a lack of top management engagement. The aforementioned difficulties result in culture-related challenges such as inappropriate leaderships dynamics and incompatible social structures which negatively influence agile scaling processes in large organizations. The last set of issues deals with ability and motivation considerations which include a lack of hard skills and knowledge-sharing practices. Not having an agile mindset and a common fear of the consequences of change constitute serious obstacles to any transformation efforts in the researched organizations.

Determinants of agile implementations in large organizations

Agile transformation is defined in the literature as a socio-technical process encompassing significant cultural and technical changes in various aspects of organizations' operations (Fuchs & Hess, 2018). Process of agile transformation is more about being agile than doing agility. This is why the application of agility in an organization does not simply mean implementing every agile practice from different methodologies. The main challenge in implementing agility in an organization is directly linked to the human factor (Gandomani et al., 2013a). This situation is caused by the fact that agile methods are by their nature oriented toward human behavior and changes in people's attitudes and organizational culture, and employees' mindsets. Human resource challenges constitute a major problem for project managers and middle management in software development companies (Nerur et al., 2005). Besides, there are not only human-related challenges, but tools and technology are also a subject of literature research, though these are not that essential for large-scale agile transformations (Conboy et al., 2011).

One of the critical success factors of an agile transformations is pilot project selection for an agile implementation (Gandomani et al., 2013b). The pilot project, to begin an agile transformation in an organization, is an important element of introducing agile from the point of view of future rollouts across the entire organization (Gandomani et al., 2013c). Similarly, it is crucial for an organization to select an agile method and define the true reasons for the introduction of agility, which aids choosing an optimal methodology adjusted to the organization's strengths and weaknesses. Optimal selection of an agile method translates to seamless achievement of the goals assumed at the beginning of the transformation process.

Prerequisites of agile implementations in large organizations must be met before the implementation encompasses areas such as winning employees' engagement, agile trainings and establishing organizational readiness for the transformation. Initial agile training sessions allow for leveling of knowledge among all participants of an agile transformation in an organization (Gandomani et al., 2013c). Another facilitating factor for agile transformations which can be found in the literature (Gandomani et al., 2013c) is the introduction of coaching and mentoring meetings accompanying the agile implementation attempt. Such sessions and meetings need to take place prior to the transformation process, during the process and after the successful implementation, and need to concentrate, in the first place, on the socio-technical aspects of the agile approach.

The transformation process requires application of explanatory procedures outlining step-by-step how to introduce agile changes in an iterative way in accordance with agile methodologies. The initial pilot transformations are adjusted to the specific needs and expectations of a given organization (Gandomani et al., 2014). Assessment of transformation readiness must precede the agile implementation in order to guarantee an adequate level of organizational maturity. It is also advised to establish and understand the rationale behind the implementation of an agile transformation process. An organization needs to identify the strategy objectives and business needs that the agile transformation is to support.

Another set of requirements linked to agile transformations deals with the specific tools and technologies which are to support the implementation of new agile processes in organizations, such as automated testing, continuous integration and daily scrums. The final group of prerequisites for a successful agile transformation is also the buy-in of the project stakeholders. Prior to any agile endeavor, it is advised to assure a positive attitude and support for the project from the stakeholders and sponsors by means of through communication about project scope and its influence on daily organizational routines.

All of the aforementioned prerequisites and essentials address agile transformation process requirements, hence organizations approaching agile

transformation shall consider them all. Analysis of the presented prerequisites proves that the transformation process is not an easy endeavor and requires careful considerations.

Methodological considerations of agile transformations

According to Pawel Paterek (2017), large organizations shall adapt both project methodologies and agile transformation processes to their needs and abilities. The methodology selection, organizational structure design, knowledge management practices and organizational culture changes may require a contingency theory approach (Paterek, 2017). The theory in question originates from organizational research on leadership, effective team motivation and organizational structure studies. The main basis of this theory is an assumption about the lack of universally applicable management practices and a uniform set of tools and methods. Contingency theory comes from the observation that some solutions that are effective in one situation are not necessarily applicable in other situations (Nita, 2013). This theory assumes that there is no single set of universal methods and the ones available at the present time are applicable only in the specific business environment (Otley, 1980). Hence, the application of the agile methodology is conditioned by the organization's surroundings, its volatility and dynamics. In such conditions and environment, project teams adopt an agile mindset to deliver business value to the end user. Members of the team take responsibility for end product delivery and are open to continuous self-development and quality improvements. Such an approach by agile teams is backed by the organizational culture, clients' engagement and management support.

A change from traditional project management practices to agile ones is an example of large-scale transformation dependent on external and internal conditions. According to the contingency theory, an agile transformation process itself eases acceptance of challenges resulting from the changes being introduced (Paterek, 2017). The first challenge is volatility, understood as the change dynamics in the organization. Research literature (Bogdanienko, 2005) argues that learning organizations undergo agile implementations faster due to their inherent ability to adapt to the changing environmental conditions. In turn, volatility causes uncertainty, understood as frequent requirements changes in the environment in which agile projects are run. Hence, an increase in uncertainty is a decision-making factor for the adoption of an agile method. The next variable is the opportunities defined as the situations surrounding the organization. The higher the dynamics and influence of this variable on the organization, the higher the probability of the agile methodology application being successful (Trzecieliński, 2011).

Selection of agile methods is also influenced by analysis of the popularity and effectiveness of this ap-

proach in designated market segments. For example, in IT/ICT (23% of popularity (VersionOne inc., 2017), agile methods are more popular due to the internal characteristics of this sector and frequent empirical confirmations of successful IT implementations (VersionOne inc., 2017). Incremental delivery of value by the project team is correlated with the engagement and positive attitude of the end user (customer).

The above-mentioned observations from the literature are confirmed by recommendations from McKinsey (Brosseau et al., 2019), according to whom, the transformation process shall include the following four elements of an organization: structure, people, technology and processes (Figure 1).

According to the recommendations depicted in Figure 1, it is advised to simplify and delayer the reporting structures and limit the headquarters to the minimum necessary to run the business in order to streamline decision making. From the perspective of the employees, McKinsey proposes to train managers on how to provide vision, inspire, model and coach rather than direct, in order to attract and retain the best talents. It is also advised to introduce changes in the existing organizational culture and mindset in order to stimulate knowledge-sharing among employees, especially the tacit knowledge, with the use of informal platforms of communication. The remaining recommendations concern the application of changes in IT and infrastructure for the purpose of introducing the right tools to support an agile way of working and to ensure appropriate infrastructure and operations to support rapid changes. According to McKinsey, the planning and decision processes in place allow for the planning design and decision-making to rapidly test and learn in the new agile performance management environment based on outcomes.

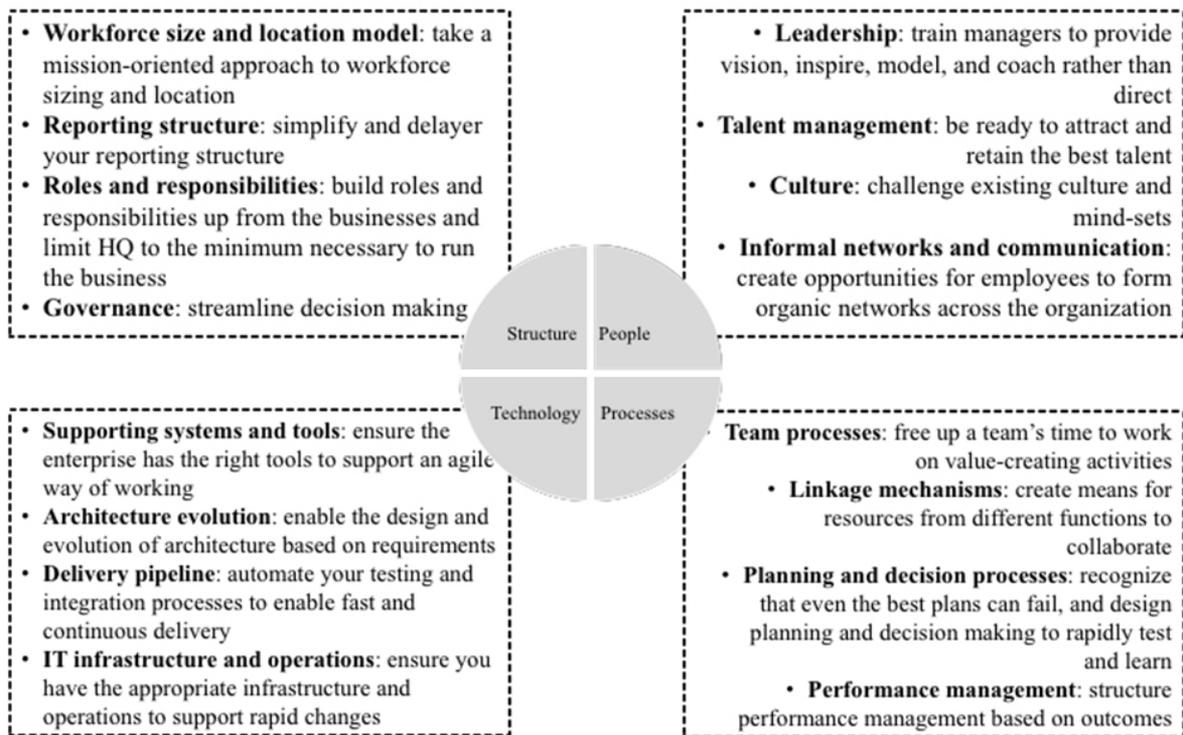
Prior to making a decision concerning a large-scale agile transformation, the organization's management needs to assure proper and accurate agile trainings as well as mentoring and coaching sessions at all levels of the organization. In ideal conditions, this shall be done with help of change agents, agile trainers and communities of practice (Paterek, 2017). Assessment of the organization's potential shall be conducted before an attempt to introduce agile methods in order to evaluate the organization's readiness and level of maturity. It is advised to establish the real reasons for attempting to introduce agile methods in the organization and start preparation for the development of new agile competences inside the company (first step in Figure 2).

In the course of the agile transformation process, large organizations need to continuously develop their own agile competencies, such as the ability to rapidly react to changing requirements as well as proactive responses to unexpected amendments from end users along with the ability to simultaneously manage and control risk. These actions allow for fast responses to the competition and delivery of high-quality products and services (Paterek, 2017). Another key success factor for an agile transformation process is

Implementation aspects of agile methods...

Figure 1

Areas of changes resulting from agile transformations in organizations



Source: *The journey to an agile organization*, D. Brosseau, S. Ebrahim, C. Handscomb, & S. Thaker, 2019. (<https://www.mckinsey.com/business-functions/organization/our-insights/the-journey-to-an-agile-organization>)

a proper set of tools supporting the implementation process and the latter business as usual work in the new agile environment. The aforementioned tools allow for monitoring, assessment and control over the implementation process not only by the teams but also by project stakeholders. Continuous integration practices in an agile transformation is a fundamental way of working in large projects (Larman & Vodde, 2017). The ability to continuously learn and use tools and methods supporting integration allows for faster implementation of new solutions and shortening of products' time to market for end users. Additionally,

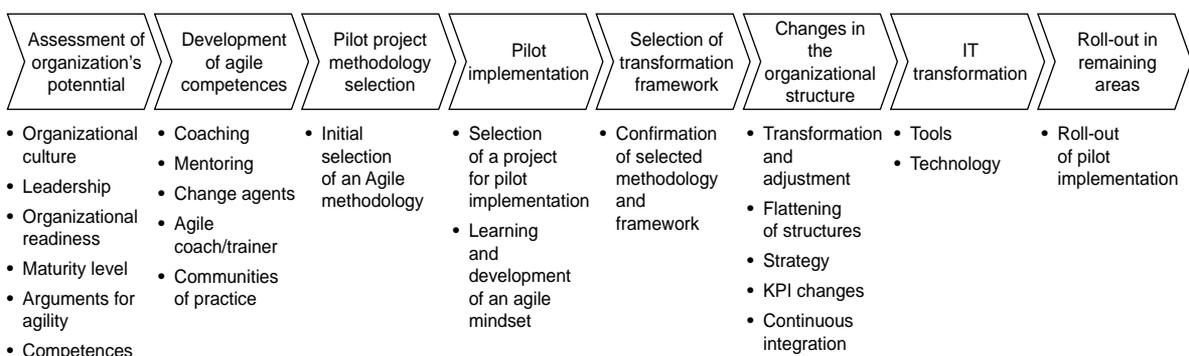
the availability of high-tech solutions stimulates creativity and innovation in new product development. Generally, the dynamics of changes in this respect favors the adoption of agile methods.

The above presented recommendations for large-scale agile transformations may serve as the basis for a proposition of the agile transformation model for organizations presented graphically in Figure 2.

The process presented in Figure 2 may be treated as a proposition of a methodology of agile transformation. In the model, the most important aspects of the organization concern an agile mindset, adjustment

Figure 2

Model of agile transformation in large organizations



Source: author's own work.

of the organizational culture and the development of agile competences, as discussed in the research literature. In accordance with the presented model, it is crucial for a successful agile transformation delivery to choose the right pilot project for “try and buy” agile adoption, which, in turn, determines the latter transformation framework selection. The selected agile transformation framework will serve as the basis for the global roll-out and implementation across the entire organization. As depicted in Figure 2, organizations undergoing an agile transformation need to not only flatten their organizational structures but also adapt the organization’s strategy to agile values, refresh their KPIs and implement continuous organizational learning and self-development. The agile mindset in question concerns not only the employees but the organization as a whole and is one of the most important criteria for proper agile values incorporation into the organization’s daily routines and practices. The traditional mindset, as opposed to an agile one, can be characterized as too much based on superiors’ decision-making and lacking in delegation of the authority crucial for taking responsibility for the work performed. For the above-mentioned reasons, openness to change, readiness to group work and accountability for actions taken are crucial requirements for the agile way of thinking.

One other important aspect of a successful agile transformation is the organizational culture (Figure 2). This culture is determined by the environment surrounding the organization, type of organization and stakeholder characteristics (Koźmiński & Piotrowski, 2000). There are various elements that influence the organizational culture, such as external ones, which are the sector of operations, market conditions, and technology, and also internal ones such as vision, values and most importantly the people who constitute the organizations. An agile organizational culture has high tolerance for frequent changes and is open to self-development and continuous learning. Flexibility is a key characteristic required in the culture of volatility understood as a chance for self-development and creativity. This kind of culture allows for undisturbed cooperation between management and employees, which is crucial from the point of view of agile processes. The last fundamental condition that must be met for a successful agile transformation is competence development (step two in Figure 2). Both hard and soft competences are necessary for agile project team development in order to assure a good understanding of agile practices and stimulate agile ways of working in the end users. Competence development might be supported by coaching and mentoring sessions, communities of practice and agile agents. The best practice for organizations in the process of agile transformation is to organize workshops and meetings with agile practitioners in order to fully utilize the potential of agile methodologies.

The rationale behind the sequence of the remaining steps in the provided agile transformation model were described in the first part of this paper. Their

importance and significance are stressed in the literature review carried out for the purpose of existing knowledge synthesis and model formulation. The proposed methodology of agile transformation is a summary of discussions and literature findings on large-scale agile implementations.

Conclusions

Agile transformations seem to be the next step in the development of methodologies and organizations. This is not only an inevitable step but also a necessity for undisturbed operations in the fast-paced business environment of the organization. An understanding of agile implementation barriers and challenges and the preparation of a list of prerequisites may ease a successful agile transformation. This paper showed that the biggest challenges experienced by organizations so far dealt with human factors in agile project management. Changes in employees’ mindsets and adaptation to agility require time and will most probably cause delays in an agile transformation process. Early recognition of warning signs and development of remedies is another consideration for successful agile transformations in large organizations.

Bearing in mind the limitation that this paper is purely theoretical, it is advised for future research to analyze the potential application of the proposed methodological model (by means of action research) in order to evaluate its usability in practical environments.

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Maria Bajak

Potential of beacons to enhance teaching and learning in stationary education

Abstract

Dynamic technological progress is actively influencing the shape of modern education. Inventions that are constantly appearing on the market are often adapted to the needs of schools. One of the technologies that shows special potential in didactics is beacons. Beacons are small devices that can be used for communication, navigation and researching the recipient's behavior. These functionalities are used in the education process, enabling the creation of completely new learning experiences. According to research, they can be successfully used in the classroom, during the formal learning process, as well as in various institutions, such as in informal transfer of knowledge, for example in cultural institutions. These sensors can contribute to the creation of a dynamic space for the exchange of knowledge and experiences, which will automatically respond to the individual needs of the recipient. The main goal of this article is to present the possibility of using beacons in the context of stationary education. The considerations were based on a review of the available literature. The work draws attention not only to the problems of the sensors themselves, but also to the possibility of their cooperation with other technologies. The collaboration of technical tools may contribute to the creation of more comprehensive solutions and, as a result, an increase in the quality and efficiency of the education process. However, as the analysis shows – beacons can be a promising technology in education, but their use is niche. Perhaps in future years, there will be more such solutions that will enable a more accurate assessment of these sensors. The author intends to continue her research to support the adoption of the described technology in Polish educational institutions.

Keywords: technology in education, beacons, Internet of Things, communication with students, stationary education, educational projects using beacons

Introduction

The impact of new media on society is becoming increasingly apparent in almost every aspect of human life. Transformation in the technological environment has not remained neutral for education, which is actively adapting to current trends (Fazlagić, 2018; Hauer, 2017). Learning processes are becoming increasingly dependent not on the content being distributed, but on the way it is delivered (Arnold, 2011; Engeström, 2014). At the same time, new media is leading to the creation of a ubiquitous and pervasive digital environment (Weiser, 1991), which enables the introduction of creative teaching methods and continuous individual learning (Herczeg et al., 2019). The transformation of education can be considered both in the context of distance learning, hybrid and stationary learning. Digital technologies are most often associated with the first two forms of education, because it is in their nature to use modern communication methods in connection with the need to overcome the barrier of distance between the student and the teacher. However, digitization also extends to residential learning spaces, making classrooms and even entire schools and colleges smart (Squires, 2017). At the level of classroom teaching, the use of new technologies relates primarily to communication, exchange of resources (e.g., information, ideas) and sensory stimulation of students through audiovisual materials (Xianyang, 2018). The availability of modern educational tools enables a comprehensive transformation of education both through innovations in the deep structure of teaching methods, as well as their optimization in the practical dimension (Meisch, 2020). However, it should be noted that even in the case of new technologies, the human factor is

still essential to the success of the teaching process (Dumančić, 2019; Gurba & Rimanelli, 2018; Hosu & Hosu, 2019). One promising solution is beacons. They are a type of sensors that connect to a compatible device via Bluetooth and transmit information. Beacons can contribute to the creation of an educational space by composing a virtual learning experience while the student is physically present in the classroom. Tasks can be carried out individually or in a group in the learning process through play.

The evolution of digital technologies, their functions and possibilities enable the creation of a virtual learning environment (VLE). It is a dynamic concept that includes digital solutions in courses – both online and as a complement to traditional direct forms of education (Alves et al., 2017; Valsamidisa et al., 2014). This, in turn, can improve the attractiveness and value of messages, and as a result, have a positive impact on their reception, increasing the interest of students and the effectiveness of learning (Xianyang, 2018). Digital forms of education in this case create a one-to-one relationship with the student by creating a personal learning environment (PLE), which means systems supporting the individual achievement of educational goals using a package of appropriate tools and materials (Xu et al., 2020). The combination of both of these concepts (VLE and PLE) is the basis for constructing an intelligent learning space that can be called SMART Classroom.

The main goal of this article is to present the possibility of using beacons in the context of stationary education. It was decided to focus on this form of learning because the sensors require the physical presence of the user to connect with them. This eliminates their usefulness for distance education. The considerations were based on a review of the available literature. The criteria of its selection are described in the methodology section. Organizing the existing knowledge on this subject may help educational institutions in making decisions about using sensors in teaching and getting to know their full capabilities. As a result, it may suggest directions for creating more comprehensive solutions that will be able to contribute to a real improvement in the level of education.

Beacons as a new digital solution in the field of education

Permeation of the education sector by modern technologies has long been a common and desired phenomenon. Profiling didactics based on said development is a natural social process. The use of modern tools makes it easier to involve students in the classes. Moreover, as technological development has already become an integral part of society, the next generations of students increasingly expect it to be used in the classroom. This trend has a positive context. Properly used technologies can create a long-term positive impact on the effectiveness of education. Research by Ozerbas and Erdogan (2016) identified three basic determinants leading to a positive impact of multimedia on didactics:

- increasing the motivation of participants of the classes thanks to increasing the audiovisual attractiveness of the educational materials,
- the possibility of access to educational materials that are unlimited in time and space,
- making communication between students more attractive and fluid.

However, it should be emphasized that the observed positive impact of digital tools in education depends on the effective symbiosis of technology and the curriculum (Sinclair, 2009). What is more, this integration also allows information on the involvement of students and the achievement of goals to be collected, and as a result, a more effective validation of learning outcomes (Fjærtøft, 2020).

Especially technologies in the area of the Internet of Things have great educational potential. Their use can generate a number of benefits for both the student and the teacher (cf. Atherton, 2019; Glover & McDonald, 2016; Kriz et al., 2016; Wu et al., 2016; Zimmerman et al., 2016). They can be used in a variety of institutions aimed at sharing knowledge, not only strictly educational, but also cultural, training and rehabilitation (e.g., social, psychological) organizations and others (Gmiterek, 2017; Lee & Choi, 2016; Manczak et al., 2020). One of the essential components of the Internet of Things are beacons. These are small sensors that use the Bluetooth communication standard to connect with devices running compatible software. In this article, both terms will be used interchangeably. Beacons enable user microlocation, data collection, and automatic transmission of programmed information (Bajak, 2019; Manczak et al., 2020). Their proper operation requires the use of a mobile application (Garg & Shukla, 2016; Manczak et al., 2019) which, on the one hand, enables the use of the devices, and on the other, determines their scope of operation. The fundamental tasks of beacons include detecting other devices, initiating a connection, and transferring data (de Cerio et al., 2017). Considering beacons from the perspective of communication with the user, their six basic functions can be distinguished in this regard (Sanak-Kosmowska et al., 2018):

1. Information function – providing the user with specific data on entering the sensor's range. The recipient receives a package of information that has been pre-programmed by the sender. The transferred knowledge can be tailored to individual needs, preferences and interests (Manczak et al., 2020). In the context of education, it will be based on providing educational materials to students.
2. Interactivity function – sending notifications as a result of a specific user behavior and actions taken by the user, as well as allowing messages to be responded to, for example, by answering or selecting one of the options. Communication can also be initiated by the user, if he/she sends a message via the application, informing, for example, about the need to help him/her – the beacon can indicate his/her location in such a sit-

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uation (Bajak, 2019). This feature can ensure connectivity and interactivity in the classroom and support group work and educational games.

3. Navigation function – locating the user in space and showing him/her the way forward. Sensors can also be placed on objects to be able to find them quickly if needed. An important advantage of sensors is the fact that they are effective with high accuracy in navigation both inside and outside the building (Dudhane & Pitambare, 2015; Handojo et al., 2020; Zhao et al., 2014). At school, it can become a useful tool for gamification and movement games.
4. Research function – collecting data about the user about his/her behavior in real and virtual space. Monitoring the recipient's behavior is possible primarily thanks to the opportunity of microlocation by devices (Yamaguchi et al., 2017) and observation of their individual reactions to information and notifications appearing in the application after coming within the sensor's range. It can make it possible to collect information about students, their progress, strengths and weaknesses, and, as a result, to personalize the learning process.
5. Promotional function – activating sales and promoting various events, actions and social initiatives. The user is sending offers and messages based on the information collected so far about him/her, as well as his/her location – for example, when he/she is next to a given room, he/she receives information that in a few hours there will be a speech that may be of interest to him/her. On campus, it can support the promotion of entertainment and science events aimed at students.
6. Image function – shaping the desired image of an institution thanks to various actions carried out with the use of beacons. The very fact and the specific way of using sensors also contribute to shaping a specific profile of the organization in the perception of the recipient (Bajak, 2019). For schools, beacons can be a tool for building the image of a modern institution open to the needs of students.

Applications that use beacons may implement all of them simultaneously or be based solely on one or more of them. Moreover, all indicated functionalities can be used in education. In practice, three of those functions are most commonly used: information, interactivity, and navigation (Figure 1) as they are relatively easy to implement while, for instance, the research function, requires the whole teaching and learning process to be rethought in a way that the data collected by beacons can help to personalize and enhance it to be used effectively. Therefore, the indicated functions should be analyzed first as the basis for solutions using beacons.

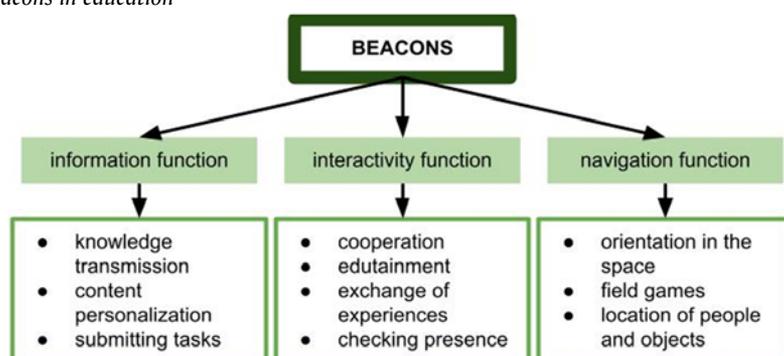
In the context of these considerations, it is necessary to emphasize that the basic functionalities of beacons can be extended as a result of equipping these devices with solutions such as, for example, Internet access, GPS transmitters (Bajak, 2021) or the use of various complementary technologies as part of the application supporting the sensors, which recognize, for example, augmented reality or artificial intelligence mechanisms.

Beacons as digital support for classroom teaching

Digital technologies have become an integral part of education (Selwyn, 2016). Various technological achievements, often initially implemented for the needs of completely different industries, ultimately find their application in teaching. It was no different with beacons. They are used both in the formal learning process in educational establishments and in the informal transfer of knowledge, for example in cultural institutions. These devices require direct contact with the recipient, so they are used only in projects carried out stationary. Beacons can contribute to transforming a classroom into a dynamic space, which creates conditions for learning through experience (Wan & Hodgson, 2019). The user may also have remote access to previously shared content via devices, which is true for hybrid forms of learning (cf. Griffiths et al., 2019), where sensors are, however, part of the real environment (schools, universities, etc.).

Figure 1

Main functions of beacons in education



Source: author's own work.

Beacons can contribute to the creation of an educational space by creating a virtual learning experience while the student is physically present in the classroom. Sensors connect the real and digital worlds by creating the possibility of education through empirical learning without leaving the school (Bajak, 2019). Tasks can be carried out individually or in a group in the learning process through play. These sensors are therefore a specific stimulus to build a broad and dynamic educational community that functions in parallel in the physical and digital spaces (Glover & McDonald, 2016). Their use generates a number of benefits – significant both from the teacher’s and student’s perspectives (Table 1). They make it possible to create a variety of lesson scenarios thanks to active access to content in the application (Kriz et al., 2016). As a result, they can facilitate, extend, and complement the education process (Glover & McDonald, 2018). According to research conducted by the team of Wu, Young and Wen (2016), their use supports deep learning and may contribute to the progress of scientific development achieved by students. Moreover, Zimmerman et al. (2016) draw attention to social interactions related to the use of sensors in the educational process. This applies to both beacon-stimulated scientific conversations between students (descriptive and conceptual), as well as the increase in the effectiveness of communication with the teacher and the resulting feedback. The observations of Atherton (2019) confirm the findings of other researchers so far. They also emphasize the possibility of personalizing the learning path for an individual student – controlling the pace, level of difficulty, and the challenges posed to him/her.

Beacons can be a helpful tool for carrying out tasks based on the core curriculum, as well as for conducting educational and integration games. However, proper

involvement of students with the use of digital tools requires conscious pedagogical work. The quality of education carried out with the use of sensors depends on the specific capabilities of the software supporting the sensors. If it is unintuitive, and the prepared tasks and games turn out to be non-engaging, the experience of using the discussed devices will be negative for students. When deciding on solutions based on beacons, teachers are responsible for the development or selection of a platform that will create a space for the exchange of knowledge and experiences and will realistically contribute to enriching the lessons. This requires that they understand the solution being introduced, and its strengths and weaknesses, and that they define specific goals for its use. It is also worth examining the affinity of the sensors with other technologies. The introduction of compatible technologies may lead to the creation of completely new educational experiences.

Beacons as a part of the SMART classroom

The digital revolution has contributed to the creation of a paradigm of change in society, economy, and education, the dynamics of which is influenced, among others, by the widespread creation of technological combinations (Schwab, 2017). This tendency also applies to beacons (Bajak, 2021), which can be integrated in any way. The collaboration of beacons with other technologies can help create an environment that can be described as the SMART Classroom (cf. Bdiwi et al. 2019; Li et al., 2015; Lu et al., 2021; Phoong et al., 2019; Temkar et al., 2016). It is a concept assuming the creation of an intelligent educational space based on technologies from the sphere of the Internet of Things (Temkar et al., 2016) and other solutions in

Table 1

Basic advantages of using beacons in education

Advantages for the teacher	Advantages for the student
<ul style="list-style-type: none"> possibility of implementing dynamic lesson plans 	<ul style="list-style-type: none"> creating opportunities for learning through experience and fun
<ul style="list-style-type: none"> opportunity to develop a variety of exercises – both group and individual 	<ul style="list-style-type: none"> attractive form of shared materials
<ul style="list-style-type: none"> building class commitment 	<ul style="list-style-type: none"> stimulating scientific and social interactions between students
<ul style="list-style-type: none"> facility of increasing the quality of communication with students 	<ul style="list-style-type: none"> capability of increasing the quality of communication with the teacher
<ul style="list-style-type: none"> possibility of obtaining detailed feedback 	<ul style="list-style-type: none"> providing individual materials at a convenient time for the student
<ul style="list-style-type: none"> ability to observe and analyze the individual reactions of students to the materials provided 	<ul style="list-style-type: none"> possibility of personalizing the learning process
<ul style="list-style-type: none"> opportunity to examine the effects of conducted classes 	<ul style="list-style-type: none"> facility of monitoring scrupulously achieved progress
<ul style="list-style-type: none"> automation of selected processes, e.g. checking presence, sharing educational content 	<ul style="list-style-type: none"> increased involvement in the implementation of exercises thanks to their engaging and innovative formula
<ul style="list-style-type: none"> capability of stimulating students’ progress through gamification 	<ul style="list-style-type: none"> possibility of competing with other people in the form of games and activities, and receiving prizes

Source: author’s own work.

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the field of ICT (Bdiwi et al. 2019). SMART Classrooms enable the automatic distribution of educational and instructional materials, create a personalized environment for individuals and groups, and support, adaptive and mobile learning and all other activities related to didactics (Li et al., 2015; Pace, 2017). The Internet of Things involves connecting various devices and objects using solutions such as a local computer network, Wi-Fi, RFID, Bluetooth, ZigBee, 3G, 4G, and other wireless technologies (Hassan, 2016). Within this context, it is worth mentioning that beacons are, by definition, part of the Internet of Things (cf. Aftab, 2017; Bhargava, 2017; Miller, 2015; Pathak & Bhandari, 2018; Raj & Raman, 2017). Therefore, they should be treated as an integral part of the system connecting smart objects. The created network may be characterized by a different complexity of the structure (Zhang et al., 2010), which translates into the functionalities implemented by a given system. The development of the network with new components translates into the extension of the possibilities of its use and, as a result, an increase in usability. In the case of beacons, the above-mentioned data exchange standards can be implemented in two ways:

- direct retrofitting of beacons with additional transmitters enabling data exchange in a different standard (e.g., LTE),
- developing a network of intelligent objects by adding new devices to it that directly or indirectly cooperate with beacons.

In both of these cases, the functionalities available within a given system are extended, and as a result, its scope of possible applications increases.

In addition to solutions in the area of the Internet of Things, the SMART Classroom also uses other solutions in the area of ICT. The most popular of them are virtual and augmented reality, as well as artificial intelligence. These solutions also have significant educational potential (Keser & Semerci, 2019; Raman & Rathakrishnan,

2019). For example, beacons respond to user behavior and transmit information (Manczak et al., 2020), while VR/AR provides sensory stimulation (Ding et al., 2020). Such a combination draws attention in particular in the context of the possibility of creating educational games. The indicated technologies complement each other by creating a platform for interactive gamification that affects the senses. In turn, benefiting from the use of AI-based methods cooperating with technologies such as beacons is part of a novel and practical topic for technological development (Kose & Vasant, 2020). Sensors can locate the user and provide him/her with specific knowledge in the right place and time, while artificial intelligence is able to diagnose problems, analyze learning processes, independently adapt and generate personalized educational materials (Arnold et al. 2012), which in turn creates perspectives for creating comprehensive educational systems. The consolidation of technologies with particular perspectives in the area of learning can therefore have numerous advantages, such as, for example:

- extending the functionality of educational programs,
- ability to create an interactive and intelligent environment that affects the user's senses,
- a more effective adaptation of educational programs to the needs of individual users, including those with various dysfunctions,
- possibility of conducting multifaceted analyses of the educational process and its effects,
- supporting the processes of remembering and consolidating knowledge in the memory of students through their stimulation with various stimuli involving individual senses.

In the light of the presented considerations and a thorough analysis of the literature on the subject, it can be indicated that beacons show educational potential (Table 2). However, these devices should be considered in a broader context – as one of the

Table 2
Potential of using beacons in education

Beacons	Information function	Interactivity function	Navigation function
As standalone devices	<ul style="list-style-type: none"> • automatic sending of materials on coming within range of the device • sharing content with the student in the right place and time • ability to generally personalize content 	<ul style="list-style-type: none"> • supporting the exchange of experiences between students • facilitating tutoring • collecting information about the effects of the work • mutual communication about the effects of the work 	<ul style="list-style-type: none"> • supporting the implementation of educational games based on the user's location • supporting user orientation in the space • automating the process of checking attendance
As part of the SMART Classroom	<ul style="list-style-type: none"> • conveying content that affects the sensory experiences of students • adjustment of shared content based on the individual characteristics of the student, • creating a dynamic space for knowledge transfer. 	<ul style="list-style-type: none"> • increase in the interactivity of the system • independent analysis of the obtained feedback and drawing conclusions by the system • automatic adjustment of the system to the needs of students • creating a realistic interaction based on current conditions 	<ul style="list-style-type: none"> • possibility of implementing complex field games and gamification • augmenting reality based on the user's location • creating an interactive educational space that reacts to user behavior in real time

Source: author's own work.

elements of the Internet of Things that can cooperate with other technologies.

It is worth pointing out that with a high degree of probability, the cooperation of beacons with other solutions in the area of ICT may lead to the accumulation of possible benefits. The use of beacons in cooperation with the discussed solutions, as well as any other educational solutions, can transform the classroom into an intelligent space that analyzes the environment, adapting to the current conditions, contributing to an increase in the quality and efficiency of the teaching process (Gligoric et al., 2015).

Research methodology

Until now, most of the articles on the use of beacons in education were based solely on the analysis of single implementation examples, or presentations of projects of this type of system. This is a selective approach that does not take into account the comparison between different solutions. Moreover, the literature lacks indications of their usefulness in education in a broader context that goes beyond the research conducted by the authors. This creates a research gap that needs to be filled. To accurately illustrate the potential of beacons in education, it was decided to first analyze the practical examples of their use in this area based on the secondary data. It is a preliminary literature review on a given topic, which will be used in the future for further quantitative and qualitative research. Reports, interviews and articles were used (Estimote, n.d.; Freehill-Maye, 2018; Fusco, 2016; <https://unc-checkin.unc.edu>; Loughborough University, 2018; Radda & Hultin, 2018; Rath, 2018; Śpiechowicz, 2018; University of Regina, n.d.; Zimmerman, 2018), as well as data available from the App Store (<https://www.apple.com/pl/ios/app-store/>) and Google Play (<https://play.google.com/store>). The analysis was further supported by a review of world scientific literature. Some of the discussed solutions have been previously described in the form of case studies by other researchers (Bhattacharya, 2017; Burton et al., 2017; Dent et al., 2018; Griffiths et al., 2019; O'Connell & Frydenberg, 2019; Zhu & Xie, 2019). These considerations will constitute the theoretical foundation for further research on the use of beacons in education. At the same time, it should be emphasized that this topic still does not have a strong theoretical and practical basis. It is necessary to organize the knowledge on this subject and conduct empirical research. The main goal of this article is to present the possibility of using beacons in the context of stationary education. It was decided to analyze the possibilities, including the usefulness of the solutions that use beacons. The following specific questions were prepared:

- What tasks does the system perform?
- What new technologies support the solution?
- Is this software used in education?

As part of the work on this publication, available sources of knowledge were searched for information on university applications that use beacons. As a re-

sult, information on only 18 projects was obtained. The conducted research only fills the outlined research gap to a limited extent. They are only the first step to further analyses that are planned for implementation in the future. However, they helped to identify the spectrum of the use of beacons at universities and to indicate the directions of planned research.

Practical implementation of beacons in education

As part of the considerations, on the basis of the available sources of information, projects from 18 universities in Europe, North America and Asia were compared (Table 3). These are all of the projects about which the author was able to find information and which met the assumptions of the research. In order to be classified for comparison, the systems had to fulfil the following conditions:

- be implemented at universities,
- use beacons as an important element,
- be widely available and downloadable.

The selected projects were compared with each other in terms of the technologies used, the possibility of application in the education process, and the main goals of implementation.

Despite the potential of the use of beacons in the education sector, there are still few practical implementations of this type of solution. Moreover, as the comparison shows, only two of the studied cases (11.1%) were used in the teaching process during the classes (projects no. 4, 13). Most of the projects (66.6%) are aimed at assisting the user with navigation and providing information about the environment. Most of them show the user around the campus, but some are directed only at locating him/her in only a limited area, such as a library (projects no. 7, 8, 11, 18) or an arboretum (project no 6). An important area of activity of the analyzed beacon-based applications is also the promotion of university events (projects no. 1, 2, 5, 9, 13, 14). Another task of the discussed solutions that deserves attention is to ensure the safety of students on campus (projects no. 3, 16, 17). In view of the Covid-19 pandemic, this is an application that may grow in importance. Research shows that beacon-based solutions can support the detection of contacts with people infected with the SARS-Cov-2 virus (cf. Martin et al., 2020). Many European countries have chosen to base their official applications to limit the spread of the disease on solutions based on the beacon mechanism (cf. Barthe et al., 2021). Some solutions are focused solely on providing entertainment, such as the University of Illinois application (project no. 12), which shows places such as bars, cafes, and clubs. It also shows users where their friends are having fun. We cannot speak of any educational benefit here. Considering the discussed solutions from the perspective of the beacon function in communication with the user, the most important should be the information, navigation and interaction functions (Table 4), which confirms the assumptions made earlier. Interestingly,

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Table 3

Overview of universities using beacons

No.	Institution	Technologies used	Used in education	Main tasks
1.	American University	Beacons, Virtual Reality, Augmented Reality	No	<ul style="list-style-type: none"> • guided tours around the campus • applying augmented reality objects to the surroundings • providing information about services offered on the campus and events taking place • 360° video sharing
2.	Bentley University	Beacons	No	<ul style="list-style-type: none"> • providing information about facilities located on the campus • sending notifications about nearby events
3.	Columbus State University	Beacons	No	<ul style="list-style-type: none"> • increasing the safety of students • ability to report suspicious behavior • indicating the location of students to the security services
4.	Hong Kong Polytechnic University	Beacons	Yes	<ul style="list-style-type: none"> • checking presence • running quizzes and games • sharing information and files
5.	Loughborough University	Beacons	No	<ul style="list-style-type: none"> • checking presence • sharing schedules • navigating around the campus • sending notifications about events
6.	Penn State University	Beacons	No	<ul style="list-style-type: none"> • locating the user • sending information about nearby objects
7.	Radford University	Beacons, QR Codes	No	<ul style="list-style-type: none"> • organization of outdoor games and activities • encouraging exploration of the library
8.	St. John's University	Beacons	No	<ul style="list-style-type: none"> • navigating through the library • indicating the location of the books you are looking for • information sharing
9.	Stony Brook University	Beacons, NFC, QR Codes	No	<ul style="list-style-type: none"> • sending information and multimedia • navigating around the campus • promoting events
10.	Texas Agricultural and Mechanical University	Beacons	No	<ul style="list-style-type: none"> • navigating around the campus • alerting about threats
11.	University of Edinburgh	Beacons, QR Codes	No	<ul style="list-style-type: none"> • navigating through the library • sharing information and files
12.	University of Illinois	Beacons	No	<ul style="list-style-type: none"> • navigating around the campus • sending information about attractions and events • indicating the location of friendly users
13.	University of Hawaii Maui College	Beacons	Yes	<ul style="list-style-type: none"> • managing groups of students • submitting tasks • providing information about services offered on the campus and events taking place
14.	University of Lodz	Beacons	No	<ul style="list-style-type: none"> • navigating the campus and the city • sending information about attractions and events • sharing knowledge about educational programs and all necessary documents
15.	University of North Carolina at Chapel Hill	Beacons	No	<ul style="list-style-type: none"> • checking attendance
16.	University of Oklahoma	Beacons	No	<ul style="list-style-type: none"> • navigating around the campus • indicating a safe location in the event of an emergency
17.	University of Regina	Beacons	No	<ul style="list-style-type: none"> • sending information when a threat is detected
18.	Virginia Polytechnic Institute and State University	Beacons	No	<ul style="list-style-type: none"> • navigating through the library • transmission of information and files • conducting quizzes

Source: author's own work.

Table 4*Functions of beacons in the considered solutions*

Function	Percentage of all solutions	Project numbers
Information	72.2%	1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 18
Interactivity	61.1%	2, 3, 4, 5, 6, 7, 10, 13, 15, 17, 18
Navigation	66.7%	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 16, 18
Research	0%	–
Promotional	38.9%	1, 2, 5, 9, 12, 13, 14
Image function	22.2%	1, 9, 12, 14

Source: author's own work.

none of the researched projects is aimed at using the research function of beacons (data collection and analysis)¹.

Interestingly, only four researched applications (projects no 1, 7, 9, 11) use other technologies apart from beacons. All others are based solely on sensors. Most of them (projects no. 7, 9, 11) are supported by other technologies including solutions from the area of the Internet of Things. Only one solution (project no. 1) uses virtual and augmented reality. However, there is no indication that any of the analyzed software makes significant use of artificial intelligence. These mechanisms are not used to upgrade the functionality of the system, but only to support it to the necessary extent. Due to the purpose of the projects, we cannot describe any of them as a SMART class. As defined in this article, it is a concept assuming the creation of an intelligent teaching space based on cooperation between various solutions from the sphere of the Internet of Things. None of the examined solutions create such a multidimensional educational space.

It is worth noting that apart from official university applications, some universities conducted research involving the design of solutions based on beacons. For example, at universities such as the University of Economics in Bratislava, Chalmers University of Technology, Gothenburg, and the Asian Institute of Technology, such programs were designed and tested by research teams and students (cf. Glover & McDonald, 2016; Jurkovičová et al., 2015; Karlsson et al. 2016; Puckdeevongs et al., 2020). However, despite positive user feedback, they were not implemented on a larger scale. In order to indicate the reasons for resignation from the implementation of the above-mentioned solutions and a small number of implementations of systems cooperating with beacons, further research is essential. The indicated problem is also discussed in other scientific papers on sensors that concern their use in various public institutions. The authors point to barriers such as (Bajak, 2021; Karlsson et al. 2016; Manczak et al., 2020; Puckdeevongs et al., 2020):

- limited sources of financing,
- insufficient knowledge of the technology by users,

- occurrence of technological imperfections (e.g. devices do not always connect to the application, software errors).

Difficulties such as skepticism and unfamiliarity with the solution by recipients can be reduced by properly conducted education and marketing communication. Educational establishments can actively contribute to disseminating the solution despite initial audience concerns. On the other hand, limitations related to incorrect operation of devices are more difficult to combat by educational institutions. Their occurrence is influenced by technology providers and solution developers who should strive to offer a well-functioning system. In this area, good practice includes testing the beacons and compatible applications before implementation, regular monitoring of their operation, and exchange of experiences with organizations that previously decided to use the sensors.

Summary

The literature analysis shows that beacons show potential as devices supporting stationary education. They can be used to achieve educational goals both as part of systems based solely on this solution, and can be supported by other technologies. Especially the latter solution seems to be attractive. It is creating perspectives for the implementation of the SMART Classroom concept. The practical implementation of this idea enables the achievement of four basic benefits in the context of education (Li et al., 2015):

- integration of the virtual and physical environment creates the capability of contextual awareness of the technological solutions used, manifested by the possibility of adjusting individual parameters to the current conditions,
- providing adaptive support for the educational process, personalization of teaching content, interaction support, as well as support for conducting classes of various profiles,
- creating the possibility of collecting, storing and analyzing data to optimize the teaching process,

¹ Checking presence is treated as part of the interactivity function.

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- introducing students into the context of classes thanks to digital educational aids, stimulating participants' motivation, engaging their creativity, and creating opportunities for practical learning.

Unfortunately, there are still too few practical implementations of this type of project to confirm these assumptions with certainty. Only a few universities around the world use beacons in their applications. Moreover, the vast majority of them do not use the devices for educational purposes. Identifying the reasons for this state of affairs comprises a research gap that requires analysis and searching for answers. Therefore, further implementations should be monitored and research in this area should be continued.

The potential of using beacons in education, as discussed in this study, is an important issue for further analysis. Although this topic appears in the literature quite frequently, it is usually presented in general terms as part of the analysis of other corresponding issues. Currently, only a few works deal with the matter of the use of beacons in education in an extensive way. In most cases, the attitude of the authors toward this technology is approving (cf. Atherton, 2019; Glover & McDonald, 2016; Kriz et al., 2016; Wu et al., 2016; Zimmerman et al., 2016), and a comprehensive analysis of the technology is still missing in the context of didactics. The presented work focuses on the advantages of using beacons in education, while the possible difficulties generated by beacons are only mentioned. This thread will be supplemented in the future. In addition, it is planned to conduct qualitative and quantitative research at universities in Poland that decide to implement the solution. This will make it possible to give a practical context to the considerations on beacons that have been conducted so far.

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Stimulating active participation with class materials using Interactive Document

Abstract

Online learning became one of the most discussed topics during the COVID-19 pandemic. The educational world had to implement and deliver online courses for their students, and millions of students found themselves behind their laptop rather than in class in a matter of weeks.

This article introduces a specific piece of software, Interactive Document, tailored to higher education to allow heightened interaction and active participation with study materials. This article explains the main elements of the tool, including how instructors can benefit from using Interactive Document integrated with Microsoft Teams. Characteristics of the software such as in-line comments, practice questions, anti-skimming features, comment sorting, and the ability to attach files are discussed, with references to use cases where these features were applied.

Finally, a case study from Texas A&M International University is presented, highlighting how Interactive Document enhances students' critical skills and structural understanding, while allowing instructors to have a deeper overview on student performance and interaction with the study material.

Keywords: online learning, Microsoft Teams, FeedbackFruits, interactivity, engagement, active participation, online teaching tools

Introduction

While the COVID-19 pandemic might have taken the world unprepared, the strong evolution and the clear importance of digital technology in education during the last years was a surprise only to some. When the world of teaching was forced to rely more heavily on asynchronous and online practices, having access to good pedagogical software became imperative for higher education institutions. While higher education is heading toward the integration of online teaching and learning, research has shown both benefits and difficulties of online learning in all its facets. Indeed, online learning has to face not only issues such as technological malfunctions (Restauri et al., 2001), but also disruptions of the feedback loop between instructors and students, and the inability to use specific tools when the learning scenario is online (Dumford & Miller, 2018).

However, when implemented properly, online education has also proven to be effective both for students and faculties. Well-crafted online courses make learning more flexible for students, allowing them to focus on the specific parts of the content they feel need more attention, and letting them deploy their preferred metacognitive learning strategies (Kirtman, 2009; You & Kang, 2014). Indeed, in a world more and more dominated by media and digital technologies and where students arrive in the classroom with a higher level of digital literacy than ever before (Hashim, 2018), being able to successfully apply new ways to teach and keep students engaged has become a necessity.

Research has also proven that not only learning but even personal development is positively and strongly affected by student engagement (Astin, 1993; Pace, 1980; Pasarella & Terenzini, 2005); another feature that online learning can enhance.

Students feel the most activated by the material when there is the possibility of frequent and constructive feedback between them and the instructors via what is called

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supported engagement (Ragusa & Krampton, 2018), achievable, for example, via comments, quizzes, and the possibility to share answers and ask questions among students.

Indeed, one of the biggest struggles for instructors when approaching (online) learning is how to keep their students active and engaged throughout the courses offered; how can quality courses, constructively aligned with the intended learning outcomes, while at the same time keeping students stimulated, be delivered?

Providing an answer to this question is at the core of companies such as FeedbackFruits, whose main goal is the co-creation of learning tools to increase student engagement, not just with course material, but with each other. New tools and learning software, such as Microsoft Teams, have risen to this challenge and have become widely used in the higher education world. However, while they helped collect material and manage its distribution among students, they also came with shortcomings. Above everything, students have reported that these platforms give them the feeling of being merely a way to distribute tasks and deadlines.

Indeed, the main usage of Microsoft Teams is to facilitate both video-calling and the distribution of essential documents and course materials to students. Such software can be enhanced with plug-ins to assist in other tasks in the organization and delivery of these materials and activities. Rather than replacing instructors' existing teaching activities, the most effective use of these plug-ins is to support instructors at a pedagogical level.

This brings the question: in what ways can instructors in higher education make online learning not only comprehensive, adhering to the learning objectives of the courses, but also able to engage and activate students in order to avoid a passive educational experience? And how can online learning tools be used to support these objectives, while at the same time resulting in a simpler way of working for both students and instructors?

This article outlines a specific tool called Interactive Document, built by FeedbackFruits and fully integrable in Microsoft Teams. This tool is able not only to help flipping the classroom, improving the blended approach of a course, but also to activate students in asynchronous scenarios, boosting their confidence on how to analyze complex material and increase collaboration when approaching any content. Moreover, the complete integrability of FeedbackFruits in Microsoft Teams in a single interface is able to combine two powerful tools with good pedagogy, leading to the best learning and teaching outcomes.

Interactive Document in the area of Constructive Alignment

One of the most well-known designs for teaching present at every level of the educational system is Constructive Alignment (CA) (Biggs, 2014). In this

teaching design, what is intended for students to learn, and how they should express their learning, is clearly stated before teaching takes place. This happens via the formulation of clear *learning objectives* based on specific "actions" and, subsequently, a series of *teaching/learning activities* that require students to engage with those actions. *Assessments* and *grading* are then the final part of the design, where students are evaluated.

FeedbackFruits' mission, with its Interactive Document tool, is to bring the application of this model one step further in the environment of online learning. Not only do students deserve to harvest the best from their online education and university experience, but instructors must also benefit from the appropriate use of technology that can make designing learning activities more straightforward. The design of Interactive Document takes into account both of these goals. The aim of the tool is thus to help students become more engaged in achieving instructors' intended learning outcomes, and to simplify work for instructors.

Very often, students are asked to read, elaborate on, and analyze a vast amount of information in the form of articles, book chapters, and papers that instructors deem necessary to improve their understanding of a specific subject. However, simply sharing these documents with the students and inviting them to passively read them can easily turn out to be an inefficient and ineffective method of creating engagement and boosting their learning outcomes and skills.

Interactive Document is a low-barrier tool easily integrable in Microsoft Teams, that is able to transform learning into a more both engaging and collaborative experience. Interactive Document, in the words of Dr. Fleur Prinsen from the Rotterdam University of Applied Sciences, "[...] allows students to prepare for the classes so that they have done the reading and also thought about the reading before coming to class." The tool allows users to enrich a document in various ways, adding elements such as practice questions, attachments, sorting learners input, and blocking the view of the document until specific actions are taken by the students.

What can Interactive Document do for instructors in Microsoft Teams, and what issues can it solve?

This section presents the main advantages the Interactive Document app can bring to a course when integrated into Microsoft Teams. It will be followed by a case study illustrating the practical use of the app, enriched by the opinions of the course instructor.

- **Increase students' engagement via Practice Questions**

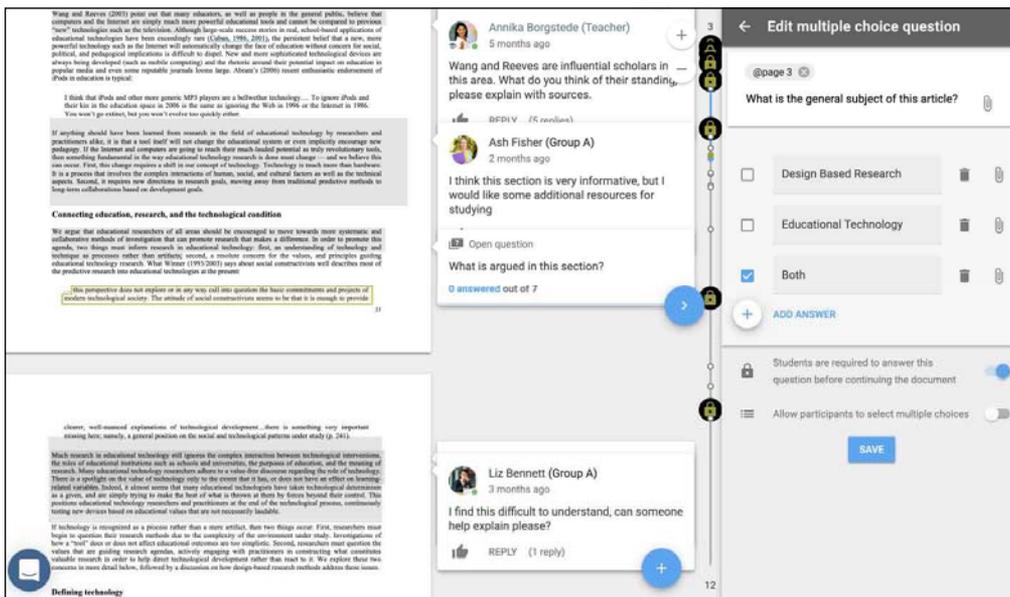
When students read and digest documents properly, they not only add to their knowledge, but arrive to class well prepared. When this happens, instructors can then focus on specific aspects of the content, knowing that the students are ready to take the next step.

Interactive Document allows the instructor to add questions and comments in any part of the

document (Figure 1). Students can then comment, read the instructor’s annotations, and react to each other’s questions and additions, while also answering the quizzes placed by the instructor directly in the document. This not only makes sure that students are paying attention to the document but creates a collaborative environment able to start discussions and transform learning from passive to active.

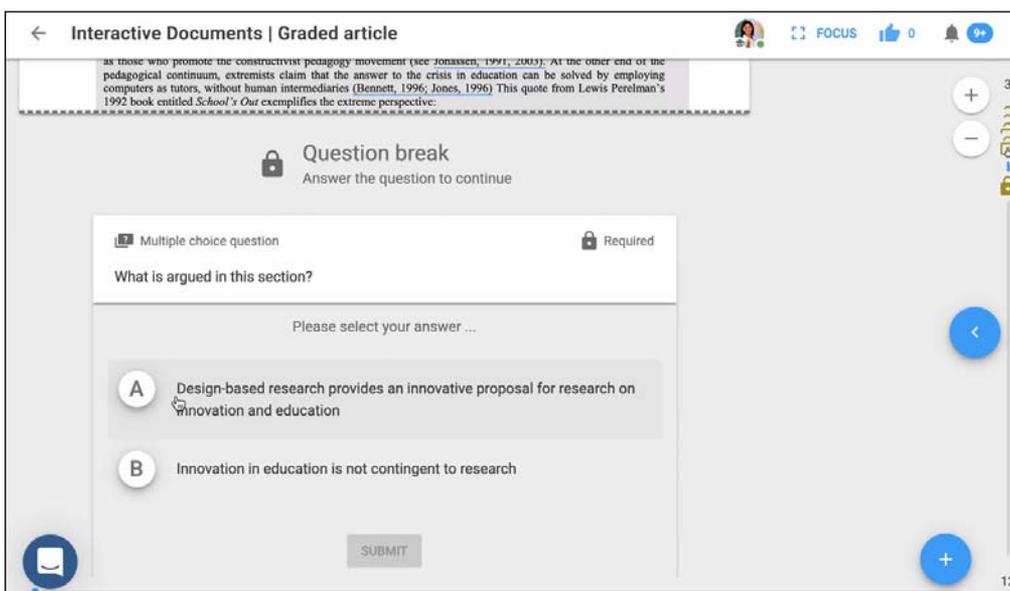
- **More control over students’ workflow via locking specific document sections**
In addition to questions and comments, the instructor is also able to avoid excessive skimming through the document from the side of students. In fact, it is possible to lock, by hiding, parts of the documents that are revealed only after the student answers a quiz or adds a comment to the discussion added via the tool (Figure 2).

Figure 1
Interactive Document – setup interface showing the document, left, and the dialogue to add a multiple-choice question, right



Source: FeedbackFruits platform.

Figure 2
Interactive Document – example of a question break a student must answer to access the rest of the material



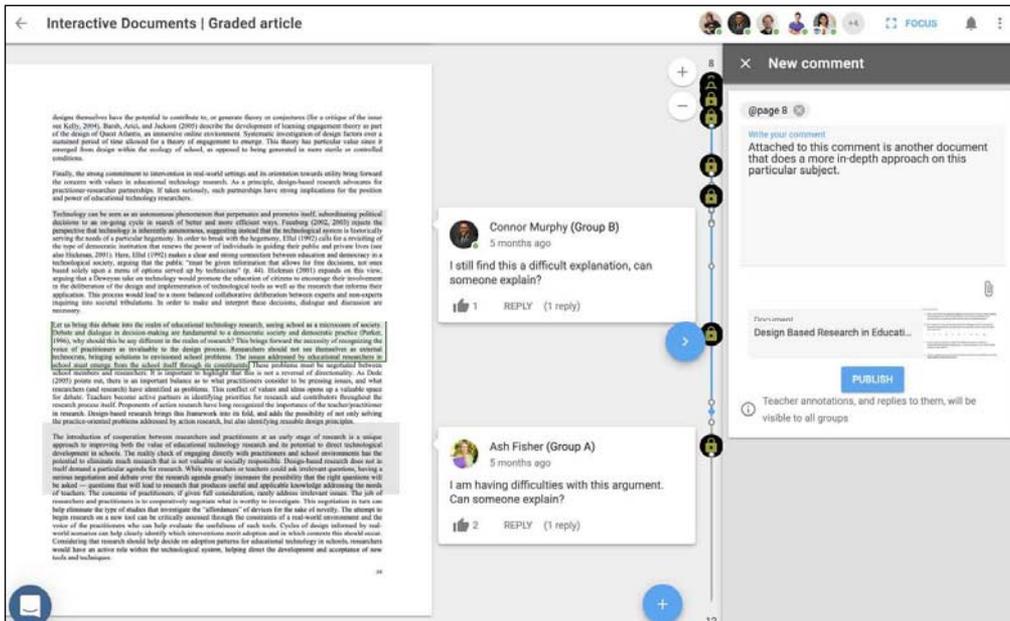
Source: FeedbackFruits platform.

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- More convergence of tools and media via attachments**
 Instructors can add attachments such as other documents, links, videos, and so on to their own and their students' comments (Figure 3). In this way, it is possible to guide students who would like to know more about a specific topic, and to answer by using specific examples and cases.
- Understand student input and learning via comment sorting**
 Interactive Document lets instructors order and/or filter students' comments on a document (Figure 3). This allows for a more comprehensive understanding of students' learning processes by understanding how students consume the article, and to see where students focus more or

Figure 3

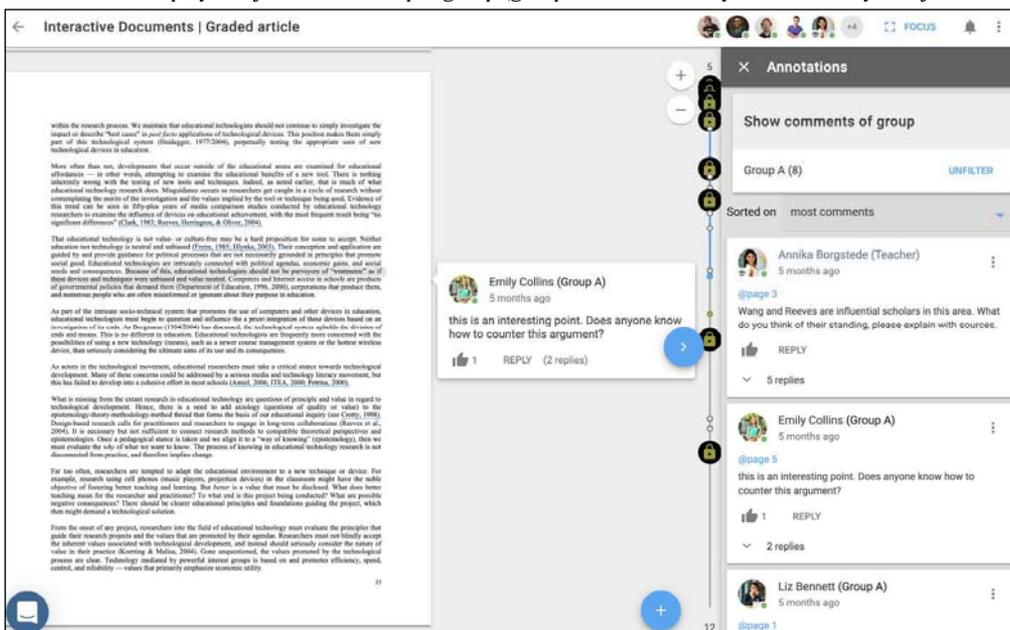
Interactive Document – new comment interface where a selected piece of text can be annotated with a comment and optional attachment



Source: FeedbackFruits platform.

Figure 4

Interactive Document – display can filter comments per group (groups can be manually allocated or synced from the LMS)



Source: FeedbackFruits platform.

less by seeing what the most upvoted comments are (e.g. a question was deemed interesting or important to answer by other students). It is also possible to grade students' answers to better emphasize which points should be given more attention.

Improving students' critical thinking skills in a collaborative learning environment with Interactive Document – The Case of Texas A&M International University

Instructors at Texas A&M have been using the tool in several courses and have seen notable changes in several key aspects. When a first-year bachelor's course in academic skills at TAMIU saw the need to improve the collaborative and engaging aspect of a specific group assignment, they used Interactive Document in the context of a specific group assignment.

In the course, students were asked to analyze papers critically in order to create a correct bibliography. To do so, they needed to be able to clearly locate the elements on the papers that needed to be reported, understand how a scientific paper is organized, and quickly identify the key information to be extracted. Quotations used in this section are drawn from a use-case interview with the instructor of that course.

- **Activity Context and Motivation**

The Interactive Document tool was used in the first weeks of the course to stimulate more transparent engagement with the study materials. "Critical thinking has always been difficult to assess... moreover, the possibility for students to work together online in this way did not exist in the LMS we were using. That is why we started using FeedbackFruits tools."

- **Learning Objectives**

By the end of the course, students can:

- Understand how to read a scholarly article and follow the reasoning in it.
- Identify key sections and where to find particular elements.
- Become familiar with the structure and characteristics of scientific articles.

- **Learning Activities**

The instructor uploaded an article with Interactive Document, and the students:

- Answered in-line practice questions: students answered questions about the text, showing how much they had actually understood and digested it.
- Followed a given structure: the instructor blocked off parts of text, meaning that only after answering questions (correctly or incorrectly), the following part of the document was revealed, to be sure that the students understood the article systematically.

- Gave comments and answers: all comments and answers were visible to the other students, so that a collaborative environment could be stimulated.

"I would find the article and walk the students through it, I would then proceed to block specific parts and decide how to present them to the students. Some pieces were presented as a good way to determine the summary, others as a good fit to create a specific part of the bibliography, and so on."

The students engaged with the documents and read every section of the text, including the instructor's comments. They answered the in-line questions, sharing their answers while commenting on the document and their fellow students' ideas.

What are some of the most frequently mentioned outcomes that using Interactive Document offers instructors, and what additional value does it bring students? From the interview with the Texas A&M International University professor, the following features were noted as being most useful:

- **Stop and Think – blocking off sections**

Sometimes, students skim too rapidly through a paper, missing important sections or information that create confusion when they are asked to use that paper to solve a case or in their future assignments. Being able to block sections of the text was found to be very useful for guiding students to stop and think about specific sections at the right time throughout the article. Written documents and videos can also be blocked off with guiding questions (for example, see the case of Leiden University Medical Center (Hasan, 2020d).

- **More clarity and critical analysis – teacher comments**

Thanks to the possibility to add comments to specific sections of the document provided by the tool, instructors can add explanations and deeper insight into difficult, important, or interesting topics. In this way, students are guided more carefully and are able to direct their attention to what really matters. Moreover, they can also reply to comments, and upvote what they find most interesting or useful (for another example of how these comments can support learning objectives, see here (Hasan, 2020j)).

- **More structural understanding of the material – in-line questions**

In the experience of Texas A&M instructors, students often had trouble identifying the structure and components of academic papers. After using guided, in-line questions with Interactive Document, the instructor noticed a big improvement in how the students were able to read those articles. This improvement was also reflected in the students' overall performance that was the highest yet for that course. Notably, one Dutch university used FeedbackFruits to

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make the whole program more interactive for students (Hasan, 2020i).

- **More insight on students' performance – available statistic overview**

When students answer a question, upvote, or reply to a comment, the Interactive Document tool keeps track of all these digital behaviors. To see how student analytics benefit instructors even in classes of over 500, see here (Hasan, 2020g).

This provides insights into students' individual and overall performance, allowing the instructor to check where students are lacking the most in their preparation. This makes it possible for the instructor to prepare their lessons in a more efficient and effective way by going deeper in those areas the students really need to know more about.

- **Less stress for teachers – from statistic overviews and the tool in general**

The number of insights an instructor can get via the tool reduces uncertainty from the side of the instructor, who now knows more where to focus during their lectures in order to tackle specific aspects of the course effectively. Moreover, Interactive Document lets the students arrive more prepared for the lecture as the instructor intended (e.g. students focus more on what the instructor thinks is important). This reduces stress for the instructor who knows how to structure their lectures in the most effective way possible and does not have to spend time reviewing past homework with the students, since questions and issues have already been taken care of via the tool. For other examples on how FeedbackFruits tools have been used to reduce workload, see here (Hasan, 2020e).

Reading a paper is widely regarded as one of the least engaging and interactive activities for students. The Interactive Document tool, by using all the features explained above, is able to transform the way students engage with a document. Instead of passively reading and moving through sections in an unguided way, students can instead assume a more active and engaged role when consuming the material. In-line questions make students aware of the important aspects of the paper and activate their analytical skills with a right-on-time approach, while the instructor's comments create a collaborative environment where students can reply by asking and answering questions, which is otherwise impossible when engaging offline with a paper.

For the instructor from Texas A&M, "Interactive Document was a much more efficient way to go about the activity. The methods we had before, like post-its," she added, "were not as effective. We wanted them to learn how to read the article, not just how to annotate it." Using Interactive Document, "the students had a better attitude and developed high competency in reading skills."

Indeed, students are more active and focused when reading a specific section if they see that the rest of the paper is blocked from their view, and they need to take a step-by-step approach. The possibility for instructors to know in advance where students encounter issues or problems thanks to the statistical overview of their answers and comments also makes it possible to engage with them before and during the lecture in a more guided way.

Conclusion

As demonstrated by the unexpected crisis in the education world caused by the COVID-19 pandemic, teaching and learning online can be an environment that is both tricky and full of opportunities. Students are asked to perform at their best and instructors have to undergo an even larger amount of work to be sure that their lecture and material can be adapted to the new online conditions. One of the activities that sometimes are applied to an online environment without any substantial difference to offline teaching is to make students read papers, documents, and articles to prepare them for lectures and improve their knowledge and skills on a specific subject. In such a situation, it is easy for students to become passive and bored, and for the instructor to be unable to follow their students' learning process.

Edtech companies such as FeedbackFruits adopted a specific mission to combat these situations: to activate students while making instructors' lives easier; to make every course engaging. It is under this premise that FeedbackFruits created its many pedagogical tools, easily configurable in Learning Management Systems such as Microsoft Teams or Canvas. One of these tools, Interactive Document, tackles the issue of activating students while they engage with papers and articles to read throughout their courses.

By using this tool, instructors have prepared more efficient lectures (Hasan, 2020c). Interactive Document allows instructors to know in advance where students need more help, (Hasan, 2020a) and thus which topics should be stressed more or explained in more detail. Interactive Document has been shown to not only increase student engagement but also to enhance collaborative practices. With the abovementioned characteristics, students engage with each other, sharing material and helping each other toward a better understanding of the content (Hasan, 2020b).

In conclusion, the Interactive Document tool provided by FeedbackFruits helps students to be more active and engaged, with a marked improvement in both their learning (Hasan, 2020h) and their assessment (Hasan, 2020f). It also makes it easier for instructors to create more efficient lectures and allows for clear learning activities that are well-connected to the intended learning outcomes. All this directly in a single interface, accessible through the LMS or Microsoft Teams – a way to seamlessly integrate rigorous pedagogy with all the possibilities that technology can offer.

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