Transprofessional competences of school teachers in the digital environment: education employers' perspective

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Abstract

The shift towards digitalization in education, intensified by the COVID-19 pandemic-related issues, has led to the emergence of a need to expand the borders of the teaching profession. To be effective in the digital environment, school teachers have to master new transprofessional competences (TPCs), enabling them to use the skill sets of other careers, gain new skills and abilities and find non-standard solutions to professional and pedagogical problems using digital technologies. This study investigated education employers' opinions (61 principals and deputy principals from 31 Russian secondary schools) about the comparative importance of TPCs for school teachers working in the digital environment and their perceptions of what barriers prevent teachers from developing TPCs. The survey used a three-item questionnaire asking the respondents to rank the TPCs and the TPC clusters in order of importance for teachers working with the digital and to describe the obstacles to teachers' TPC development. The findings revealed that the employers attached the greatest importance to psychological TPCs while assigning the least importance to digital citizenship TPCs. The major barriers to TPC development, in the respondents' opinion, lay in teachers' fear of new trends and their excessive workload. Based on the survey results, we designed a model of school teachers' transprofessional competences in digital teaching and learning that can be used as an assessment tool in different professional settings. The paper concludes with suggestions on how to overcome the barriers and help improve school teachers' TPC development.

Keywords School teachers · Education employers · Transprofessional competences · Professional development · Digital teaching and learning · Digital environment

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1 Introduction

Before COVID-19, digital technologies found their way into educational practices in varying degrees but were not fully integrated (Tomczyk et al., 2020). The COVID-19 pandemic, however, has accelerated the integration process and given a spur to global discussions of the consequences of the shift towards digitalization (Rajab et al., 2020). Because of an interruption to face-to-face education (Manco-Chavez et al., 2020), teachers have faced challenges in adapting to digital teaching and learning, developing online communication (König et al., 2020) and collaboration skills (Lāma & Lāma, 2020), discovering new methods of evaluating, conveying knowledge and cooperating in the web (Manco-Chavez et al., 2020). Thus, digital transformation has become a prevailing trend in education: digital literacy and digital footprint have come to determine professional efficiency in the workplace.

The digitalization of education, associated with the intensive integration of information and communication technologies into the educational process of the school, has led to the emergence of a need to develop transprofessional competences of school teachers and modifies the requirements for their training and life-long learning. Teachers are expected to be mediators both in technology and the process of education (Tomczyk et al., 2020). Those altered requirements have an impact on teachers' individual accomplishments and evolution, active citizenship, societal engagement and operation in an information society (Fraile, 2018).

Transprofessional competences in the digital environment ensure teachers' ability to go beyond the framework of the teaching profession, quickly acquire new skills from other career paths and perform professional tasks in situations of uncertainty with the help of digital technologies. Ultimately, transprofessional competences form the basis for teachers' aptitude to continuing education, which is an essential factor in the professional development of any specialist. Therefore, teachers have faced the need to master new transprofessional competences for the twenty-first century challenges with repercussions for teacher training and professional development, which require further investigation.

Previous research on the issue of transprofessional skills has been limited to the field of medicine (Field et al., 2020; Haruta et al., 2017; Groessl and Vandenhouten, 2019; Olenick et al., 2019). Apart from "transprofessionalism", these studies resort to the terms "interprofessionalism" and "multiprofessionalism" and define them in the context where some team members acquire knowledge with, from and about each other, share it as well as values while collaborating within and across disciplines (Olenick et al., 2019). A similar understanding of transprofessionalism has been implemented in social work-related research (Johnson et al., 2017).

A different approach to the understanding of transprofessionalism is reflected in international diplomacy studies (Constantinou et al., 2016). Transprofessionalism consists, on the one hand, in a significant expansion of the range of functions performed by an official diplomat, on the other hand, in the fact that some diplomatic tasks are currently delegated to other professions (scientists, journalists, marketers, etc.) working at the international level.

Russian researchers in recent years have thrown some light on the methodological foundations of transprofessionalism in careers providing education services to individuals and groups. They define transprofessionalism as specialists' integral attribute, displaying their potential in mastering skills and carrying out tasks from diversified professions (Zeer et al., 2018).

Literature analysis has revealed a lack of research on transprofessional competences of school teachers, in particular, the education employers' perspective on the crucial transprofessional competences for school teachers in the digital era. To fill this gap in research, this study attempts to advance the understanding of the employers' perspective on key transprofessional competences of school teachers engaged in digital teaching and learning and to expand the reflections on pedagogical strategies and practices for professional development in digital environments.

2 Theoretical framework

The construct of the study is determined by the trends that are currently influencing teachers' continuing education and lifelong learning (Burbules et al., 2020; Familiars'ka & Kloyts, 2020). The first trend is the digital transformation of education: teachers face the need to integrate digital literacy, media literacy and mastery of digital teaching and learning tools (Manco-Chavez et al., 2020). Therefore, to function in the changing world and to be effective in situations of uncertainty, teachers should redefine and readjust their professional roles (Amin, 2016). The second trend is the ongoing process of certain professions becoming obsolete and others emerging at a fast rate, accompanied by a blurring of borders between them. The third trend is the development of emerging industries, such as the creative industry, augmented reality design and human-centered services (Zeer et al., 2020). These trends necessitate teachers' developing new transprofessional competences in the digital environment.

Our study of transprofessional competences of school teachers engaged in teaching in the digital environment calls for a clear definition of the term "transprofessionalism" in relation to similar concepts and terms, as well as for an understanding of the structural characteristics of TPCs.

Contemporary studies of transprofessionalism are scarce and only concern a limited number of occupational fields, namely, medicine/patient care, social work, health education and diplomacy. A feature that limits our perspective is a variety of similar concepts pertaining to competences that go beyond the boundaries of a particular profession: trans-, multi- and interprofessional learning (education) and collaboration that co-exist with the concept of transprofessionalism.

Multiprofessional learning is defined by Horsburgh et al. (2001) as learning about the roles of different professionals engaged in collaboration and teamwork within and between professional teams. A social work-related study interprets interprofessional education in a similar way: as an educational tool to improve interdisciplinary teamwork and professional outcomes (Barnett, 2017). Another study, however, differentiates between the learning objectives for interprofessional education vs. multiprofessional education as existing across health professions for the former and

within different health professions for the latter (Bachmann et al., 2016). Field et al. (2020) draw a similar distinction between interprofessional education and transprofessional learning. They suggest that interprofessional education occurs when students from two or more professions within one field learn about, from and with each other, providing students with the opportunity to learn and practice the knowledge, skills, behaviors and attitudes that will ultimately translate into a higher-quality output in collaborative professional environments. The concept of transprofessional learning implies that students learn skills across a wider range of professions than health professions alone (Field et al., 2020).

Böhm-Kasper et al. (2016) define multiprofessional collaboration as a collaborative deed of the same professional sector representatives pertaining to different groups. This must be distinguished from professional collaboration which refers to the collaboration of members of the same profession, e.g. teachers. Looking at multiprofessional collaboration in German schools, the study in question (Böhm-Kasper et al., 2016) emphasizes that non-teacher actors within and outside the school develop their own competences and those of the teachers in the same extent through cooperative action. A healthcare case from Japan (Goto and Haruta, 2020) shows that transprofessional collaboration motivates people to transcend their profession boundaries. Occupational limitations are erased or removed to afford the deliberate interchange of knowledge and skills with the aim of meeting complex professional needs. Professionals should go beyond established disciplinary barriers when there is a lack of human resources.

The understanding of the more general concept of transprofessionalism seems to diverge from the definitions mentioned above and has more to do with the way a professional adapts to the rapid changes fueled by current trends of technological development. For instance, a diplomacy-oriented study (Constantinou et al., 2016) sees transprofessionalism as an efficient progress that mirrors the broadened diplomatic expanse and the intense pacing of global linkage and networks and the new prospects they discover for practicing diplomacy in miscellaneous environment. In the field of education, Mockler (2005) looks at transformative teacher professionalism as the teacher professional identity and the methods that enhance it through the teacher susceptibility to the dynamic and rigorous educational setting they discover themselves in. Recent Russian studies have regarded transprofessionalism as a specialist's integral trait, which displays his/her capability to acquire and fulfill actions from diverse groups of professions with a high degree of rapprochement that have similar functions and a joint aim (Zeer et al., 2018). Further studies interpret transprofessionalism as an integral characteristic of someone who is ready, willing and able to adjust to changing circumstances of social and professional context (Zeer et al., 2020) and perform professionally in line with social and professional innovation challenges (Zeer et al., 2019). Based on Zeer's understanding of transprofessionalism, we define transprofessional competences as abilities enabling people to expand the borders of their profession, use the skill sets of other careers, quickly master new skills and abilities and find non-standard solutions to professional problems.

Many professionalism-oriented studies in the recent years have focused on so-called soft skills (also termed work skills, XXI-century skills, metaprofessional

skills). To compare soft skills and the TPCs and reveal a distinction between them, we used a compilation of soft skills put forward by Khampirat et al. (2019) that collates the findings from different studies: critical thinking, problem-solving, attention to detail, writing proficiency, business understanding, IT management, communication, teamwork skills, the ability to learn new technologies, the ability to respond quickly to work, being able to work independently, agility, flexibility, adaptability and sound knowledge. Meanwhile, Zeer et al. (2019), whose view we support, mention such transprofessional competences as systems thinking, intercourse with other professions representatives, uncertainty resilience, interdisciplinary cooperation, people skills and organizational skills. Looking at the TPC set suggested by Zeer, we find that they encompass a specialized and clearly outlined range of competences that specifically characterize a professional facing the challenge of new, previously unknown professional tasks and interactions. This opinion is shared by van Laar et al. (2017). It follows, then, that the exact constituents of TPCs will partly be determined by the initial profession of the person and the new professional field the person must reach out into.

It is worth mentioning that the undertaken literature review did not discover any studies of school teachers' TPCs from the point of view of the educational administrators, therefore, our study is the first attempt to fill that particular gap. It seeks to examine the employers' understanding of comparative relevance of transprofessional competences for school teachers in digital environment.

We explored the following two research questions:

- What is the employers' perspective on the hierarchical relations of the transprofessional competences of school teachers in digital environment?
- What are the barriers teachers face in developing transprofessional competences in digital teaching and learning?

Based on the data obtained in answer to the above questions we designed a model of school teachers' transprofessional competences in digital teaching and learning. The model can be used as an assessment and self-assessment tool for continuing teacher professional development.

3 Methods

3.1 TPC clusters constituents

To determine the major constituents of school teachers' transprofessional competences (TPCs) in the digital environment, we undertook a literature review (Liventsova et al., 2018; Claro et al., 2018; Starkey, 2020; Tican & Deniz et al., 2019; Iriani & Handoyo, 2020 and others) that revealed the directions in which teachers' skills, methods, tools and forms of labor have been transformed with the introduction of digital technologies into education (Selwyn et al., 2017). Moreover, there is a strong connection between digital education and intensification of teachers' work that calls for their psychological adjustment. Given the

transprofessional transitions teachers have to make and the way the digital era has redefined the role of teachers (Amin, 2016), we singled out six general directions of transformation of teachers' professional competences and obtained six corresponding clusters of transprofessional competencies of teachers engaged in digital teaching and learning: the psychological cluster, the technological cluster, the creative cluster, the communicative cluster, the methodological cluster and the cluster of digital citizenship-related transprofessional competences. Our next step was to identify the TPCs within each cluster.

To determine the constituent TPCs of the psychological cluster, we considered several research papers concerned with the problem of teacher reflection in online professional development (Philipsen et al., 2019; Prilop et al., 2019; Mumford & Dikilitaş, 2020). Another study (Choi et al., 2018) looked into teachers' performance in the digital environment in terms of individuals' thinking, skills and behaviors with regard to the use of digital resources. We also included teachers' psychological characteristics and teacher autonomy to engage with a digital task (Lemon & Garvis, 2016) into the psychological cluster.

The TPCs included into the technological cluster were derived from studies focused on designing, using and sharing digital teaching resources (Gruson et al., 2018) and providing a deeper understanding of teachers' expertise in the changing nature of the resources (Pepin et al., 2017) and their efficient management (Eshet, 2004).

The creative cluster comprises the TPCs based on the findings of how teachers use creative thinking skills (Basarmak, 2019) and pedagogical innovation (Avidov-Ungar and Forkosh-Baruch, 2018) in the digital teaching process, including the ways teachers creatively design learning environments by means of media and digital technologies (Karakuş et al., 2020).

The communicative TPC cluster was compiled from studies of the ways digital technology reshapes and benefits student–teacher and student–student communication (Denizalp & Ozdamli, 2019) and how the increasing use of technologies in learning institutions, particularly during online learning, impacts this mode of communication (Hussin et al., 2019). The expectations and the components of online communication between teachers and students were derived from Blaine (2019).

The studies that formed the basis for the methodological TPC cluster covered the design of learning activities with certain characteristics (Rapanta et al., 2020) and the need for adapting assessment to the new learning requirements (García-Peñalvo et al., 2020). Of key importance was the idea (Vivitsou et al., 2017) that teachers introduce digital learning strategies and facilitating techniques in their practices as well as guide and support students online. According to Vivitsou et al. (2017), they introduce the use of web-based environments and digital technologies, adapt their teaching plan accordingly and enrich existing instructional material.

We shaped the digital citizenship TPC cluster based on habitual teaching practices involving digital risks: inappropriate sharing of information and digital content, neglecting sensible password choices and an ignorance of digital footprint and digital reputation concerns (Gallego-Arrufat et al., 2019). Another inspiration for this cluster was Tomczyk's (2019, 2020) studies of the key areas of teachers' digital literacy in relation to digital safety.

As a result of the literature review, we identified the constituent TPCs of each of the six TPC clusters that teachers need to perform in the digital environment (Fig. 1). Afterwards, we used these transprofessional competences to create a questionnaire for the survey of education employers.

3.2 Developing the survey questionnaire

We further used the TPC clusters to develop a questionnaire for the survey of education employers (Appendix 1), consisting of three items. The first and the second ones were close-ended, while the third one was open-ended. The first item asked the employers to rank the transprofessional competences within each cluster according to their significance for school teachers working in the digital environment (1 being the highest rank). The second item was to rank the TPC clusters as whole units. The third item concerned the existing barriers in mastering the transprofessional competences by school teachers working in the digital environment. Items 1 and 2 of the questionnaire enabled the collection of data for the first research question, *What is the employers’ perspective on the hierarchical relations of the transprofessional competences of school teachers in digital environment?* Item 3 targeted the second research question, *What are the barriers teachers face in developing transprofessional competences in digital teaching and learning?*

To carry out the statistical analysis of the quantitative data, we used the Kendall’s coefficient of concordance and Pearson’s chi-squared test. We assessed agreement

Fig. 1 Transprofessional competences of school teachers engaged in digital teaching and learning

among raters with the help the coefficient of concordance and we evaluated how likely it was that the observed difference between the obtained sets of ranks arose by chance, using Pearson's chi-squared test.

3.3 Data collecting

To collect data for the survey, we took the following steps.

- Step 1 We compiled a list of eleven-year secondary schools in Ishim and neighboring territories, Tyumen Region, Russia.
- Step 2 We emailed the principals of the schools, inviting them and their deputies to take part in our anonymous survey, specifying its goals and the time required to complete it.
- Step 3 Within a 7-day period, we received 67 respondents' consents to participate in our survey. They represented 31 eleven-year secondary schools.
- Step 4 We sent the respondents the questionnaire via email, attaching the instructions on how to complete it.
- Step 5 Within 2 weeks, the respondents filled out the questionnaire and sent us their answers by email.

Data collecting was carried out in December, 2020.

3.4 Participants

We collected research data from 67 school principals and deputy principals of 31 eleven-year secondary schools in Ishim and neighboring territories, Tyumen Region, Russia. Among the schools, 97% were state-owned and 3% were private. All the participants had a university degree in education; 82% of them were female. The mean age of the participants was 52.

4 Results

4.1 Ranking results within the TPC clusters

The first item of our survey asked the respondents to assign ranks to transprofessional competences (TPCs) within each cluster, with Rank 1 given to the most important competence within the cluster. To enable comparison between the ranking positions of the TPCs included in different clusters, we calculated the relative value of each rank. We arranged the TPCs in sequences from the most to the least important, thus obtaining a hierarchy of the TPCs within each cluster. The lower the relative ranking value of a TPC is, the higher the position this TPC occupies within the hierarchy.

We found that within the psychological cluster, the highest position is shared by "self-development and self-improvement" and "adaptability to new conditions". To

Fig. 2 Hierarchy of TPCs within the psychological cluster

Fig. 3 Hierarchy of TPCs within the technological cluster

a slightly lesser extend the respondents value “self-organization and self-government”. They consider “self-reflection” to be of the least importance (Fig. 2).

Within the technological TPC cluster (Fig. 3), the respondents assign equally high importance to “selecting, evaluating and using digital content” and “working with a variety of software”. The lowest position on the ranking scale is given to “using the Internet and social networks”.

The TPC hierarchy within the methodological cluster (Fig. 4) is headed by “selecting and using context-sensitive methods of online teaching and learning” whereas “facilitating learning in the digital environment” occupies the lowest position.

Within the communicative cluster (Fig. 5), the respondents give preference to “direct online student–teacher communication”. It is noteworthy that the relative ranking value of this transprofessional competence (0.37) is the lowest across all the clusters, suggesting the greatest perceived importance of this TPC for teachers

Fig. 4 Hierarchy of TPCs within the methodological cluster

Fig. 5 Hierarchy of TPCs within the communicative cluster

working in the digital environment. Meanwhile, the respondents ascribe the least significance to “teacher-supervisor interaction”.

The hierarchy of creative TPCs (Fig. 6) starts with “out-of-the-box thinking” and ends with “developing innovative digital content”.

Within the framework of digital citizenship TPCs (Fig. 7), “respect for students’ digital rights” ranks as the most valuable TPC, while “using antivirus software” tails the hierarchy. Comparing the ranking data across the clusters, we see that “using antivirus software” and “using the Internet and social networks” are perceived by the respondents as the least important for teachers in the digital environment.

4.2 TPC clusters hierarchy

The second item of our survey involved ranking the clusters of transprofessional competences as whole units. The resulting hierarchy of TPC clusters (Fig. 8) shows the prevalence of psychological TPCs in the respondents’ assessment. The creative and digital citizenship TPC clusters occupy the lowest positions in close sequence.

Fig. 6 Hierarchy of TPCs within the creative cluster

Fig. 7 Hierarchy of TPCs within the digital citizenship TPC cluster

Fig. 8 Hierarchy of TPC clusters according to the respondents' ranking

The reliability of the data obtained was confirmed using the Kendall's coefficient of concordance ($W=0.815$ indicates a sufficient degree of agreement of experts' opinions). To assess the significance of the concordance coefficient, the Pearson's matching criterion was calculated, which showed that the value $W=0.815$ is not random. Therefore, the results obtained are moderately significant and can be used in further studies.

4.3 Model of school teachers' transprofessional competences in digital teaching and learning

The purpose of this study is to examine the employers' understanding of key transprofessional competences of school teachers. Taking into account the ranked positions of the TPC presented above, we designed a model of school teachers' transprofessional competences in digital teaching and learning (Fig. 9). Structurally, the model is a sequence of four expanding areas of teachers' transprofessionalism, named the “core”, the “semi-periphery”, the “periphery” and the “development vector”. Each area represents a set of relevant competences of the same rank interval.

The core of school teachers' transprofessional competences includes competences recognized by the respondents as key for the implementation of professional and pedagogical activities in the digital environment. Among them are teachers' “self-development and self-improvement” abilities and “adaptability to new conditions”, as well as “selecting, evaluating and using digital content” and “working with a variety of software”, “selecting and using context-sensitive methods of online teaching and learning”, “direct online student–teacher communication”, “out-of-the-box thinking” and “respect for students' digital rights”. These transprofessional competences occupy the top ranking positions within each TPC cluster.

The semi-periphery of the model is represented by the transprofessional competences, occupying the second ranking positions within their cluster hierarchies. They

Fig. 9 Model of school teachers' transprofessional competences in digital teaching and learning

include teachers' "self-organization and self-government" abilities, "working with a variety of hardware", "selecting effective online forms, methods and techniques", implementation of "subject-specific online learning and teaching techniques", "combining different digital tools" and ensuring "digital security".

The periphery of the model includes the transprofessional competences ranked the third by the respondents in each cluster hierarchy: complying with "digital workplace discipline", "facilitating learning in the digital environment", carrying out "online parent-teacher interaction", manifesting "willingness to learn".

The development vector of the model comprises the TPCs placed by the respondents beyond the third ranking position in each cluster hierarchy: teachers' "autonomy", "self-regulation and stress management", "openness to change", "self-reflection" ability, "using the Internet and social networks", "developing innovative digital content", "indirect online student–teacher communication", "teacher-supervisor interaction", "facilitating learning in the digital environment", "plagiarism prevention", "compliance with copyright", "using antivirus software".

4.4 Barriers

This study defines barriers as internal and external factors determining the choices teachers make in the digital environment that cause resistance to innovations and inhibit the implementation of new technologies. In response to the open-ended question of the questionnaire, the employers pointed out the barriers that prevent the development of TPCs of school teachers engaged in digital teaching and learning (Fig. 10).

Fig. 10 Barriers in teachers' TPCs development as seen by education employers

The majority of employers (26%) focused on a fear of new trends and technopessimism (Tomczyk et al., 2020) as the main barrier. They mentioned “a lack of confidence in their own digital abilities”, the fact that “teachers are convinced that it is possible to teach effectively in the old way”, “the teaching staff are committed to the traditional teaching tools” and “they seem unable to adapt flexibly to new conditions”.

A slightly smaller number of the surveyed employers (16%) named teachers’ excessive workload as a barrier. Their answers included: “due to the heavy workload, there is not enough time for self-development” and “there’s a heavy workload and, as a result, professional burnout”.

A lack of modern equipment was described as a problem by 13% of employers, justifying this by the fact that “not everyone has modern digital equipment” and “constrained life circumstances do not allow having smartphones with Internet access, computers or various gadgets”. The same proportion of participants (13%) named low self-organization skills as a barrier to TPC development, saying that “a lot of teachers are disorganized”, “there’s a lack of time-management skills” as well as “it is a challenge to master these competences on one’s own”.

A lack of administrative support as a problem accounted for 10% of the survey answers: “a lack of support and assistance from supervisors”, “many teachers need help and assistance from the administration in mastering new types of activities”, “most teachers need administrative assistance, mentoring”. Equal prominence (10%) was given to the problem of low motivation, unwillingness to change as a barrier to mastering TPC by teachers: “there’s little incentive to improve and self-develop”, “teachers are not motivated to master new types of activity”, “the staff are reluctant to learn new things”.

The smallest number of the surveyed employers (6%) recognized the challenge of selecting and using digital resources, as evident from their answers: “teachers face difficulties in finding, evaluating and using suitable digital content”, “the variety of digital products is confusing”. Other barriers to TPC development include “colleagues’ hostility (envy, jealousy)” (3%), “health problems caused by using digital technologies” (3%).

5 Discussion

The findings of this study has allowed us to suggest possible reasons for the hierarchical positions of the clusters. The priority of the psychological TPC cluster in the employers’ view appears to be due to the need to overcome the existing barriers associated with teachers’ unwillingness to change, a fear of current professional challenges, situations of uncertainty and leaving their comfort zone. The significance of psychological TPCs is consistent with other findings concerning teachers’ professional identity in the light of demands of pedagogical innovation and construction of professional selves (Avidov-Ungar & Forkash-Baruch, 2018). Online teacher interaction and development could instigate teacher reflection (Philipsen et al., 2019; Mumford & Dikilitas, 2020) and self-reflection (Prilop et al., 2019).

An unexpectedly low rank was assigned to the creative TPC cluster, which contradicts the traditionally esteemed role of creativity in teaching and learning and the widely propounded idea that creative educational practices should be supported by technology (Basarmak, 2019). The respondents' answers suggest that the factors undermining the perceived significance of the creative aspect of teaching in the digital environment are a large workload teachers have to cope with, the risk of professional burnout and health problems associated with digital gadgets and tools. This agrees with the idea that there are certain disjunctions across the teaching workforce encumbering the implementation of digital technologies (Selwyn et al., 2017).

The digital citizenship TPC cluster occupies the bottom line in the rating, which is in accordance with the conclusions Tomczyk (2020) and Gallego-Arrufat et al. (2019) draw from their surveys: teachers demonstrate insufficient knowledge in the area of intellectual property law and digital safety, as well as an average competence in the area of digital security. On the part of the employers, the rating results might indicate an insufficient understanding of the digital citizenship TPCs relevance to effective teaching and learning in the digital environment. Another reason might be the influence of the respondents' individual backgrounds and psychological characteristics on their levels of digital citizenship (Choi et al., 2018).

The design of the model of school teachers' transprofessional competences in digital teaching and learning has deepened our understanding of each area of teachers' transprofessionalism. The core of the model comprises the indispensable TPCs that every teacher needs to acquire in order to be effective in the digital workplace. Both teachers and education employers may be advised to focus primarily on the core TPCs while planning professional development for digital teaching and learning success.

Mastering the TPCs in the semi-periphery conceivably expands the field of teachers' transprofessionalism, allowing them to rise to new levels of professional development in the digital environment and to choose an individual path of continuing professional development. There may be a potential for further improvement of transprofessional solutions for teaching and learning problems arising in the digital environment.

Improving the TPCs in the periphery might enable teachers' differentiated growth into specific spheres of digital teaching and learning according to teachers' professional needs and further self-development goals.

The request for the TPCs, included in the development vector, might not have been formed in the education system. Therefore, these competences may not play a key role in professional transformation of teachers from the point of view of education employers. Despite the fact that the new trends in education call for teachers' autonomy, self-regulation and stress management, openness to change (Lāma & Lāma, 2020), these transprofessional competences have not yet been included in the expert assessment of employers as paramount for professional performance in the digital environment. It seems important to actualize these competences in continuing professional and pedagogical development.

5.1 Practical applications

The suggested model of school teachers' transprofessional competences in digital teaching and learning can find wide practical application and prove useful in a variety of professional settings. On the one hand, it is the first attempt to produce an assessment tool for teacher TPCs, on the other hand, it is uniquely based on employer opinions which fills a gap in international research.

Firstly, it can be used in the recruitment process to evaluate the competences of teacher candidates' for educational positions, as well as to build professional resumes. Secondly, the model can be implemented in school teachers' professional assessment and used as a basis for choosing professional development paths and determining professional growth areas both individually and by professional teams. Another possibility is to incorporate the model into teacher training courses, mentoring guidelines and continuing education programs. Finally, school administrators can resort to the suggested model to ensure that the school provides the necessary conditions for teachers' TPC development, including digital equipment and digital educational recourses.

5.2 Recommendations for overcoming the barriers to school teachers' TPC development

Our study of the perceived barriers to the development of school teachers' TPCs is in agreement with other studies concerning the tensions that teachers face while implementing digital technologies into their practice, e.g. Viberg et al. (2019), Cantú-Ballesteros et al. (2017), Avidov-Ungar and Forkosh-Baruch (2018). Our findings informed possible measures for overcoming the barriers that correlate with the current context of teacher professional development:

- to raise school teachers' motivation for mastering the TPCs in the digital environment;
- to design advanced variable training programs for teachers aimed at TPC enhancement;
- to design individual paths of TPC development for teachers;
- to revise the established practice of managing digital processes in schools allowing for an adjustment period for teachers;
- to provide consulting services to teachers in need of administrative assistance or mentoring in the use of digital technologies;
- to form teacher communities, online teacher associations and internship sites in order to share best practices of digital tool implementation;
- to implement professional development formats conducive to self-development and self-organization of teachers (gamification, digital badges, immersion training, etc.);
- to create and maintain a resource bank for the development of TPCs in the digital environment.

5.3 Limitations of the study

The limitations of this study were as follows:

1. The sample size for this study was limited because it only covered eleven-year secondary schools in Ishim and neighboring territories, Tyumen Region, Russia. The sample can therefore be described as a local case. This prevents a full generalization of the findings to other regions and countries. The sample does not allow for strong conclusions on the national or international macro scale (educational policies).
2. The constructs in this study are based on employers' subjective ratings of school teachers' TPCs in the digital environment. To further address and validate the observations, it is necessary to draw upon other education stakeholders' viewpoints and weigh them against the findings of the present study.
3. Because the concept of transprofessional competences is subject to rapid alterations, its understanding may be further extended thus restricting our findings to a specific type of professional phenomena in accordance with current challenges in education.

6 Concluding remarks

In contemporary education, there is a demand for transprofessional school teachers who are prepared to work in professional situations of uncertainty, increasing variability and complexity (König et al., 2020; Lāma & Lāma, 2020; Manco-Chavez et al., 2020). Teachers are expected to be self-motivated, self-organized (Rajab et al., 2020) and self-developing, as well as to be open to change and continuing professional education (Familiars'ka & Kloyts, 2020).

The survey of education employers' opinions enabled us to answer the first research question concerning *the relative significance of the transprofessional competences of school teachers engaged in digital teaching and learning*. We built a descending hierarchy of TPC clusters of school teachers working in the digital environment with the top rank attributed to the psychological cluster, followed by the technological, methodological, communicative, creative clusters and digital citizenship clusters. According to the employers, the most important school teachers' TPCs are “direct online student–teacher communication”, “self-development and self-improvement”, “adaptability to new conditions”, “willingness to learn” and “openness to change”.

Based on our findings, we designed a model for assessing school teachers' transprofessional competences in digital teaching and learning. The core of the model includes the TPCs, indicated by the employers as key for the school teachers working in the digital environment to ensure their ability to go beyond their professional skills, as well as their willingness and ability to continue their professional development. The expansion from the core competences to the

periphery reflects the vector of the teachers' growth, their self-development and self-improvement.

Answering the second research question about *the barriers teachers face in developing transprofessional competences in digital teaching and learning*, this study revealed a set of perceived impediments to the development of school teachers' TPCs, among them “a fear of new trends, techno-pessimism (Tomczyk, 2020)”, “the teachers' large workload”, “a lack of modern equipment”, etc. To overcome the identified barriers, we suggested some recommendations.

The study contributes vital information about an important group of stakeholders such as the employers revealing opinions of the issue of school teachers' TPCs in the digital environment. Nevertheless, there are still areas that need further research. Future studies may focus on school teachers' TPCs in situations of interdisciplinary interaction or carry out a comparison between different stages of education, e.g. pre-school educators and school teachers. This will further deepen our understanding of the field.

Appendix 1

Survey: Transprofessional competences of school teachers engaged in digital teaching and learning

Instructions:

(1) Please assign a rank to each of the TPCs within EACH CLUSTER according to their importance (1 = the most important, 2 = less important, etc.) for school teachers engaged in digital teaching and learning.

TPC clusters	Transprofessional competences (TPCs) of school teachers engaged in digital teaching and learning	Rank
Psychological cluster	Self-reflection	
	Adaptability to new conditions	
	Self-regulation and stress management	
	Openness to change	
	Self-development and self-improvement	
	Autonomy	
	Self-organization and self-government	
	Willingness to learn	
Technological cluster	Working with a variety of hardware	
	Using the Internet and social networks	
	Selecting, evaluating and using digital content	
	Working with a variety of software	
Creative cluster	Developing innovative digital content	
	Combining different digital tools	
	Out-of-the-box thinking	
	Selecting effective online forms, methods and techniques	

TPC clusters	Transprofessional competences (TPCs) of school teachers engaged in digital teaching and learning	Rank
Communicative cluster	Interdisciplinary professional collaboration	
	Teacher-supervisor interaction	
	Indirect online student–teacher communication	
	Online parent–teacher interaction	
	Direct online student–teacher communication	
Methodological cluster	Selecting and using context-sensitive methods of online teaching and learning	
	Facilitating learning in the digital environment	
	Subject-specific online learning and teaching techniques	
Digital citizenship cluster	Plagiarism prevention	
	Using antivirus software	
	Compliance with copyright	
	Respect for students’ digital rights	
	Digital workplace discipline	
	Digital security	

(2) Please assign a rank to each of the TPC clusters according to their importance (1 = the most important) for school teachers engaged in digital teaching and learning.

TPC clusters	Rank
Communicative cluster	
Creative cluster	
Digital citizenship cluster	
Methodological cluster	
Psychological cluster	
Technological cluster	

(3) Please share your opinions about the barriers to the development of school teachers’ TPCs in the digital environment.

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Data availability Upon request authors are prepared to send relevant raw data in order to verify the validity of the results presented.

Declarations

Consent to participate The participants of this study completed and returned an anonymous survey *Transprofessional competences of school teachers engaged in digital teaching and learning* providing tacit consent to participate in the research. However, the authors are prepared to provide the documentation required.

Consent for publication The authors are prepared to provide a formal written consent to publish the work *Education and Information Technologies*.

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