FOUR SCENARIOS OF PERSONALIZED LEARNING INTEGRATION MEDIATED BY A DIGITAL PLATFORM

Dr. Mikhail SHCHEVLIAGIN
ORCID: 0000-0002-0523-2789
Laboratory for Educational Innovation Research, Institute of Education
National Research University
Moscow, RUSSIA

Dr. Diana KOROLEVA
ORCID: 0000-0001-5296-8708
Laboratory for Educational Innovation Research, Institute of Education
National Research University
Moscow, RUSSIA

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ABSTRACT

The process of humanization, placing a person at the heart of learning and teaching, has become a key movement in education to meet the requirements of the 21st century. In this regard, designing innovations to serve the human needs first is essential. Personalized learning (PL), being an example of a human-centric innovation, is a promising methodology that leads to positive student's outcomes. However, it has not found ts way in the practical implementation and has become a topic for heated debates among different stakeholders. This study investigates PL at the secondary education level underpinned by a digital platform. The PL integration is analyzed from the perspective of teacher practice (TP) which integrates the digital platform built on the PL methodology. In accordance with the thematic analysis of the interviews and the developed matrix of indicators for TP, PL has found its realization in four scenarios. In order to construct the scenarios, the study involves 24 semi-structured interviews with secondary school teachers. Prior to the interviewing, the participants were categorized in nine profiles due to the survey results of NorBa (traditional-constructivist beliefs) and technology readiness index (TRI). The results indicate that TP embraces four scenarios of the PL integration. The study outlines personalized learning as one of the scenarios, partial personalization (individualization and differentiation), non-personalized TP (traditionalism), and TP without digital platform embedding.

Keywords: Personalized learning, e-personalization, teaching practice, scenarios, digital platform.

INTRODUCTION

PL has become one of the promising trends in education, which is actively discussed by academic community and policy makers, integrated by school administrators and teachers, and appealing to students and their parents (UNESCO, 2022; The Book of Trends 2.0, 2015). Recent research on PL provides the evidence on its effectiveness (Pane et al., 2017, 2015), the support of students' satisfaction and intrinsic motivation (Alamri et al., 2020), triggering greater situational interest (Walkington & Bernacki, 2020), and fostering social and emotional skills (Author, 2021; Murphy et. al., 2016). Although PL "picks cherries" bringing together a range of ideas and theories, known about effective teaching (Jones & Mclean, 2018), its practical implementation is not seamless. In the USA, large-scale implementation of PL in high schools has been reported to be a challenging process, as tailored instruction and a variety of materials to every student

were found difficult for TP (Steiner et al., 2017). Courcier (2007) states that in England some teachers do not have a clear idea of personalization in learning, which might be connected with school leaders' decisions. In some schools of New Zealand teachers and leaders also do not have complete understanding of PL (Cardno, 2017). Swedish teachers (Bunting et al., 2021) relate PL with more work for them. In the Russian Federation, the initial steps towards personalization at secondary schools were found inconsistent and complicated for teachers, students, and parents (Kraynova & Obukhov, 2020). Recent studies show that the PL implementation varies both at an individual (teacher) level (DeMink-Carthew et al., 2017) and at an organizational (school) level (Steiner et al., 2020; Bingham et al., 2016). At an individual level, PL is related to teacher beliefs (conceptions, personal ideologies and values) and teacher predisposition to the integration, shaping the TP. Organizational level is the context for the methodology integration, including the organizational culture and climate, shared vision of the staff, necessary for PL scaling.

In response to the issue of the PL practical implementation, the focus of this paper is on school teachers' methodology integration, mediated by a digital platform. The research objective is to identify the scenarios of the PL integration and formulate the strategy for overcoming barriers and further scaling. The contribution is valuable for the research field as it distinguishes the levels of the PL integration mediated by a digital technology.

The article has five sections. The first part is a literature review of the perspectives on defining PL to outline the key elements of personalization, and its features in contrast to individualization and differentiation of learning to create the scheme for further analysis. In addition, the literature scrutiny refers to digital technology for PL in order to investigate similar to our study experience of digital tools embedding. The second section describes the research design, study sampling (the selection of schools and teachers), and the interview methods. The third part presents the findings, i.e. the four scenarios ranged by the degree of student-centeredness in TP, and the encountered barriers to the PL implementation. The discussion interprets the research findings, including teacher training implications for each scenario. Although the study was conducted in one country, the results might be relevant to other contexts, as PL was not integrated as a specific governmental reform.

PERSPECTIVES ON DEFINING PL

Personalization in learning has encountered various approaches in its definition, which leads to the ambiguity in conceptualization. It is one of the reasons why different strategies are adapted in practice. The educational organizations also do not express the same viewpoint on PL. The Organization for Economic Cooperation and Development (OECD, 2006) emphasizes taking into account students' strengths and weaknesses, while Pane et al. (2015, 2017) regard PL as learning tailored to address learner's needs and goals. From this perspective, PL is viewed as a customized approach to the teaching-learning process. However, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2013) and Patrick et al. (2013) assume that tailoring instructions serve the purpose of student choice enabling student ownership. Therefore, the concept is interpreted by a student as an active agent of the learning-teaching process, taking ownership of one's learning. In addition to the international organizations' conceptualization, the researchers worldwide provide their interpretation of the methodology. Bray & McClaskey (2014), in Making Learning Possible, claim that students are active participants in PL, having a voice in what and how they learn and a choice to demonstrate what they know in a learner-centered environment. As Walkington & Bernacki (2020) point out, this viewpoint has become ''particularly influential in schools" (p. 238). In accordance with the provided opinions, personalization is viewed from at least two angles. The first is tailored instructions due to the individual characteristics and needs, and the second is student choice and voice in learning. From the perspective of this study, PL will primarily be viewed through learning which, being a constitutional element, provides a student with choice and voice in the education process (Author, 2022). Nonetheless, there are other concepts that are close to PL and student-centered perspective; hence, the boundaries between differentiation, individualization, and personalization should be outlined.

Differentiation, Individualization and Personalization of Learning

The three concepts in question lay in the continuum of teacher-centered learning (TCL) and student-centered learning (SCL). In accordance with O'Neill & McMahon (2005), TCL and SCL vary by the following parameters: (a) student choice in learning, (b) active versus passive learning and (c) power. The power in TCL is primarily given to the teacher, whereas in SCL, learners possess the power, and there is "student empowerment" in the learning process (Attard et al., 2010). The active parameter is connected with student choice in learning, since students have the power in SCL. Therefore, they are able to make a choice while in TCL, such opportunities are limited. Finally, TCL suggests that learners are passive, i.e. they are the recipients of knowledge, whereas SCL encourages student's active participation.

Regarding PL, different opinions are expressed on its position in the TCL-SCL paradigm. Cuban (2018) proposes viewing PL on the continuum, rather than staking out a single static point. At one end of this continuum are teacher-led classrooms, in which learning is tailored to the achievements of individual students to teach pre-determined content and skills; at the other end are student-centered classrooms that, with tailored approaches, aim to ''cultivate" student participation, expressing the student's own interests (Attard et al., 2010). However, Kaufman et al. (2020) propose that an ''ideal personalized learning system" is truly student-centered (p.16). The same viewpoint is expressed by UNESCO (2013), and Bray & McClaskey (2014). In regard to differentiation and individualization, the Book of Trends in Education 2.0 (2015) claims that the concepts are teacher-centered. Owing to the TCL-SCL parameters introduced by O'Neill & McMahon (2005), student choice is fully given in PL, being student-centered, while in individualization and differentiation, these opportunities are limited. As for the second parameter, PL gives power to students, enabling their choice and voice, whereas in individualization and differentiation, power is given to the teacher, who is a driver of learning. In the latter two, the individual characteristics are taken into account, yet it is the teacher who makes the decision on the goal to set, the content to cover, and skills to develop. The third parameter, ''active versus passive learning," varies in all three concepts caused by the method of instruction. In differentiation, the instructions are given for a group of students who share the same characteristics; in PL, the student chooses the learning method, and in individualization they are given for each individual student (the Book of Trends in Education 2.0, 2015). Yet the concepts are different not only in the methods of instructions and distribution of the power, but also in the curriculum objectives, responsibilities of learning and assessment. Thus, the matrix of characteristics is necessary for a clear understanding.

We attempt to build the scheme of concepts on the basis of the available research. For its development, the conceptualization of Bray & McClaskey (2018), the Book of Trends in Education 2.0 (2015) and the view of the Foundation ''Investment in the Future" (2020) were adapted. The main criterion for their selection was the information provided on all three concepts and their characteristics. The key features of differentiation, individualization and personalization are presented in Table 1.

Table 1. Characteristic features of personalization, individualization and differentiation in learning-teaching process.

	Differentiation	Individualization	Personalization
Centeredness	teacher-centered	teacher-centered	student-centered
Curriculum objectives	the same curriculum objectives for everyone	the same curriculum objectives for everyone, specified for individuals	each student has his/her own learning goals
Education boundaries	education is limited to school (as the place of study)	education is limited to school (as the place of study)	education does not end at school, it goes beyond the education system and hard skills
Responsibility for learning	the teacher is responsible for student learning	the teacher is responsible for student learning	the student owns learning and shares responsibility with the teacher
Instructions and tools	different instructions and tools for groups of learners	different instructions and tools for individuals	the student chooses the method, when and where to learn

Design of learning	the teacher organizes the learning-teaching process according to the group characteristics	the teacher organizes the learning-teaching process according to individual characteristics	the student actively participates in organizing the learning-teaching process according to his/her own learning trajectory
Collecting data about students' to inform learning	the teacher informs learning with data and students' progress to modify further learning for groups	the teacher informs learning with data and students' progress to modify further learning for individuals	learning is informed by data on students' needs, interests and progress, The data is constantly updated, to design learning pathways
Assessment	assessment *of* learning with some elements *for* learning	assessment *of* and *for* learning with some elements *as* learning	assessment *as* learning and *for* learning with minimum *of* learning

The table shows that differentiation, individualization, and personalization are respectively on the teacher-to-student line. Differentiation and individualization share the same *curriculum objectives* for learners, and in PL, each student has one's own goal in the learning process. Regarding the element *educational boundaries*, PL differs from the other concepts as it goes beyond the school, within and outside the classroom, and learning occurs at different times and places. It means that a student should have the possibility to gain knowledge and skills anytime and anywhere (Patrick et al., 2013). Besides, the concepts vary in *learning design*, in which tools, instruments, and instructions are distributed for groups, e.g., "strong" and "weak" students (differentiation), or are addressed at individual students (individualization). Regarding differentiation, Dumont and Ready (2023) argue that schools have a tendency to treat academic differences as obstacles and group students with similar abilities together; therefore, differentiation may result in reducing student heterogeneity. PL, being purely SCL, proposes a learner who chooses the tool and method to receive the content. In individualization and PL, for each student, the decisions of learning design, tools, and methods to use are *underpinned by data about students* that is regularly collected and analyzed. Pane et al. (2017) suggest developing personal profiles as a "record of each student's individual strengths, needs, motivations, progress, and goals" (p. 6). These profiles make individual learning plans possible. In *assessment*, PL places emphasis on formative assessment (*for* and *as* learning) with little amount of the summative assessment (*of* learning). Summative assessment is common for differentiation with limited opportunities for assessment *for* learning.

The most significant difference of PL from other concepts is the element of choice in the learning process. The choice is closely connected with *responsibility,* shared between the student and the teacher. From a PL angle, the education process should involve opportunities for freedom of choice, e.g. acquired knowledge and skills might be demonstrated in various forms: a project with peers, individual research or presentation so that a learner has a chance to make a decision. Edelson et al. (1999) state that when students make active learning choices, they are motivated to learn and to develop a sense of ownership. The choice and voice might be limited by a responsibility over one's own cognitive development. Students may not be ready to share this responsibility or they may not know how to make the right decision in learning to achieve their goals. Furthermore, Prain et al. (2012) argue that teachers may have doubts about students' abilities to make appropriate decisions in the educational process. Consequently, teacher might not be ready to provide a student with a choice; thus, the problem can be related to giving control to a learner over the education process. Willower et al. (1967) proposed Pupil Control Ideology, in which teachers and students adopt humanistic orientation and are willing to act on their own volition and accept responsibility for their actions.

Digital Technology for PL

Technological advances in the era of digitalization are viewed as a medium of making personalized learning possible. Abbott et al. (2014) support this viewpoint, stating that "technology is necessary to bring personalized learning to scale" (p. 14), as well as Abu-Rasheed et al. (2023) express the opinion that technology-enhanced learning has the potential to enable personalization. Contributing to digital technology implementation, Boninger et al. (2019) argue that digital platforms are vital for a shift from a one-size-fits-all method to more personalized instructions. In addition, OECD (2023) outlines that digital tools may cater to varying student needs, allowing personalization. Nowadays, there are several instances of digital platform embedding in education.

Summit Learning Public Schools (n.d.) adapt the personalized approach to teaching and learning in the K-12 context. The initiative encompasses more than 400 schools in the USA. The school-participants are provided with ongoing support, professional development of staff, teaching materials, and a digital platform that supports what teachers and students do in class. Secondly, learners are enabled to set goals, and teachers can monitor progress and provide students with individualized support via the platform (Summit Learning, n.d.). Besides, Lindsay Unified School District (LUSD) integrates a personalized learning model supported by the digital element ''Empower" and, like other platforms supporting PL, students can access the learning content anywhere and anytime and track their progress (Holland, 2020). With regard to students, Holland (2020) outlines that LUSD has invested in fostering a student agency and developing their students as online/blended learners.

Another instance of a digital platform in higher education is ''Knewton," which is also aimed at personalization. The project includes courses on biology, chemistry, economics, mathematics, psychology, and statistics. It is an adaptive digital tool that takes into account students' individual characteristics: pace of learning, gained knowledge, and a better way for the learner to internalize the content. The experience of Arizona State University with learning on Knewton has shown that the portion of students withdrawing from the courses fell from 13% to 6%, and pass rates rose from 66% to 75% (Upbin, 2012).

One of the examples of a well-developed PL digital platform is ''SberClass" (SC). By November 2020, SC was integrated into nearly 2500 schools (Investment in the future, n.d.), which is 6% of the total school number in Russia (*N=40346* at the beginning of the 2020-2021 academic year (Gokhberg et al., 2021)). The platform aims at teaching 3-11 grade students. SC allows learners to create personalized learning plans, set and achieve goals, promote soft skills (creativity, critical thinking, teamwork, and leadership), and covers the majority of school subjects (maths, geography, history, literature etc.). The platform of the PL methodology has been used by schools in 65 regions of the country (SberUniversity, n.d.). The company provides the fellow school with the access to the platform and the teacher training program to integrate PL. The students can use SC inside as well as outside the school, covering the already compiled modules or the tailored made ones by a teacher. Each educational module includes four levels: the first - motivational (tasks, aimed at covering the topic of the whole module), the second - basic (comprehension and application of the knowledge), the third - target (analysis and synthesis), the fourth is the level of approximate development (research, project-based learning, and the application of the material).

Despite the potential of digital tools, the viewpoint on their limitations is also expressed. Vermette et al. (2019), taking a human-centered perspective to understand instructor's software and the PL integration, found that teachers were hindered by technological barriers. The study of Robinson & Sebba (2010), examined the use of technology and revealed that technology continues to find gaps in the ways in which it is used for PL; Beresford (2017) is convinced that digital platforms for PL involve boundaries for scaling the methodology. Furthermore, teachers' positive perception of digital tool for PL may not align their TP of technology use to foster personalization (Schoors et al., 2023).

On the one hand, the availability of technologies gives greater opportunities to support PL; on the other hand, embedding PL requires educators to reflect deeply on their TP and leads to the shift in their pedagogical approach (Sasikumar, 2023). PL encounters the set of obstacles to integration in TP in different countries, e.g., the USA (Steiner et al., 2017), England (Courcier, 2007), Sweden (Bunting et al., 2021) and the Russian Federation (Kraynova & Obukhov, 2020). In this connection more research on PL mediated by a digital element is required. Our study, making a contribution to the field, aims at investigating TP and distinguishing the levels of the PL integration accompanied by a digital platform. We believe that finding the degrees of the PL implementation is essential for a successful methodology scaling.

METHODS

This study investigating teacher scenarios of the PL integration was a part of the large-scale research project ''Digital School Platform of a Personalized Model of Learning" in the Russian Federation (2020-2022). This article includes the data, obtained by [details removed for peer review]. The research design on teacher scenarios refers to a sequential contributions strategy (Morgan, 2014), which uses the quantitative data

and results in order to facilitate qualitative outcomes, particularly to develop the informant profiles in this study. The school sampling was predetermined by the agreement of the project parties, and the informants sampling for the interviews was a part of the authors' duty. The study involves 24 semi-structured interviews with school teachers. The interviews were conducted with the use of an interview guide with eleven blocks of questions prepared by the research team beforehand. The key blocks referred to teacher perception of PL, digital technology and the PL integration, barriers to the implementation, cooperation among colleagues, student voice and choice in the learning process. The average duration of the conversation was 47 minutes. The informants had access to the digital platform of a personalized model of learning, ''SberClass" and adapted the personalized learning methodology in their teaching. The sampling procedure followed two stages: (1) the selection of schools, (2) the selection of the informants. The research used a non-probability sampling method.

Participants

The Selection of Schools

Firstly, all schools, belonging to the four territorial entities of the Russian Federation (Voronezh, Kemerovo, Lipetsk, Tomsk), were surveyed. The 1344 educational establishments (66% of the general population) participated in the survey, including the schools which applied for the SC integration. Then, the applied educational establishments were matched with those, which did not send the application, by propensity score matching method. The matching was carried out due to the school characteristics, collected from the survey (the school infrastructure: the number of equipped IT rooms, the number of computers available for learning in-class and outside of classes; the total number of students and teachers; the percentage of teachers with a higher qualification category). Finally, the school-participants (*N=372*) were selected. Both rural (59.4%) and urban (40.6%) were involved in the study, and nearly a half (46.3%) had access to SC. Before the academic year, the schools in the experimental group received the training sessions of the platform integration, so had the experience of SC use. After the selection of schools, contacts with the teachers were established.

The Selection of Teachers

In accordance with the explanatory design (sequential contribution), the teachers, provided with SC, were firstly sent the questionnaire administered in the software ''SurveyGizmo." Due to the purposive sampling nature, the interviewees should have met the following parameters outlined in the survey:

1. The teachers of Mathematics and the Russian language who conducted classes for the 5th grade students (secondary school) on a regular basis.
2. The teachers who were integrating the platform for at least three weeks during the academic year.

Before its integration on the syllabus, teachers had training on the PL methodology and digital platform as part of the research project.

1. The teachers who responded to the two blocks of the questionnaire i.e., teacher beliefs and technology readiness as the prerequisite for the PL integration mediated by technology.

The teachers were expected to respond to the survey as their subjects and classes were selected to participate in the research but submitting the answers to the form was not obligatory.

The two blocks of the questionnaire referred to (a) Nordic-Baltic comparative research in mathematics education questionnaire (NorBa instrument developed by Lepik & Pipere (2011), adapted to the Russian language and assessed in terms of psychometrics by Kulikova (2019)), and (b) the items to determine the Technology Readiness Index (TRI methodology developed by Parasuraman & Colby (2015), adapted and checked in terms of reliability and validity by Khavenson and Gizatullin (2020)). NorBa investigates teacher beliefs on the teaching-learning process and involves two scales: ''traditionalism" and ''constructivism." In accordance with OECD (Vieluf et al., 2012), constructivism suggests a more student-centered approach to teaching. Thus, in this study, the teachers who adhere to the constructivist style were assumed to integrate the PL methodology more successfully in comparison to the instructors who demonstrated traditionalism.

Secondly, TRI determines a person's predisposition to use new technologies and consists of four dimensions: optimism, innovativeness, discomfort, and insecurity. The high index shows that a teacher is inclined to accept new technology, whereas low index reflects teacher resistance to it (Parasuraman & Colby, 2015). The study involves the informants with different indices of TRI and NorBa to investigate the implementation from different perspectives.

Based on the NorBa and TRI results, the respondents were distributed into five groups (quantiles) in sequence due to their indices. Regarding TRI, the teachers in the first quantile had the highest index of TRI, in the third - medium, and in the fifth - the lowest TRI. The same procedure was used for the scale ''constructivism" of the NorBa instrument. Hence, in accordance with variable crossings referred to quantiles of TRI and NorBa constructivism, the teacher profiles were developed (see Table 2). The profile index and socio-demographic characteristics of the informants are outlined in the Appendix (see Appendix). The contact with the informants from each profile was established via the regional manager.

Table 2. Teacher profiles for semi-structured interviews

Profile number	Technology readiness index	NorBa constructivism index
9	high	High
8	high	medium
7	high	Low
6	medium	High
5	medium	medium
4	medium	Low
3	low	High
2	low	medium
1	low	Low

Data Collection and Analysis

The research is a qualitative study, gathering data via semi-structured interviews. The aim was to investigate the context of the PL integration, mediated by digital technology, with teacher practice and the perception of the PL methodology. The interviews were conducted in March 2021 in online format. Each meeting was recorded following informant agreement.

The thematic analysis (Braun and Clarke, 2006) for qualitative data was applied in the study. The procedure of analysis involved the following stages:

1. Transcribing the interviews with the aid of the recordings.
2. Familiarity with the data.
3. Generating primary codes.

The data was analyzed with the ATLAS.ti, and more than 200 codes were generated. The Excel spreadsheet was also created with the data on TP with the digital platform and the PL integration.

4. Grouping codes into themes.
5. Reviewing the themes and included codes.
6. Reviewing and developing the map of themes with the quotes.
7. Interpreting the results.

In order to differentiate one scenario from another, the matrix of characteristics outlined in Table 1 was used. Yet, the majority of the interviews represent the practice in which the features of several concepts are displayed, e.g., personalization and individualization. In such cases the analysis involves a modified version of indicators:

1. Student-Centeredness of the Education Process

PL is truly student-centered, so a learner is an active participant of the process, having choice and voice. If it is only the teacher who makes a choice in what, how and when a student should learn, such cases are regarded as non-personalized and teacher-centered.

2. Design of Learning

Teacher-centered practices may refer to individualization, differentiation, and traditionalism. In order to define other non-personalized scenarios, the analysis seeks the practice in which the learner's interests, abilities and needs are taken into account, providing the opportunity to create an individualized learning trajectory. If a teacher-centered practice involves this indicator, it is regarded as either individualization or differentiation, because both concepts take the learner's interest, abilities, and needs into consideration. The difference is the focus of instructions, i.e., for each student or for groups of students.

3. Flexible Learning Environment

Since the PL is integrated by a digital element, the flexibility of learning is essential to take into account. Pane et al. (2015) relate flexibility for PL with the blending learning format. Hence, the criterion involves the opportunity to access the platform in and outside classes. Secondly, teacher instructions are based on a technology application. The digital platform should be regularly used by the students and a teacher (not fewer than three times a week), otherwise the teaching-learning process is not fully underpinned by technology. The authors view digital technology usage during nearly each lesson as an effective way of the PL integration. The flexibility is also ensured by the variation of interaction patterns (whole class teaching is teacher-centered; individual, pair and group work are more student-centered practices). Pane et al. (2015) argue that the student grouping distinguishes the success cases from others.

The scenarios are built due to the elements in Table 1. The cases, representing two or more concepts, are assessed against the three aforementioned indicators in the given order.

FINDINGS

In accordance with the characteristics of personalization, individualization, and differentiation, and a modified version of indicators, four PL scenarios are distinguished in the study. The cases refer to the four degrees i.e., full, partial, non-personalized and the absence of technology and methodology implementation (Fig. 1).

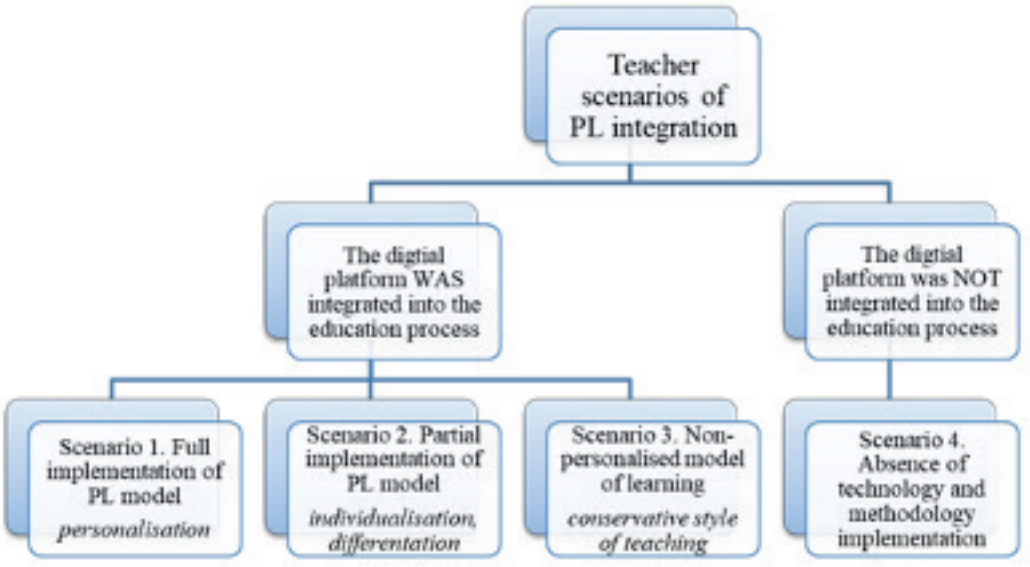

Figure 1. Teacher Scenarios of the PL Integration

In the first scenario *"Full implementation of the PL model,"* a learner is regarded as an active participant of the education process that could take into account individual characteristics, abilities, needs, and interests. The learning trajectory is built by both a teacher and a student. The teacher creates a flexible learning environment by the regular use of a digital platform and the adaptation of classroom space and different interaction patterns. The scenario reflects a personalized student-centered approach. The TP in the second scenario, *"Partial implementation of the PL model,"* views a learner as an object of instructions in which individual characteristics are also considered. However, the learning trajectory is usually built by a teacher. The TP sometimes involves the variation of interaction patterns. The adaptation of classroom space to the methodology rarely occurs and a digital platform is used occasionally. The scenario encompasses the features of individualization and differentiation, with a few elements of PL and refers to a teacher-centered approach. A *"Non-personalized"* scenario regards a learner as an object of instructions in which individual characteristics are rarely considered. Therefore, a personalized learning plan (PLP) is not created. The TP frequently uses the whole class and individual work patterns, and the adaptation of classroom space to the methodology does not take place. A teacher and learners use the platform as an additional content storage (e.g., hometask material, tasks for checking comprehension and assessment) without the personalized approach. The platform is sometimes hindered by the obstacles to its integration. The scenario reflects the conservative style of teaching. In the distinguished scenarios, the digital platform is integrated with different degrees of student centeredness. Yet, the results have indicated that some of the informants did not use the platform in TP or integrated the PL methodology. Such cases comprise the fourth scenario, *"Absence of technology and methodology implementation,"* in which the teacher encountered the various barriers to the implementation.

Scenario ''Full Implementation of the PL Model''

The scenario involves cases in which teachers have integrated the PL methodology, adapted the style of teaching and used the platform. The informants conduct classes in mathematics in urban schools and have high indices of both TRI and constructivism in teaching (NorBa instrument); hence, refer to profile nine. One of the teachers has experience of integrating SC in the previous school year. The distinctive feature of this scenario is a learner as an active participant who makes a decision in the education process. The informants answered the interview questions using the active voice to describe students' actions: "*children identify their specific goals to achieve*" (T4), *"they [students] choose the level of difficulty on their own*" (T7).

In the first scenario, the education process involves building a learning trajectory for each student, starting with setting individual goals first. The PLP is established by a student with the help of a teacher. Due to PLP "*learners acquire new knowledge at their own pace*" (T4) and are able to track their progress regularly. If the knowledge gap is identified, they may refer to the learning material one more time to fulfil it. One of the respondents reported that she does not set strict deadlines to cover the content on the platform, and the reason is: "*we give the chance [to a student] to return to the content*" (T4). This also allows students to be flexible throughout the education process.

The cases represent the flexibility of the learning environment. Firstly, it is the availability of digital content for students that makes learning happen at any time and at any place:

> *Children may access the platform at home, children may spend extra time in the class, equipped with laptops for each student to take the tasks. If learners have not managed to fulfil [the tasks] on the platform in class, they can do it after.* (T4)

The instance shows the learning outside the class underpins PL. The classroom space, being part of the learning environment, is usually adapted to various interaction patterns. The special zones are created for group and individual work, including a digital component. Due to the teacher responses, the platform aids the TP, creating additional conditions for learning and expanding the boundaries for PL.

In this scenario, TP values collaborative learning as an element of PL (OECD, 2006). The classmates are viewed as another source for acquiring knowledge: "*Children who go ahead can take the role of a consultant <...> they can help other students who struggle with the content*," (T4). The cases involve peer-teaching, developing student autonomy in which learners cooperate, teach each other, and actively participate. We assume that PL leads to the development of autonomous learning as it implies conscious decision-making and responsibility

from a student side. The informants report that they discuss the platform integration with colleagues to prevent learners from being overloaded.

Regarding teacher perception on the PL methodology, the informants express a positive attitude. The platform coincides with a student-centered style of teaching in grading tasks, in accordance with the student's abilities. The informants expressed the belief that PL, mediated by technology, is a necessity, because "*today children are another generation*" (T7) and they need new approaches for learning. Despite the regular use of SC, the informants recognize the platform integration being not equal to the methodology integrating: "*children work on the platform for 20 minutes, then for the rest of the lesson, they learn in groups, individually or with a teacher*" (T4). Although using any digital source during the lesson for more than 20 minutes is restricted by state sanitary regulations and standards, teachers also understand that the platform is an instrument to put PL into practice.

This scenario refers to TP in which students are active participants of the process with their own PLP and goals to achieve. The cases have favorable conditions for the PL implementation, i.e., technological equipment, classrooms with specific zones for learning, and cooperation with colleagues that leads to joint decisions.

Scenario ''Partial Implementation of the PL Model"

The cases demonstrate teaching that has the elements of personalization as well as individualization and differentiation. The partial implementation of the PL model has become the most frequent scenario in the study.

The teacher profile includes different indices of TRI and NorBa, and the majority of the informants have medium or high indicators (profiles 4, 5, 6, 8, and 9). The scenario involves different subject areas with the prevailing urban school type. Students are viewed as active participants who can "*choose the individual activities*" (T12) and differentiate the level of a task's difficulty. Some informants provide students with a choice in the education process. However, the scenario usually implies a teacher-centered approach to the methodology integration, i.e. an instructor makes a decision on learning content for home and class work: "*I give the tasks from the coursebook and the additional from the platform*" (T5). The choice of activities is usually restricted by the teacher, who chooses what to provide the learner with.

The informants report that they build the learning trajectories. However, these pathways are created for not only individuals but also for groups of students. The key feature of the scenario is differentiating learners into two groups by their abilities: ''weak" and ''strong," ''high-level" and ''low-level." The platform coincides with TP, as it involves the activities graded by difficulty, so the instructors' select tasks for the two groups of learners: "*I frequently use it [SberClass] with high-level students, because I need them to be busy while I am trying to cover the education program with the low-levels*" (T22). The informants use the content on the platform to adjust the education process to students' levels, making one part of the class busy to work with other students. The methodology of PL is partially put into practice, implying teaching groups rather than individuals.

In this scenario, the learning environment is flexible to a certain extent. The informants view the opportunity to learn outside the class with the platform as an advantage: "*the platform can always be used by a child at a suitable time, it is not always at the lesson, it might be another time period when one has free time to spend on studying*" (T8). It helps students to master the material when a coursebook lacks information on the topic. The cases represent the use of different interaction patterns, such as individual, pair, and group work. One of the teachers states: *"The advantage I have noticed is that there is individual work as well as group work*" (T12). Most teachers value the variation of interaction patterns, making TP more student-centered with the platform. In contrast to the previous scenario, the informants of partial implementation do not frequently report about the flexibility of the learning-teaching process due to the availability of a computer room in school, which might be occupied by another teacher and a low Internet connection.

Similar to the previous scenario, these cases take advantage of the opportunity for peer-learning and -teaching at the SC implementation, the instance is project-work. The instructors are convinced that project-based learning is a practical way of PL realization in TP. However, the pattern of staff collaboration for methodology and platform integration was not identified.

Concerning the teachers' viewpoint on PL, the expressed opinions are not homogeneous. We found two contradictory beliefs in this scenario: the PL methodology fits mass school learning and PL does not fit all students. Regarding the latter, the informants value personalization and state that it has great potential for education: "*the personality of each student is developing*" (T6). These teachers are ready to continue the PL integration. The former belief is that PL is for particular groups: "*The trouble is that personalized learning is not for all <...> I would suggest integrating it into strong classes*" (T8). Although teachers understand the methodology, they see its limitations for low- and medium-level students who do not even complete the tasks. The proponents of this belief seem to stop the PL implementation if possible. Most instructors agree that the digital component is helpful with such benefits as the range of activities and their appropriateness for different learners, its fitting to an individual's pace, and stimulating search skills and student satisfaction. Yet, the informants constantly mention the irregular use of the platform: "*every lesson - no, we do not have this*" (T3), "*one or two times a week*" (T8). The distinctive characteristic of this scenario is using the platform as an additional storage of activities. The teachers select particular tasks relevant for a particular topic and give homework.

In ''Partial implementation of the PL model" TP encounters the obstacles to digital component implementation:

Parents' viewpoint on the platform for learning: The parents complained about too much time spent by the children in front of a computer at home. Secondly, they usually help fifth grade learners with hometasks, which implies their own understanding of SC.

Internet connection: The informants usually report unstable Internet connection which restricts the platform use at school. There were those who devised a strategy to overcome the problem: "*for this reason, we print the materials*" (T2).

Complexity: The interviews revealed that the learners have difficulties with studying on the platform: "*many children had serious troubles*" (T3). The possible reasons are related to the insufficient user experience and technical problems.

The second scenario is mostly shared by the instructors of a teacher-centered approach. They adjust the materials and tasks to individuals or groups of students, building the learning trajectories; however, the decision is usually made by an instructor. The learning environment is flexible, but the obstacles to the platform integration are found, i.e., its episodic use, parents' concerns, technical issues, and the complexity for students' use.

Scenario ''Non-personalized Model of Learning"

The practice, referred to as the non-personalized model of learning, follows a conservative style of teaching in which the instructor is at the center. The cases rarely demonstrate the individualization or differentiation of the learning process. We found that these informants integrate the platform with few or no changes to TP towards personalization. The majority faced the obstacles of digital and the PL implementation.

The cases involve different indices of TRI and NorBa, whereas the two informants have high indicators (profile 9). The scenario represents different subject areas and different geotypes of school. Most teachers have considerable work experience. Presumably, they have formed, through years, the style of teaching that is difficult to change. Also, the instructors face the obstacles to SC use, leading to a lack of the PL integration.

The informants frequently view PL only through the platform use. Since the digital component was implemented insufficiently, the learning environment was not flexible. Similar to the second scenario, TP, enhanced with the aid of SC, represents a more traditional way:

To assess the students' knowledge: The time-efficiency of the digital element is valued, e.g., to administer tests which are automatically checked. According to the instructors, it saves their time outside of classes and for other in-class activities.

To consolidate previously introduced material and check the students' comprehension: The exercises on the platform, which are of differing difficulty, usually appeal to the teachers. Although most respondents consider SC as an additional source, they do not view it as an instrument for PL. The informants, similar

to the second scenario, use SC as the storage of interactive exercises and tasks. We also found that these cases demonstrated a limited integration of the platform. The instances indicate that the PL methodology, mediated by the platform, is not implemented, and there are several reasons for this:

Internet connection: It was emphasized that low Internet connection at school became one of the most frequent barriers to the platform integration. This restriction prevents full and partial technology and methodology implementation. Some informants agreed that they would use the platform if the connection were stable. To overcome this gap, one of the informants reports about the strategy: "*Every student has a modern cell phone, so we work on SberClass*" (T15). However, this way-out has the limitations imposed by the government on the telephone use in class.

Availability of technical equipment: The informants report that they cannot use the platform in class, as there is no connection, or an available room with the computers. This circumstance is typical of rural schools with one IT-classroom.

Teachers struggling to master the platform: A lack of knowledge and skills to master the platform is another common barrier. Nearly half of the informants state that they needed more time to investigate the technology: "*We use it not that actively as we would like to, because, I will repeat, we were short of time to figure it out fully*" (T20), which resulted in practical misuse, for instance: "*children of ours little fulfil [use the platform], as we have not learnt it from cover to cover*" (T11). Although some teachers are ready to implement PL supported by the platform and introduce adjustments to TP, they do not understand how to use this instrument and with whom to discuss the problem.

Preparation for qualifying state exams: The problem refers to the requirements introduced by the government. One of the informants states that the platform differs from the state educational program: "*this platform, one way or another, is different from what a student has to acquire [to pass the exam].*" This teacher also feels vulnerable when they speak about end-of-year state exams: "*we are approaching Final Qualifying Exams and [teachers] start being nervous*" (T21). The instructor prioritizes the successful exam completion by students and feels responsible for it, because it may be related to school ratings.

In the non-personalized scenario, the teachers are inclined to integrate the platform as an additional source with rare usage. The cases indicate the episodic technology integration, preventing the educational process from personalization with the platform. Most of the barriers from the second scenario are repeated in the third. It was found that the informants require more time to master the platform as a distinctive feature of this scenario.

Scenario ''Absence of the Technology and Methodology Implementation''

The last scenario refers to the cases in which a digital platform and methodology were not implemented into TP. The teachers did not integrate SC, or apply the personalized learning methodology into their TP.

Most teachers conduct classes in the Russian language and work in rural schools. The indices of TRI and NorBa in the two cases were not managed to identify due to insufficient data provided by the informants. The reasons preventing TP from using the digital component are:

Time constraints: The most frequent reason is the lack of time to master the platform. The instructors report that they are overloaded with classes, and some informants concurrently hold two positions at school, for instance teaching and administrating. In order to master the platform, additional time is required in this scenario.

Internet connection: Similar to the second and third scenarios, unstable Internet connection is an obstacle to using the platform: "*Connection, technical failures - we also have bad connection at school*" (T13). One of the informants argued that the problem was relevant to students: "*We have two persons in our group, who have access to SberClass, two persons only*" (T17). The accessibility of the platform depends on the school's Internet connection and the students' home Internet connection and hardware.

Teacher struggling to master the platform: Despite the guidelines, some of the teachers have difficulties comprehending a new technology, as there are "*many ambiguities*" (T17).

We have found that these teachers do not reject the idea to implement PL in the future: "*I tried, I investigated.*

It is difficult for me, but I am going to, I am planning" (T13). It might be connected with the requirements imposed by the administration or with the natural desire to master a new tool. Furthermore, nearly a half of the informants feel confident about the SC integration: "*I do not know anything about SberClass yet, but I know, I will learn [how to use it]*" (T9).

This scenario does not involve the five informants (Teachers 16, 18, 19, 23, and 24), who did not integrate the platform. The information provided from these teachers was not enough to outline the barriers to the SC usage or other patterns.

The scenario ''Absence of technology and methodology implementation" shows the TP without integration of the digital platform with a personalized methodology due to the lack of time and skills, and issues with Internet connection. Despite the obstacles, the informants express the viewpoint on successful the SC implementation in the future and its value for TP.

DISCUSSIONS AND CONCLUSION

This study is aimed at investigating the PL implementation, mediated by digital technology and by school teachers. Now that we have distinguished the teacher scenarios of how PL with the aid of the platform is introduced, we have a clear vision of what teachers display and lack in their TP. This gives a better chance of introducing PL in a more organized way.

Introducing PL to the education process results in various scenarios of TP. Therefore, adopting a single standardized approach to PL is not academically viable. This finding agrees with the previous studies showing that teachers at an individual level, (DeMink-Carthew et al., 2017) as well as schools at the organizational level (Steiner et al., 2020; Pane et al., 2015; Bingham et al. 2016; Robinson & Sebba, 2010) implement PL differently. The qualitative inquiry reveals one successful scenario, which is further viewed as illustrative for the PL integration, whereas the other three scenarios partially or do not correspond to the PL methodology. In these cases, the PL integration encounters the obstacles and may require considerable changes to TP and organizational support.

In the study, student choice was introduced in one scenario that is regarded as success. The teachers view a student as an active participant, sharing the control and responsibility in learning. Echoing Steiner et al. (2020), offering student choice is also uncommon for teaching in this study. Some informants from the other three scenarios report that fifth grade students are not ready to make a rational decision in learning due to the age-group peculiarities. We are convinced that this teacher's behavior is related to a more conservative belief about teaching. For successful methodology integration, conservative TP requires specific actions towards reinforcing a more constructive TP. Dealing with teacher beliefs, the process of change may take considerable time. Student choice, as a core PL element, should be promoted through special training, observations of other TP, and organizational support including horizontal links, e.g. tutoring system.

We also found that shared vision of staff on PL is essential for full personalization in TP. The cases with successful PL integration outline the common staff strategies, and the coherence in implementation informed by organizational culture and regular discussions. In agreement with Kraynova & Obukhov (2020), our research identified that undeveloped horizontal links lead to the lack of alignment within the staff and unsolved barriers to the PL and digital integration. We believe that ensuring organizational support and a sense of community is vital to overcome the difficulties that an individual teacher encounter.

Technical issues, including unstable Internet connection, is another common barrier that occurred in all scenarios that did not achieve PL. Since PL was accompanied by the platform, the teachers were supposed to implement the methodology via the technology, and this challenge impeded PL. Technical obstacles are commonly related to organizational level: school infrastructure and technology availability, but the degrees to which the challenge was experienced varied. This finding echoes the study of Bingham et al. (2016). As the platform is based on personalized methodology, the teachers in our research did not have the obstacles, described in other studies i.e., finding or developing their own resources (Pane et al., 2017; Robinson & Sebba, 2010), using the range of tools to introduce PL with technology (Vermette et al., 2019). Most informants used the technology for more complex tasks (higher-order thinking skills), especially during class time. We found that this finding does not support Pane et al. (2015) who state that technology for PL was

frequently used for routine tasks. We assume that the platform, saving teacher's time for preparation, gives the opportunity for more hands-on and cognitively challenging activities. However, the study reveals that integrating a complex technological tool may lead to misunderstanding and complaints from parents who help fifth grade students with homework. Some teachers in partial PL implementation and non-personalized model of learning were more likely to use the platform as an additional storage of materials not changing the TP. Integrating the platform for routine tasks in our study reveals TP without personalization, which might be a subject for further research.

Apart from technical issues, PL might be hindered by curriculum requirements imposed by the government, which was previously reported both in home country by Kraynova & Obukhov (2020) and foreign countries, e.g., Pane et al. (2015). Echoing the findings of Pane et al. (2017), this tension puts limits on how long students can work through the material, impeding the individual learning pace.

As described in the study by Courcier (2007), teachers have different understanding of the PL methodology. The perception of PL depends on the particular scenario: in the first scenario, most informants express a clear vision of PL and report the relevant practice, whereas the second scenario in ''Partial implementation" involve less student-centered focus, and in ''Non-personalized model of learning" most, or even all informants misunderstand the methodology. The TP without a clear idea of PL has no significant effect on methodology and digital integration.

The qualitative analysis uncovered that the barriers are consolidating from the previous cases, and, secondly, new challenges are introduced in the further scenarios. The challenges outlined in the second scenario are repeated in the third, and the barrier to PL mentioned in the third case are encountered in the fourth scenario, so they are gradually fossilized.

Our study confirms that the PL implementation with technology is not seamless, agreeing with Robinson and Sebba's (2010) research. Despite prior teacher training on the integration, teacher preparation practices and support do not usually catch up with the needs of the PL integration (scenarios 2, 3, and 4). This finding aligns with the study conducted by Bingham et al. (2016). We relate this pattern to external factors, such as school infrastructure, availability of technology, and schedule constraints, and to internal factors, i.e., a person's predisposition to use technology and teacher belief on the teaching-learning process, which might take time to change. We believe that the system of measurements is necessary to make PL, mediated by technology, work.

Teacher Training Implications

For the teachers of the ''Absence of technology and methodology implementation" scenario, the analysis of individual and organizational characteristics before the implementation is essential, providing targeted support to overcome technical issues and devising easy-to-use schemes of technology integration. These teachers can also be underpinned by the tutoring system among colleagues who have successful PL practice. Some teachers do not understand the PL methodology and require extra training and explanations on PL.

For the teachers of the ''Non-personalized model of learning" scenario, organizing extra training will be valuable, as some do not have a clear idea of PL in practice. We found that some informants do not feel confident about the platform integration, thus observing the colleagues' lessons will help to promote confidence in technology use.

For the teachers of the ''Partial implementation" scenario, showing the practical realization of PL is necessary, as their viewpoint on teaching already agrees with a more student-centered approach. The observations, recorded lessons, and workshops on methodology and technology integration are beneficial measurements for scaling TP.

The teachers of the ''Full implementation" scenario are illustrative examples of integration. Their TP might be regarded as the source for the TP development in other scenarios: conducting lessons for observations and workshops, and organizing a tutoring system.

Study Limitations

This study has several limitations, so the findings should be interpreted cautiously. Firstly, the results are limited by their self-report nature of TP. The actual teacher actions may not coincide with the reported ones during the interview. Secondly, the interview was initially aimed at identifying the context of the PL integration with technology, possible barriers to implementation, teacher's beliefs towards the methodology and impressions on the platform without explicit objective to outline the diversity of PL scenarios. Due to COVID-19, the interviewing was postponed for several weeks. Therefore, the informants had more time for the platform and methodology integration. The questions addressed initial steps to the PL and platform integration revealed the common practice and gave sufficient data to formulate the scenarios of the PL integration. The last limitation is uneven platform integration among teachers. The management system to monitor the activity at the platform revealed that the teachers started using the digital platform at different times of a school year. It means that they were at different stages of the PL platform integration, which is connected with the increased workload at the beginning of a school year and COVID-19 adjustments.

In conclusion, this study makes a contribution to the explanation of the PL implementation into the teaching-learning process at a school level. The research identifies four scenarios of TP towards PL mediated by a digital platform. The cases of successful PL integration refer to a student-centered approach and represent favorable conditions for methodology implementation, including a clear perception of PL, developed school infrastructure, availability of technology, fostered organizational culture with shared vision on PL, and cooperation among staff. The other three scenarios present a teacher-centered approach, in which the PL integration is hindered by individual characteristics (conservative beliefs and methodology misunderstanding) and organizational factors (technical challenges at school, lack of institutional support and undeveloped horizontal links). We found that the identified barriers are consolidating from the previous scenarios and new challenges are encountered in the further cases. In these scenarios, the PL implementation with a digital component requires significant adjustments to teaching and promoting organizational culture for further methodology scaling.

BIODATA AND CONTACT ADDRESSES OF AUTHORS

Dr. Mikhail SHCHEVLIAGIN is a researcher at Laboratory for Educational Innovation Research, Institute of Education. Mr. Shchevliagin is pursuing his Ph.D. in Education, which is dedicated to personalized learning, supported by digital tool, within school setting. In 2023 he graduated from Ph.D. school at National Research University Higher School of Economics. In 2020 Mr. Shchevliagin gained the University of London Tutor Status and also has Bachelor and Master Degrees in education. His primary research interests are: personalized learning, the integration of digital tools, teacher practice and beliefs, student voice and choice. Throughout his academic and teaching career, Mr. Shchevliagin has actively participated in research and academic activities.

Mikhail SHCHEVLIAGIN
Laboratory for Educational Innovation Research, Institute of Education
Address: National Research University Higher School of Economics, 101000, Moscow, Russia
Phone: +7 4957729590
E-mail: mshchevlyagin@gmail.com

Dr. Diana KOROLEVA is an Associate Professor at Institute of Education, National Research University Higher School of Economics. She holds the position of Director of the National competition for Innovations in Education and is a Head of Laboratory of Educational Innovation Research. Dr. Koroleva gained her Ph.D. in Education and Pedagogy in 2018. In 2013 she received Master Degree in Education from Paris Pantheon-Sorbonne University. Diana Koroleva specialises in the implementation and diffusion of innovations in education. Her research interests are: modern technologies in education, especially use of artificial intelligence, mobile phone technologies and social networks. Dr. Koroleva repeatedly was awarded Humanitarian Science Foundation grants.

Diana KOROLEVA
Laboratory for Educational Innovation Research, Institute of Education
Address: National Research University Higher School of Economics, 101000, Moscow, Russia
Phone: +7 4957729590
E-mail: dkoroleva@hse.ru

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APPENDIX

Profile Index and Socio-demographic Characteristics of the Informants

Informant number	Subject	Geo type	Year of birth	Work experience	Profile
Teacher 1	Mathematics	rural	1961	36	9
Teacher 2	Russian	urban	1978	20	6
Teacher 3	Russian	urban	1975	22	9
Teacher 4	Mathematics	urban	1986	12	9
Teacher 5	Russian	urban	1972	26	8
Teacher 6	Russian	urban	1977	24	4
Teacher 7	Mathematics	urban	1972	26	9
Teacher 8	Mathematics	urban	1988	6	8
Teacher 9	Russian	urban	1957	44	6
Teacher 10	Russian	urban	1983	5	9
Teacher 11	Russian	urban	1958	37	3
Teacher 12	Mathematics	rural	1988	10	6
Teacher 13	Russian	rural	1971	29	N/A
Teacher 14	Russian	rural	1980	12	1
Teacher 15	Mathematics	rural	1958	36	7
Teacher 16	Russian	rural	N/A	31	N/A
Teacher 17	Mathematics	rural	1990	8	N/A
Teacher 18	Mathematics	urban	1987	11	N/A
Teacher 19	Russian	rural	1966	35	9
Teacher 20	Mathematics	urban	1984	11	9
Teacher 21	Russian	rural	1972	27	2
Teacher 22	Russian	urban	1974	5	5
Teacher 23	Russian	rural	1973	27	5
Teacher 24	Mathematics	urban	1961	35	2