PEDAGOGICAL AND PSYCHOLOGICAL OPPORTUNITIES OF USING DIGITAL DIAGNOSTIC TECHNOLOGIES IN ASSESSING STUDENTS' SOCIAL-EMOTIONAL DEVELOPMENT

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Abstract. The article examines the pedagogical and psychological potential of digital diagnostic technologies for evaluating the social-emotional development of schoolchildren. Building on the competence model of social-emotional learning together with cultural-historical and ecological approaches to development, the study analyses how online questionnaires, ecological momentary assessment, game-based simulations, learning analytics and affective computing can complement teacher observation and paper-based testing. It is argued that digital diagnostics makes measurement more frequent, context-sensitive and individualised, strengthens formative feedback and allows teachers and school psychologists to plan timely support. At the same time, the paper identifies methodological, ethical and organisational constraints, among them the limited validity of self-reports, algorithmic bias, the protection of children's personal data and the danger of reducing a child's personality to a set of indicators. A model of responsible use is proposed in which digital instruments are combined with professional pedagogical judgement and the active participation of students and parents.

Keywords: social-emotional development; social-emotional learning; digital diagnostics; formative assessment; learning analytics; affective computing; school psychology; ethics of educational data.

1. Introduction

The contemporary school is expected to do far more than pass on academic knowledge. Families, employers and education authorities increasingly point to self-regulation, empathy, cooperation and responsible decision-making as preconditions of personal well-being and of success in a rapidly changing society. Large-scale comparative research carried out by the OECD has demonstrated that such skills differ noticeably between age groups and are closely linked with students' life satisfaction, school achievement and attitudes towards learning[1]. Meta-analytic evidence likewise shows that systematically implemented social-emotional learning programmes improve not only behaviour and emotional state but also academic results, with an average gain of about eleven percentile points[2].

In Uzbekistan, attention to the learner's personality is anchored in the legislative framework: the Law "On Education" proclaims the humanistic and democratic character of education and upbringing among the basic principles of state policy in this field[3]. Yet turning this principle into everyday practice depends on whether teachers possess dependable means of understanding how a pupil's emotional and social sphere is actually developing. Conventional methods such as observation, individual conversations

[1] OECD. Beyond Academic Learning: First Results from the Survey of Social and Emotional Skills. – Paris: OECD Publishing, 2021.

[2] Durlak J. A., Weissberg R. P., Dymnicki A. B., Taylor R. D., Schellinger K. B. The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions // Child Development. – 2011. – Vol. 82, No. 1. – P. 405–432.

[3] Law of the Republic of Uzbekistan "On Education" No. ZRU-637 of 23 September 2020.

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and paper questionnaires keep their value, but they demand considerable time, are carried out only occasionally and depend heavily on the subjective stance of the observer.

The ongoing digitalisation of schools adds a new dimension to this problem. Electronic journals, learning platforms, mobile applications and educational games already generate a constant flow of information about how students learn, communicate and react to difficulties. The question is whether this flow can be transformed into pedagogically meaningful diagnostic knowledge without violating the rights and dignity of the child. Accordingly, the aim of this article is to identify and systematise the pedagogical and psychological opportunities and limitations of digital diagnostic technologies in assessing students' social-emotional development and to formulate principles for their responsible application. The study relies on theoretical analysis of psychological and pedagogical literature, comparative analysis of existing digital tools and generalisation of school practice.

2. Theoretical framework

In current scholarship, social-emotional development is most often interpreted through the competence model proposed by the Collaborative for Academic, Social, and Emotional Learning (CASEL). The model distinguishes five interrelated areas: self-awareness, self-management, social awareness, relationship skills and responsible decision-making[4]. Its conceptual roots lie in research on emotional intelligence, understood by J. Mayer and P. Salovey as the ability to perceive, use, understand and regulate emotions[5], an idea that D. Goleman later brought to a wide audience of educators and managers[6]. For diagnostic purposes, the competence model is useful because it breaks a complex and somewhat elusive phenomenon into observable components that can be described, measured and deliberately developed.

The cultural-historical theory of L. S. Vygotsky provides a further methodological reference point. According to Vygotsky, higher mental functions first appear in joint activity with other people and only later become the individual's internal possession; moreover, the zone of proximal development reveals what a child can achieve with the help of an adult or a more capable peer[7]. It follows that diagnosis of social-emotional qualities should be dynamic rather than static: its task is not simply to fix a level but to uncover the potential for growth and the kinds of support a child needs. U. Bronfenbrenner's ecological model adds that development unfolds within nested systems — the family, the classroom, the peer group, the community[8]. Today the digital environment in which children spend a substantial part of their day can reasonably be regarded as one more such system, and therefore as a legitimate field of observation.

Measuring social-emotional qualities, however, is a notoriously difficult task. A. Duckworth and D. Yeager have shown that questionnaires are vulnerable to social desirability, to differences in how respondents interpret the scale and to so-called reference bias, when students compare themselves with

[4] CASEL. CASEL's SEL Framework: What Are the Core Competence Areas and Where Are They Promoted? – Chicago: CASEL, 2020.

[5] Mayer J. D., Salovey P. What is emotional intelligence? // Emotional Development and Emotional Intelligence: Educational Implications / Ed. by P. Salovey, D. J. Sluyter. – New York: Basic Books, 1997. – P. 3–31.

[6] Goleman D. Emotional Intelligence. – New York: Bantam Books, 1995.

[7] Vygotsky L. S. Mind in Society: The Development of Higher Psychological Processes. – Cambridge, MA: Harvard University Press, 1978.

[8] Bronfenbrenner U. The Ecology of Human Development: Experiments by Nature and Design. – Cambridge, MA: Harvard University Press, 1979.

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the standards of their own school; the authors conclude that no single instrument is sufficient and that different methods must be combined[9]. C. McKown, in turn, stresses that assessment in this domain is valuable only when its results are usable in practice, and argues for complementing ratings with direct performance-based tasks in which children actually demonstrate their skills[10]. It is precisely here that digital technologies open up new possibilities.

3. Digital diagnostic technologies: an attempt at classification

The range of digital tools that can be used to study students' social-emotional sphere is broad and heterogeneous. Depending on the source of data and the degree of the student's involvement, they may be grouped into five categories, summarised in Table 1.

Table 1. Main groups of digital technologies for diagnosing social-emotional development

Group of technologies	Examples of diagnostic tasks	Main pedagogical value
Online questionnaires and adaptive tests	Self- and peer-rating scales, screening of emotional and behavioural difficulties, digital sociometry	Rapid group screening, automatic scoring, visual profile of the class
Ecological momentary assessment	Short daily mood and stress check-ins, an "emotion thermometer" at the start of a lesson	Captures change over time in a natural setting, reduces recall errors
Game-based and simulation assessment	Virtual conflict scenarios, cooperative tasks, choices in interactive stories	Observes actual behaviour rather than declarations; motivating for students
Learning analytics	Participation patterns on a learning platform, forum interaction, help-seeking, persistence	Unobtrusive indicators of engagement and collaboration
Affective computing	Analysis of facial expressions, voice, sentiment of written texts	Real-time signals of frustration or boredom; requires strict ethical safeguards

Online questionnaires are the most widespread and the easiest group to introduce. Their strength lies in the possibility of transferring well-validated instruments into a digital format; a typical example is the Strengths and Difficulties Questionnaire by R. Goodman, a brief screening scale covering emotional symptoms, conduct problems, hyperactivity, peer problems and prosocial behaviour[11]. Once digitised, such scales are scored instantly, and results can be presented to the teacher as a class profile. Digital

[9] Duckworth A. L., Yeager D. S. Measurement matters: Assessing personal qualities other than cognitive ability for educational purposes // Educational Researcher. – 2015. – Vol. 44, No. 4. – P. 237–251.

[10] McKown C. Social-emotional assessment, performance, and standards // The Future of Children. – 2017. – Vol. 27, No. 1. – P. 157–178.

[11] Goodman R. The Strengths and Difficulties Questionnaire: A research note // Journal of Child Psychology and Psychiatry. – 1997. – Vol. 38, No. 5. – P. 581–586.

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sociometry goes a step further: by turning pupils' choices of partners into a network graph, it helps the teacher notice isolated children, closed micro-groups and hidden leaders.

Ecological momentary assessment changes the logic of measurement itself. Instead of asking a child to recall how he or she has felt "in general" or "during the last month", it collects brief reports of current states repeatedly and in the natural environment, thereby reducing retrospective distortion and making it possible to trace fluctuations over time[12]. In school, this may take the form of a one-click mood check at the beginning and end of a lesson, which gradually accumulates into an informative picture of a student's emotional dynamics.

Game-based and simulation assessment addresses one of the main weaknesses of questionnaires — the gap between what a student says and what he or she actually does. V. Shute described the idea of "stealth assessment", in which evidence about a learner's competences is gathered unobtrusively from his or her actions within a game, so that the diagnostic procedure is woven into the activity itself[13]. A scenario in which a student must resolve a quarrel between virtual classmates or distribute roles in a team reveals the strategies he or she actually uses, while reducing test anxiety.

Learning analytics, defined by G. Siemens and P. Long as the measurement, collection, analysis and reporting of data about learners and their contexts for the purpose of understanding and optimising learning[14], supplies indirect but continuous indicators. The frequency of a student's contributions to group discussion, the tone of comments, the readiness to ask for help or to persist with a difficult task are all behavioural traces of self-management and relationship skills.

Finally, affective computing, a field founded by R. Picard, seeks to enable machines to recognise and respond to human emotions[15]. Studies by S. D'Mello and A. Graesser have shown that states such as confusion, frustration and boredom follow characteristic sequences during complex learning, and that timely recognition of these transitions allows the learning process to be adjusted[16]. This group is the most technologically advanced, but also the most sensitive from an ethical point of view.

4. Pedagogical and psychological opportunities

Analysis of the tools described above allows us to single out several interrelated opportunities that digital diagnostics offers to teachers and school psychologists.

The first opportunity is a shift from episodic to continuous monitoring. When diagnosis is carried out once or twice a year, its results describe a state that has often already changed. Regular digital measurements, by contrast, make assessment an integral part of the educational process and bring it close to formative assessment, whose capacity to raise learning outcomes was convincingly demonstrated by P.

[12] Shiffman S., Stone A. A., Hufford M. R. Ecological momentary assessment // Annual Review of Clinical Psychology. – 2008. – Vol. 4. – P. 1–32.

[13] Shute V. J. Stealth assessment in computer-based games to support learning // Computer Games and Instruction / Ed. by S. Tobias, J. D. Fletcher. – Charlotte, NC: Information Age Publishing, 2011. – P. 503–524.

[14] Siemens G., Long P. Penetrating the fog: Analytics in learning and education // EDUCAUSE Review. – 2011. – Vol. 46, No. 5. – P. 30–40.

[15] Picard R. W. Affective Computing. – Cambridge, MA: MIT Press, 1997.

[16] D'Mello S., Graesser A. Dynamics of affective states during complex learning // Learning and Instruction. – 2012. – Vol. 22, No. 2. – P. 145–157.

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Black and D. Wiliam[17]. In the social-emotional domain this means that a teacher receives feedback while there is still time to change the situation.

The second opportunity concerns individualisation and early identification of risk. Accumulated data make it possible to notice a persistent decline in mood, growing isolation from classmates or a sudden drop in engagement long before these signs become obvious in behaviour. Such signals do not constitute a diagnosis in the clinical sense, but they serve as grounds for a careful conversation with the student, consultation with the school psychologist and, where necessary, involvement of parents. In this way digital instruments help to move from reacting to crises towards preventive work.

The third opportunity is the transformation of diagnosis into a means of development. When students see visualisations of their own emotional states, set personal goals and track their progress, they practise exactly those competences that are being measured: self-awareness, reflection and self-regulation. The diagnostic procedure thus ceases to be something done to the child and becomes something done together with the child, which is fully consistent with the cultural-historical view of development as a process mediated by tools and by interaction with others.

The fourth opportunity relates to the professional activity of the teacher. Aggregated class profiles help to plan group work, to form balanced teams, to choose themes for class hours and to discuss the needs of particular students with colleagues and parents on the basis of concrete observations rather than general impressions. It is important to emphasise, however, that the appropriate model is data-informed rather than data-driven decision-making: numbers inform the teacher's judgement, but do not replace it.

The fifth opportunity is the evaluation of educational programmes. Comparing data collected before and after the introduction of a social-emotional learning course, a mentoring scheme or an anti-bullying initiative allows a school to judge which measures actually work in its specific context and to make reasoned managerial decisions.

5. Limitations and ethical conditions of use

Recognising the potential of digital diagnostics should not obscure its limitations. From a methodological standpoint, the main issue is validity. Digital self-report scales inherit all the weaknesses of paper questionnaires, while behavioural indicators drawn from platforms and algorithms for emotion recognition may be calibrated on samples from other countries and cultures. Expressing emotions, keeping distance with adults and interacting with peers are culturally shaped, so instruments created elsewhere require careful adaptation and standardisation before they can be used with Uzbek schoolchildren.

A second group of risks is connected with the datafication of education. B. Williamson has shown how the spread of big data transforms not only teaching but also the governance of schools, creating a temptation to see the learner primarily as a source of measurable indicators[18]. N. Selwyn, discussing artificial intelligence in schools, warns that technology cannot take over the relational and moral dimensions of a teacher's work[19]. When applied to the emotional life of a child, these warnings acquire special weight: labelling a student on the basis of an algorithmic score may itself become a source of stigma and harm.

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[17] Black P., Wiliam D. Assessment and classroom learning // Assessment in Education: Principles, Policy & Practice. – 1998. – Vol. 5, No. 1. – P. 7–74.

[18] Williamson B. Big Data in Education: The Digital Future of Learning, Policy and Practice. – London: SAGE, 2017.

[19] Selwyn N. Should Robots Replace Teachers? AI and the Future of Education. – Cambridge: Polity Press, 2019.

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The third and perhaps most acute problem is the protection of personal data. Information about the emotional states, relationships and psychological difficulties of minors is highly sensitive. In Uzbekistan the processing of such information falls under the Law "On Personal Data"[20], while European regulation explicitly states that children merit specific protection with regard to their personal data, since they may be less aware of the risks involved[21]. Schools that use international platforms must therefore know where data are stored, who can access them and how long they are kept.

Taking these considerations into account, we propose the following principles of responsible use of digital diagnostic technologies in assessing social-emotional development:

1) purposefulness: data are collected only for clearly formulated pedagogical aims and are not used for ranking or punishing students;
2) informed consent: parents give consent and students give age-appropriate assent, having been told in plain language what is measured and why;
3) triangulation: digital results are always compared with observation, conversation and the opinions of other teachers before any conclusion is drawn;
4) human control: interpretation and decisions remain the responsibility of the teacher and the school psychologist, not of the algorithm;
5) feedback and transparency: students have access to their own results in an understandable form and use them for self-reflection;
6) data minimisation and security: only necessary information is collected, it is stored securely and deleted when no longer needed;
7) professional readiness: teachers receive training in the psychological basics of social-emotional development and in the digital competences needed to interpret data correctly.

6. Conclusion

The analysis carried out allows us to conclude that digital diagnostic technologies significantly expand the pedagogical and psychological toolkit for assessing students' social-emotional development. Online questionnaires, ecological momentary assessment, game-based simulations, learning analytics and affective computing make it possible to move from rare, retrospective measurements to regular, context-sensitive observation; to identify difficulties at an early stage; to turn diagnosis into a means of developing students' reflection and self-regulation; and to give teachers and school psychologists a more solid basis for planning support.

At the same time, these opportunities can be realised only when digital tools are embedded in a well-founded pedagogical system. The validity of instruments must be checked in the national cultural context, data must be protected in accordance with legislation, and final interpretation must remain with qualified professionals who know the child personally. Digital diagnostics should be regarded not as a substitute for the teacher's attentive gaze, but as a means of sharpening it.

Promising directions for further research include the adaptation and standardisation of digital social-emotional assessment instruments for schools of Uzbekistan, the development of methodological recommendations for teachers on interpreting digital data, and empirical study of how regular feedback on emotional states influences students' self-regulation and the psychological climate of the classroom.

[20] Law of the Republic of Uzbekistan "On Personal Data" No. ZRU-547 of 2 July 2019.

[21] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 (General Data Protection Regulation). – Recital 38.

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4. D'Mello S., Graesser A. Dynamics of affective states during complex learning // Learning and Instruction. – 2012. – Vol. 22, No. 2. – P. 145–157.
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9. Law of the Republic of Uzbekistan "On Education" No. ZRU-637 of 23 September 2020.
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