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**NEW LITERACY AND DATA-FUTURE IN EDUCATION:
ADVANCED TECHNOLOGY SMART BIG-DATA**

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Abstract

The content of the study is presented: how the countries of the world are developing digital educational platforms, digital educational data services, and technologies for managing the development of education based on smart data. It reveals: how national education systems are revising educational approaches in order to create opportunities to develop new literacy and competencies of the future. It is presented: how the development of big-data, smart-data, block-chain technologies will lead to a change in assessment tools, regulations for converting educational results at different levels of education and in different forms of education (formal and non-formal education). It is described: how the countries of the world implement models of educational data analysis in education based on the development of digital platforms and services for the analysis of educational data and educational statistics.

Keywords

New literacy – Data-future in education – Advanced technology smart big-data

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Introduction

Countries are implementing reforms of educational performance assessment systems in connection with the forecasting of new literacy and new types of competencies that are in demand in the future.

New areas of management and pedagogy are being developed - Data Driven Pedagogy, Data Manager in Education, Evidence-based educational policy. National education systems are revising educational approaches, methods and forms of education in order to create opportunities for children to develop new literacy, future competencies, necessary for success in the 21st century, in a new technological, socio-economic structure.

According to the OECD: assessment is the field of education where the least number of innovations took place. According to the results of the international TALIS study: teachers experience professional deficits in assessing educational results¹.

The development of big-data, smart-data, blockchain, digital portfolio technologies may lead to the transformation of assessment systems and tools, regulations for converting educational results when moving from level to another level of education, between different education systems (public and private, formal and non-formal education). The countries of the world are developing digital educational platforms, digital educational data services and advanced technologies for managing the development of education based on smart data (advanced technology smart big-data). As an object of analysis, there can be data and traditional assessment results (state exams), and new types of literacy (competences of the 21st century), and digital traces independently formed by schoolchildren (choice of content, methods of solution, research or project, etc.). Organizations researching and developing models of new literacy and competencies of the 21st century:

- UNESCO (UNESCO): project “Future competencies and the future of the curriculum”²;
- OECD (OECD): “The Future of Education and Skills 2030”³;
- Global Education Futures: “Education for a complex society” - a report that presents the evolution of indicators of educational success and changing assessment tools⁴;
- The Institute for the Future - report "Future Work Skills 2020"⁵, which presents a map of professional skills of the future;
- Charity Fund “Contribution to the Future” - the project “Key competencies and new literacy: from declarations to school reality”⁶;

¹ OECD, TALIS - The OECD Teaching and Learning International Survey. Available at: <https://www.oecd.org/education/talis/>

² UNESCO, Document: Future Competences and the Future of Curriculum Document: Future Competences and the Future of Curriculum. Available at: <http://www.ibe.unesco.org/en/news/document-future-competences-and-future-curriculum>

³ OECD, The Future of Education and Skills 2030. Available at: <http://www.oecd.org/education/2030/>

⁴ Global Education Futures, Global Education Futures Report. Obrazovaniye dlya slozhnogo obshchestva. Available at: https://futuref.org/educationfutures_ru

⁵ The Institute for the Future, Future Work Skills 2020. Available at: <http://www.iff.org/home/>

⁶ Blagotvoritel'nyy fond «Vklad v budushcheye», Proyekt «Klyuchevyye kompetentsii i novaya gramotnost': ot deklaratsiy k shkol'noy real'nosti». Available at: <https://vbudushee.ru/education/lidery-obrazovaniya/proekt-klyuchevyye-kompetentsii-i-novaya-gramotnost-ot-deklaratsiy-k-shkolnoy-realnosti/>

- ATC21S "Assessment & Teaching: of 21st Century Skills"⁷.

The problem of research

The research problem is the contradiction between the urgent need of the education system in modeling and analyzing data for personalizing education, in developing and evaluating the development of new literacy and competencies of the 21st century for effective pedagogy based on data, and the insufficient development of the methodology for analyzing educational data, insufficient development of educational analytics services and statistics of data, as well as professional development programs for teachers and managers in the field of analysis of developmental evidence and evidence-based management of educational development.

Research Issues:

a) what new competencies and literacy are assessed and analyzed as educational data, on the basis of which education management and educational policies of countries are based?

b) how is the accumulated data on the assessment of new literacy and competencies of students on electronic educational platforms and educational statistics services?

c) what digital traces of schoolchildren capture the dynamics of the development of new literacy and competencies of the 21st century?

d) what is the methodology and technology for the analysis of educational data on new literacy and competencies of the 21st century?

e) what analytical data in education become the basis for pedagogical and managerial decisions?

Methodology and research methods

The study was carried out on the basis of the educational-data mining system-methodological approach (educational data analysis methodology). The study was conducted on the basis of methods for analyzing the application of educational tools and digital data mining services and educational statistics by national educational systems. A systematic and methodological approach based on the analysis of educational data (Educational Data Mining) allows you to explore the management of schoolchildren's learning on the basis of data (learning management system) and ways to organize educational data for making organizational, pedagogical and managerial decisions in education (Big Data Management in Education).

The objects of the study were the projects and programs of countries to develop new literacy and competencies of the 21st century among schoolchildren (national strategies for the development of 21st century competencies - Skills Strategy: Skills to Shape a Better Future), and digital analytics services for the results of assessing the development of new literacy and competencies of the 21st century in schoolchildren.

⁷ Assessment & Teaching: of 21st Century Skills. Available at: <http://www.atc21s.org>

The analyzed digital data analysis services of both the international level: OECD-Data⁸, as well as national platforms and services of educational analytics and statistics based on the results of monitoring education:

- Analytical data of the Finnish National Council for Education: the results of monitoring education⁹ and education statistics¹⁰;

- Analytical data of the Ministry of Education of Singapore: an integrated platform for open education data¹¹ and an information platform for informing parents of students about education and educational results - Parentsineducation¹²;

- Analytical data of the Ministry of Education, Culture, Sports, Science and Technology of Japan: analytical reports and education statistics¹³;

- Analytical data from the Ministry of Education of Brazil: educational information portal¹⁴;

- Analytical data of educational statistics (NCES) USA¹⁵;

- Analytical data of the national educational database (NLB) of the Republic of Kazakhstan¹⁶;

- Analytical data on education on the open data portal of the Russian Federation¹⁷ and open data of the Ministry of Education of the Russian Federation¹⁸;

and other digital education statistics and analytics services.

The results of the study

Based on the results of the study, the following conclusions are made:

a) the models of new literacy and competencies of the 21st century in national educational systems are different and depend on the representations of expert communities about future competencies that are in demand and predictive studies of future competencies that are in demand;

b) data on the assessment of new literacy and competencies of schoolchildren are accumulated on electronic educational platforms and educational statistics services

⁸ OECD-Data, Available at: <https://data.oecd.org>

⁹ Statistics Finland, Available at: https://stat.fi/index_en

¹⁰ Kansallinen koulutuksen arviointikeskus. Available at: <https://karvi.fi>

¹¹ School Information Service (SIS), Available at: <http://sis.moe.gov.sg/>

¹² Parentsineducation, Available at: <http://parents-in-education.moe.gov.sg/>

¹³ MEXT, Ministry of Education, culture, sports, science and technology - Japan Report&Statistics. Available at: <https://www.mext.go.jp/en/publication/index.htm>

¹⁴ Ministerio da Educacao. Portal do Governo Brasileiro. Available at: <http://www.mec.gov.br/>

¹⁵ NCES, Available at: <http://nces.ed.gov/index.asp>

¹⁶ NOBD, Kazakhstan. Available at: <https://e.edu.kz/ru/statistics.html>

¹⁷ Otkrytyye dannyye Rossiyskoy Federatsii. Available at: <https://data.gov.ru/o-proekte>

¹⁸ Otkrytyye dannyye Ministerstva prosveshcheniya Rossiyskoy Federatsii. Available at: <http://otkrytyye-dannyye.minobrnauki.rf/opendata/>

insufficiently or such data is not available on the open data portals, or presented as the results of individual results of projects implemented within the framework of the national educational policy of countries;

c) the dynamics of the development of new literacy and competencies of the 21st century among schoolchildren are recorded by digital traces of schoolchildren participating in specialized competitions for assessing the competencies of the 21st century, specialized national studies on the development of new literacy (for example, digital literacy¹⁹) or a new format for international competitions (for example, International Olympiad of Metropolises²⁰?

d) the methodology and technologies of assessing new literacy and competencies of the 21st century and analyzing such educational data are changing (for example, competitions of teenage school teams in meaningfully new competitive assignments in the form of a competency olympiad²¹, assembling a personal matrix of competencies based on digital tracks, and students and research and development). To analyze such educational data, new technologies and methods of “in-memory analytics” are used in the study of “digital tracks”, methods for identifying relationships “relationship mining” (for example, the relationship between the features of the organization of project activities of students in the lessons and the results of the development of meta-subject competencies based on the results of mastering educational programs), the digital technology “cognitive tutoring based analysis of educational data”, an integrated electronic educational platform for analysis through behavioral patterns of personal and social competence to analyze digital learning difficulties students for the purpose of intelligence cognitive competence of students.

e) the analytical data obtained on the development of new literacy and competencies of the 21st century in education become the basis for pedagogical and managerial decisions on changing national curricula, educational standards, forms and content of assessing educational results, initiating national projects for the development of new literacy and competencies of the 21st century schoolchildren.

Conclusion

As a result, we can conclude that the growing attention of the pedagogical, expert and managerial community in education, public and private investors in education to new educational results in the form of new literacy and competencies of the future (competences of the 21st century), initiates the need in the world to develop new assessment tools and analysis of new educational results (data-future in education), advanced technologies of smart data analysis (advanced technology smart big-data). Such advanced technologies for the intelligent analysis of educational data developing in countries around the world on the basis of national educational platforms²² include digital trace analysis technologies (“in-memory analytics”), digital smart-data analysis technology for identifying relationships (“relationship mining”) Between the competency components of new literacy and subjects of education (users of electronic educational platforms), the digital technology“ cognitive tutoring based analysis of educational data ”, an integrated electronic educational platform

¹⁹ Tsifrovaya gramotnost' RF. Available at: <https://tsifrovayagramotnost'.rf>

²⁰ International Olympiad of Metropolises. Available at: <http://megapolis.educom.ru/>

²¹ Rossiyskaya kompetentnostnaya olimpiada. Available at: <https://olimpiada.ru/activity/5273>

²² O. A. Fiofanova; T. N. Bokova y V. I. Morozova, “International comparative analysis of national state electronic educational platforms for school children”, Revista Inclusiones Vol: 7 (2020).

to analyze the development of cognitive competence of schoolchildren and other new competencies of the 21st century.

The greatest effect in the implementation of advanced technologies of smart data analysis (“advanced technology smart big-data”) is achieved by those countries, those national educational systems that integrally solve two parallel problems: 1) development of the technological infrastructure for the analysis of educational data and digital services for smart data analysis; 2) the development of competencies in the analysis and interpretation of educational data among teachers, educational leaders, educational politicians and public servants.

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