DOI: 10.15838/esc.2021.6.78.12
UDC 316.733:37.032, LBC 60.53

Smart Competencies as a Tool for the Development of the Information Culture of Society*

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* The reported study was funded by RFBR, project number 19-010-00811/21 "Smart education as a vector of the human potential development in the younger generation".

For citation: Babich L.V., Golovchin M.A., Mironenko E.S. Smart competencies as a tool for the development of the information culture of society. *Economic and Social Changes: Facts, Trends, Forecast*, 2021, vol. 14, no. 6, pp. 210–224. DOI: 10.15838/esc.2021.6.78.12

Abstract. The article considers the process of formation of smart competencies, which have a synergistic nature, as a tool for creating samples of the information society culture. The purpose of the study is to assess the effectiveness of smart competencies formation in a managed (institutionalized) and unmanaged (non-institutionalized) environment. The paper presents a conceptual understanding of smart competencies as the integration of modern basic and flexible skills in the educational profile of a student. We provide the results of a modeling experiment conducted in 2020–2021. The experiment consisted of the identifying, forming, and resulting stage. Seventy-six schoolchildren from Vologda and Staraya Russa participated in each stage. The participants were divided into a control group and experimental groups. In the framework of the experiment, in accordance with the principles proposed in the study, two measurements of smart competencies (initial and control level) were carried out. In the interval between the measurements, a stable level of smart competencies was maintained in the participants. The results of the experiment have revealed considerable opportunities for the formation of smart competencies in a controlled environment in conventional educational conditions. It was in this case that the strategic level of competence development was preserved during the experiment (which was not observed in other groups). In conclusion, we determine which types of information culture are created by smart education. The novelty of the project consists in the proposed original model for the study of smart competencies, which defines the structure and features of this phenomenon. Within the framework of the study, we propose a methodological approach to organizing the process of development of modern competencies in the smart environment, which can be used by educational organizations in Russian regions.

Key words: smart competencies, information culture, modeling experiment, diagnostic test, cultural patterns.

Introduction

In the modern world, technical skills become obsolete every year, and there is an ever growing demand for specialists with a balance of "soft" and "hard" competencies; this is facilitated by the specifics of the information society, which forms qualitatively new cultural patterns and practices [1].

At the modern stage of civilization development, the dominant role belongs to information and knowledge as a driving force of social progress and to the construction of an information society as a "universal ideology in the context of globalization" [2]. The scientific community has now formulated quite a large number of definitions of this phenomenon and a number of conceptual approaches to its study. The classification of information society concepts is considered in detail in the works of several authors [2–5]. In general, we can say that the idea of an information society originated among sociologists, philosophers and futurologists. Japanese scientists T. Umesao (*Information Industry Theory,* 1963) and Yu. Hayashi (*Informatized Society: from Industrial society to Intellectual Society*, 1969) are among those who introduced the term "information society" into scientific circulation. Among the pioneering works on this topic, we can also note *The Coming of Post-Industrial Society* by D. Bell [6], where he argues that scientific and technological progress contributes to the dominance of information processing activities. In the monograph *The Information Society as a Post-Industrial Society*, Y. Masuda outlined the difference between the future information society and the existing industrial one and showed that "the production of an information product, rather than a material product, will be the driving force of education and development of society" [7, p. 49]. E. Toffler designated the third wave of the social revolution as the transition to

an information society [8]. P. Levy proposed the idea of a "collective mind", considering it to be the global network Internet [9]. The concept of the information society in the domestic scientific environment was recognized a little later thanks to the works of A.I. Anchishkin, N.N. Moiseev, A.D. Ursul, etc.

Foreign and Russian scientists consider the term "information society" in the framework of the idea of increasing the role of reliable information and the value of theoretical knowledge against the background of the widespread introduction of information and communication technologies. Under these conditions, the impact of ICT on all spheres of human activity: politics, economics, generally accepted norms and rules of behavior, i.e. on society as a whole, becomes obvious [10]. The corresponding processes generate a new culture of society – information culture, which is the information basis for the development of society [11]. Information culture "reflects and expresses the complex processes taking place in society in connection with the informatization of its various spheres, transformations in economic, socio-political and spiritual life" [12, p. 80].

The concept and content of information culture are currently being considered both in the Russian and foreign scientific community from the point of view of various approaches. For example, A. Curry and C. Moore, using the designated concept, speak of a culture "in which the value and usefulness of information for achieving operational and strategic success is recognized, where information forms the basis of organizational decision-making, and information technology is easily used as a tool for effective information systems" [13, p. 94].

We adhere to the opinion of Russian researchers (A.A. Gorodnova and others) and will consider information culture as "a new type of communication and thinking, formed as a result of the liberation of an individual from routine information and intellectual work, among the features of which the orientation to self-development and self-learning is clearly manifested" [14, p. 85]. The role of human potential is obvious in the development of information culture, since the importance and role of the individual in this process increases significantly. "Such an individual is required to have a sense of the new, a prognostic orientation for the future, they have other personal and professional competencies, a different system of values, a different culture, a type of consciousness, worldview, the role of which increases both in a crisis and a transitional state of society" [15, p. 6]. This means that for each subject of information culture separately, it is necessary to form such competencies that will be used for successful socialization and for the creation of socially useful goods. In the opinion of the authors, these competencies can be found in smart competencies.

In modern conditions, it is smart competencies (S – self-directed, M –motivated, A – adaptive, R – resource-enriched, T – technological) that are a reliable tool for forming the culture of the information society at the early stages of personal and professional development (high school age). The process of developing smart competencies in an individual is itself synchronized with the pace of development of the information society. In other words, they are usually formed in the process of gaining experience of interaction of an individual with modern culture, society and economy. The more developed the information society becomes, the more samples of everyday life it offers, the more different competencies an individual receives. However, the culture of the information society creates both positive and negative patterns. The former include demassification and personalization of culture, maximizing opportunities for the disclosure of the potential of an individual in the field of economics and creativity; the latter – Internet addiction, retreatism, electronic aggression and identity crisis [16, p. 1362].

In this regard, questions arise as to how to determine the minimum conditions sufficient to

maintain and broadcast positive samples of information culture to the younger generation; which institution should take over the functions of selecting and cultivating verified samples of information society culture, as well as their corresponding modern competencies? Should it be the family? Education? The media? Civil society? Authorities?

Within the framework of the study, we confirmed the working hypothesis: positive samples of information culture are formed more effectively within the framework of a purposeful process of forming smart competencies (i.e. in controlled conditions of the educational smart environment). In the course of free development (outside the educational environment, in the process of acquiring and enriching life experience, in the process of communication), such an effect is not achieved.

The purpose of our research is to assess the opportunities for the formation of smart competencies in different educational conditions (free and controlled) as a driver of the development of information society and information culture. To achieve this goal, we developed a theoretical model of smart competencies as a set of basic knowledge and flexible skills necessary for the adaptation of the younger generation to the information society; we present an algorithm for evaluating these competencies in the process of their formation; we conducted an experiment in small groups of subjects; the results of the experiment helped us to evaluate the possibility of productive formation of smart competencies in different educational conditions. As part of the research, we tried to introduce an experimental model of purposeful formation of smart competencies into the educational process.

Theoretical framework of the study

Living in the "information society" implies daily work with a huge flow of information. Our success and survival depend on our ability to skillfully and appropriately find, analyze and use information. Problem solving, decision-making, critical thinking, information gathering and comprehension are abilities associated with a special kind of literacy and culture. New competencies prepare an individual to meet the special requirements of the information age.

M.I. Orlov believes that in modern conditions, the paradigm of civilizational development can be based on the idea of building a knowledge society as a social structure that constantly produces and consumes knowledge (a special form of information). The author emphasizes that the concepts of the information society and the knowledge society have a common feature, which consists in "their fundamental agreement on the essence of the processes taking place in modern society – intensification of social and economic processes and an increasing importance of intangible factors in the process of changing human life" [17].

It is also pointed out that there exists a possibility of developing a modern information technology paradigm in the direction of taking into account the needs of society in continuous learning, the implementation of which is associated with overcoming the main contradiction between the rapid growth of information in the world and the natural limitations of the possibilities of its assimilation by an individual. This contradiction encourages educational structures to form qualitatively new skills in people, including the ability to learn, find information, critically evaluate it and creatively comprehend it. In the future, these competencies can provide people with the opportunity to successfully live and work in the information society [18]. G. Halász considers new educational competencies as a direct response to the challenges facing modern Europe (preservation of an open society, multilingualism, multiculturalism, development of complex organizations, dynamic changes in the economy, etc.) [19].

To the information society, competence is more than just knowledge, skills and abilities, since it

includes the ability to meet complex requirements by attracting and mobilizing psychosocial resources (including skills and relationships) in a specific context [20]. Changes in society and culture based on the use of new technologies, and their rapid development affect the choice of certain competencies. Living in the information space requires a modern individual to possess competencies that open up great opportunities for interaction in professional network communities, contribute to effective socialization and further self-realization. Against this background, new literacy and flexible skills become the most important competencies for a person's full participation in the information society.

From our point of view, the paradigm of information society development at the present stage could be supplemented by the concept of the formation of smart competencies as a basis for the adaptation of the population to the conditions of modern society, the labor market and technological environment. These competencies reflect the principles of setting life tasks in the modern world: ability to respond immediately to changes in the external environment; adaptation to transforming conditions; independent development and self-control; effective achievement of results. Such competencies are based on knowledge management in the real and virtual world [21]. We understand smart competencies as a system of "new" knowledge and flexible skills that a person requires in order to adapt to the modern world and the new information culture. Such competencies are formed from an early age. In an ideal situation, a person will have a combination of skills, the nature of which is likely to change over the course of life in response to changing circumstances and context [22].

By their nature, smart competencies are fundamentally different from the subject knowledge developed within the framework of federal state educational standards and programs, and perform an additional role in relation to them. Smart competencies are fundamentally important not for the general culture of a person, but for the activities of a new type of workers, "knowledge workers", to adapt to the rapidly changing information and communication technologies that constantly appear in our world and affect all areas of personal and professional life. New knowledge makes it possible to use the Internet and other technologies in order to find and synthesize information, critically evaluate its usefulness, answer questions, and then communicate the answers to others. Smart competencies largely underlie effective participation in key areas of life and work. In today's high-tech environment, they are the basis for full participation in the life of society and, as such, should develop and improve over time and in accordance with the personal and professional circumstances of individuals. Due to their specifics, smart competencies broadly affect the interpersonal area related to teamwork and cooperation (including communication skills, cooperation, ability to work in a team); the intrapersonal area related to intellectual openness, positive self-esteem (flexibility, initiative and meta-awareness); the cognitive area related to cognitive processes, knowledge and creativity (including critical thinking skills, information and financial literacy, argumentation, as well as creativity).

We propose to consider smart competencies as a complex phenomenon, consisting of a series of structures:

a) the competencies of the "new" knowledge that are highly relevant to the information society and "professions of the future"; this includes digital literacy (DL) as the ability to work with modern software and tools of the Internet; financial literacy (FL) as a combination of knowledge, skills and attitudes in the field of financial behavior; project literacy (PL) as the ability to work with data sets of scientific information, to carry out exploratory analysis;

b) soft skills – cross-functional skills that are required in the modern world regardless of employment and profession; these are

communicative literacy (ability to communicate with people, ComL), organizational skills and teamwork skills (TWS), as well as network culture (value-ethical attitude toward Internet technologies, NC). The rationale for the composition of these competencies was presented in our previous publications [22; 23].

Within the framework of the research idea, we believe that the process of forming and updating smart competencies in the modern world is continuous, which is associated with the specifics of the information society and information culture. However, at present it is poorly institutionalized and develops mainly in an uncontrolled environment (in other words, it is associated with the acquisition of life experience, the development of personality and professional in the information society).

We believe that each of the smart competencies manifests itself at several levels: strategic (the level of proficiency is sufficient for independent decision-making taking into account long-term consequences); autonomous (the level of proficiency is sufficient for independent performance of professional and educational tasks); basic (the level of proficiency is sufficient for work and training, but at the same time the individual has difficulties in performing various tasks) [23].

To identify the levels of development of smart competencies, we used O.Yu. Svergun's approach that proposes to describe the manifestations of competencies in behavioral terms. The criterion for the selection of levels is the object to which the potential of accumulated competencies is directed (internal or external environment). Thus, within the framework of the proposed typology, the competence carrier either strives to show the necessary skill in life (basic level), or uses it for personal development (autonomous level), or not only uses the skill, but also creates opportunities for the development of competencies in other people: classmates, relatives, colleagues (strategic level). Such patterns of behavior characterize the application of smart competencies in practice [24].

With regard to digital literacy, the strategic level of competence development means that the student knows all computer programs, knows how to use them, etc.; the average level indicates that the student has this knowledge only in general terms; the basic level indicates that the student does not possess such information at all [23].

In order to have a strategic level of financial literacy, the student must be well aware of the use of funds, personal budget and its planning, financial security, credit transactions, investment and the work of the stock market; manage personal and family budgets, plan expenses, be aware of the need to live within his/her means, etc. The autonomous level is formed when awareness of financial literacy is partial; and a complete lack of knowledge indicates the basic level. In addition, the basic level of financial literacy development is characterized by a lack of conviction in the need for savings, unwillingness to save, the desire to make spontaneous purchases and the confidence that outsiders can be informed of bank account details or part of them [23].

The strategic level of project literacy indicates a constant conscious interest of the subject in research activities (several hours a week are systematically spent on research work); the autonomous level indicates episodic interest (less than one day a week); the basic level indicates a complete lack of interest in such activities [23].

The strategic level of communicative literacy and the ability to work in a team determines a high level of communicative abilities (according to the KOS test of V.V. Sinyavsky and V.A. Fedoroshin); sociability, friendliness, ease of communication; the autonomous level – an average level of communication skills, closeness, lack of flexibility and integrity; the basic level – a low level of communication skills, passivity in the team and self-sufficiency [23].

The strategic level of network culture means that the subject has no conflicts with parents and other people about the content and time spent on the

Internet; does not hide from parents the amount of time spent online; rechecks information from the Internet using alternative sources; tries not to open messages coming to e-mail from strangers; does not communicate with people insulting on the Internet, immediately puts them on the "blacklist" of contacts; believes that rules of politeness are required for communication on the network; does not use nicknames and fake accounts to insult people. The basic level of network culture means that the subject considers life without the Internet boring, empty and joyless; often neglects communication with parents, household chores because of the Internet; finds ready-made works on the Internet and passes them off as his/her own; has boundless confidence in information on the Internet and online interlocutors; believes that personal data can be safely posted on the Internet; in conflict situations arising online, squabbles with others publicly on the forum (website) [23].

Thus, we consider the formation of smart competencies as a process of gradual transition of "new" knowledge and flexible skills from the basic to the strategic level of development. We assume that such an effect can be achieved in both managed and unmanaged environments, but with different results. In order to substantiate this effectiveness, we experimentally reproduced the elements of the formation of smart competencies in a small experimental group.

Research methodology

Assessment of the level of competencies development as a result of educational activity is one of the most discussed, controversial and still unresolved problems in connection with the continuously changing requirements of society to the education system. The choice of methods and techniques for studying the level of competencies development is of the greatest difficulty, which is explained by the complexity of the structure of competencies itself [25, p. 103].

As part of the assessment of general and professional competencies in science, two methodological approaches are usually used. The first one is a *traditional approach* focused on the evaluation of academic results based on measurement by pedagogical measuring materials that are created on the basis of the experience, and their quality is evaluated intuitively. The second one is a *technological approach* involving the use of modern evaluation tools that are created on the basis of technology (rather than experience), their reliability and validity are assessed on the basis of empirical data. Diagnostics and assessment of the level of competence development in this case occurs as a result of the implementation of the competence development itself, which implies giving the student the opportunity to act as a competence carrier and evaluator themselves. The tool used in the framework of the traditional approach is usually a test, which is used during control and evaluation procedures; in the framework of the technological approach, the following tools are used: a questionnaire, diagnostic questionnaire, portfolio, which are used in the framework of observation, case study, questionnaire, interview and experiment. The advantage of the traditional approach is the apparent simplicity of data interpretation; the disadvantage lies in the fact that this approach identifies the level of awareness of this competence rather than the competencies as such. The technological approach provides much richer material for reflection (the nature and personal features of the competence carrier, motives and inclinations), but at the same time provides the researcher mainly with a set of subjective results [23].

In our study, as part of the approbation of the authors' approach to smart competencies, a method of modeling experiment is proposed, which is a system of observations of short-term changes in an individual's personal development (psychological or educational). This observation is carried out in the process of exerting an active influence of the researcher on the subject.

The modeling experiment is built in accordance with the principles of the technological approach to the assessment of competencies. We chose this

method because it is not limited to the registration of individual facts about the development of personality, but, through the creation of special situations, it reveals patterns and allows us to evaluate the effectiveness of the process of personal development in dynamics, which corresponds to the purpose of our research [26].

The experiment was conducted within the framework of RFBR scientific project "Smart education as a vector of human potential development of the younger generation". As an object of the modeling experiment, the level of development of smart competencies in children studying in high school grades 9–10 is considered. The task was to create conditions conducive to the optimal formation of smart competencies in a managed environment, as well as to compare the level of competence development in a managed and unmanaged environment [23].

In accordance with the recommendations of experts, the experiment consisted of three stages: 1) ascertaining (within the framework of which the initial level of development of smart competencies was clarified); 2) forming (implementation of the impact that forms smart competencies); 3) control (during which the effectiveness and performance results of the work on the formation of smart competencies was assessed by comparison with the initial level) [26]. Thus, the project team had the opportunity to draw conclusions about the conditions under which the competencies under consideration are formed, while preserving the important natural conditions of the life of the object of study.

The modeling experiment was conducted during the 2020/2021 academic year. At all stages of the experiment, the composition of the subjects remained constant – 76 people. The subjects were arranged into three groups: a) control group (CG) – students of Vologda Secondary School no. 13 (28 people); b) experimental group 1 (EG1) – students of the academic class of VolRC RAS Research and Education Center (27 people); c) experimental group 2 (EG2) – students of schools of the town of Staraya Russa, who participated in the project "VolRC RAS Internet School". Thus, the groups were created based on the principles of having similar conditions for personal and educational development [23].

The subjects included in the CG formed smart competencies in a free (uncontrolled) environment, during the experiment they were not affected at all. The subjects from the experimental groups within the framework of the work of VolRC RAS Research and Education Center (hereinafter – REC VolRC RAS) were purposefully influenced by the formation of smart competencies (formative influence).

In the study, we proceeded from the understanding that the subjects already had a certain initial level of development of smart competencies before the experiment, and this level may be different. The education system cannot yet offer conditions for the purposeful formation of relevant competencies. This means that they are not formed in children purposefully or in an educational environment, but, rather, in a free mode, during the acquisition and enrichment of life experience.

Research results

As part of the experiment, we tried to propose an action program for the purposeful formation of smart competencies in the experimental groups. The algorithm of the experiment included a sequence of several stages.

The first stage is ascertaining (September 2020). Within its framework, an initial measurement of the available level of competencies of all subjects was carried out (before the formative influence was exerted). The assessment tool was a diagnostic test which helped the subjects to assess whether they had the signs of smart competencies. For the formation of the test, we used our own developments and well-known methods of psychological diagnostics.

During the ascertaining stage of the experiment, it was determined that representatives of two groups (CG and EG1) had an initial level of smart competencies at the lower limit of the strategic

level (0.71). However, the level of development of smart competencies of EG2 representatives has not reached strategic values. At the same time, there was a lag in the development of communication skills and the ability to work in a team in all groups of subjects. For example, in EG2 representatives, communicative literacy was developed only at a basic level.

At the second stage (October 2020 – May 2021), the subjects from the experimental groups experienced a formative influence aimed at the development of individual smart competencies. The formative effect was to maintain the strategic level of smart competence development in a managed environment and strengthen communication literacy and the ability to work in a team. The events were held on the basis of REC VolRC RAS (for EG1 in offline format) and VolRC RAS Internet School (for EG2 in online format), in particular, elective courses (financial literacy, economic mathematics, fundamentals of research), master classes "Artificial intelligence. How to make friends with the computer mind", "How to protect data on your gadgets?", Science and Entrepreneurship Week, Financial Literacy Week, discussion club (where the topics "Difficulties of professional choice", "The art of public speaking", "How to build an individual trajectory of professional development" were discussed).

The formative impact was exerted when teachers used digital technologies and online services in the educational process to create interactive exercises to test knowledge (LearningApps, Etreniki, Quizizz, Baamboozle, Gamilab, Worldwall, Educandy). Active and interactive technologies and teaching methods based on students' own activity, interactive communication, teamwork, group and individual reflection were used: critical thinking development technology, communicative learning technology; discussion, game technologies, case technologies, presentations, brainstorming, lessons using audio and video materials, online tests, workshops, trainings, interactive voting, surveys, organization of research activities, distance learning technologies, "blended learning" technologies, including "flipped learning", mobile learning, etc. We also used our teachers' own online courses at REC VolRC RAS.

At the third stage (May – June 2021), a control measurement of the level of smart competencies was carried out using a diagnostic test. The test fully corresponded to what was used at the ascertaining stage.

After the formation of databases of two waves of measurements, we conducted a diagnosis of the sincerity (conscientiousness) of the subjects based on the use of the sociological technique of survey multiplication. As a result, 22.4% of tests that did not meet the criteria of conscientiousness were rejected in the database of the first wave of measurements as part of the analysis; 10.5% – in the database of the second wave.

As part of the reflection on the experimental data, we tested the following scheme of actions to compare the short-term results of purposeful and non-purposeful formation of smart competencies in the subjects. First, the responses were processed according to a single scheme, each response was assigned a value from 0 to 1, depending on the level at which the relevant competence was developed (strategic level – 1; autonomous – 0.5; basic – 0). Thus, we obtained two arrays of values. Then, by averaging the corresponding values, sub-indices were found. After that, the final smart competence index (I_{sk}) was formed by finding the arithmetic mean of the values of the sub-indices. Next, smart competence development indices were compared over two measurement periods, on the basis of which the trend of changes was determined *(Tab. 1)*. At the next stage, index values were correlated with the level of smart competence development according to the following scheme: strategic level – from 0.7 to 1; autonomous level – from 0.5 to 0.69; base level – index less than 0.5 *(Tab. 2)*. The threshold values of the indicators were determined by clustering the entire array of experimental data using the k-means method.

Table 1. Dynamics of smart competence formation indices in the subjects

	DL			FL			PL			ComL			TWS			NC			SK on the whole		
	Period		Trend	Period		Trend	Period		Trend	Period		Trend	Period		Trend	Period		Trend	Period		Trend
	2020	2021		2020	2021		2020	2021		2020	2021		2020	2021		2020	2021		2020	2021	
On the whole	0.71	0.72	↑	0.73	0.73	○	0.82	0.78	↑	0.57	0.58	↑	0.63	0.60	↓	0.80	0.70	↓	0.71	0.69	↓
By groups of subjects																					
CG	0.72	0.70	↓	0.73	0.72	↓	0.84	0.80	↓	0.58	0.54	↓	0.63	0.55	↓	0.83	0.68	↓	0.72	0.66	↓
EG1	0.70	0.73	↑	0.73	0.76	↑	0.82	0.83	↑	0.66	0.63	↓	0.63	0.63	○	0.78	0.73	↓	0.72	0.72	○
EG2	0.72	0.72	○	0.73	0.73	○	0.81	0.73	↓	0.46	0.57	↑	0.61	0.62	↑	0.77	0.69	↓	0.68	0.68	○

Note: ↑ – upward trend ↓ – downward trend; ○ – neutral trend.
Source: own calculation.

Table 2. Changes in the level of development of smart competencies in the subjects during the measurement period

	DL		FL		PL		ComL		TWS		NC		SK on the whole	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
On the whole	S	S	S	S	S	S	A	A	A	A	S	A	S	A
By groups of subjects														
CG	S	S	S	S	S	S	A	A	A	A	S	A	S	A
EG1	S	S	S	S	S	S	A	A	A	A	S	S	S	S
EG2	S	S	S	S	S	S	B	A	A	A	S	A	A	A

Note: S – strategic level; A – autonomous level; B – basic level.
Source: own calculation.

Table 3. Proportion of subjects with different levels of development of smart competencies at different stages of the experiment, %

Level	CG		EG1		EG2	
	2020	2021	2020	2021	2020	2021
Strategic	65.0	45.8	60.9	62.5	56.3	40.0
Autonomous	30.0	41.7	39.1	33.3	37.5	50.0
Basic	5.0	12.5	0.0	4.2	6.3	10.0
Total	100	100	100	100	100	100
Source: own calculation.						

The measurements have shown that during the experiment, the effectiveness of the development of competencies in the subjects as a whole decreased slightly, but this decrease occurred due to the group that was not exposed to formative influence. The results of the control measurement indicate that in the control group of subjects, the overall level of smart competencies decreased (from strategic to autonomous). Moreover, during the experiment, the reduction affected the values of sub-indices for all individual competencies (from digital literacy to network culture). In general, the main reason for this transition was the decline in the level of network culture, which was transformed from strategic to autonomous.

The experimental group, which was exposed to formative influence in the traditional classroom format (EG1), managed to maintain the strategic level of development of smart competencies. The values of the sub-indices of basic knowledge (digital, financial and project literacy) even increased in these subjects (in this case, there was a reduction in the control group). EG1 was the only group that managed to maintain the strategic level of development of network culture during the experiment.

The final level of development of smart competencies among the EG2 subjects could not be raised to the strategic level, mainly due to a sharp decrease in the level of development of network culture (as in CG). At the same time, there are also positive results of the formative effect for EG2. During the experiment, the communicative literacy of its representatives has developed from the basic to the autonomous level. In the other groups, there were no similar dynamics in relation to communicative literacy.

Thus, during the period of the experiment without providing a formative influence, the proportion of subjects with the strategic level of smart competences development in the control group sharply decreased (from 65 to 46%). The subjects shifted to the group with both autonomous and basic levels of development *(Tab. 3)*.

Something similar happened in EG2, whose representatives were exposed to formative influence online. However, in this case we see mainly the transition from the strategic to the autonomous level (and then mostly due to the network culture).

Qualitatively different trends are typical of EG1, whose representatives received formative influence in traditional classes. The proportion of subjects who have reached the strategic level of smart competencies has slightly increased (from 61 to 63%). This is the best result among all groups. Only 4% of the subjects remained at the basic level (in CG – 13%; in EG2 – 10%).

An important limitation of the experiment was the low effectiveness of the development of the ability to work in a team. In all groups, these skills have not reached the strategic level during the measurements, although positive changes in this direction are noticeable in EG2. Perhaps this is due to the need to plan a longer period of formative influence and a more detailed account of the psychological characteristics of the subjects.

Conclusion

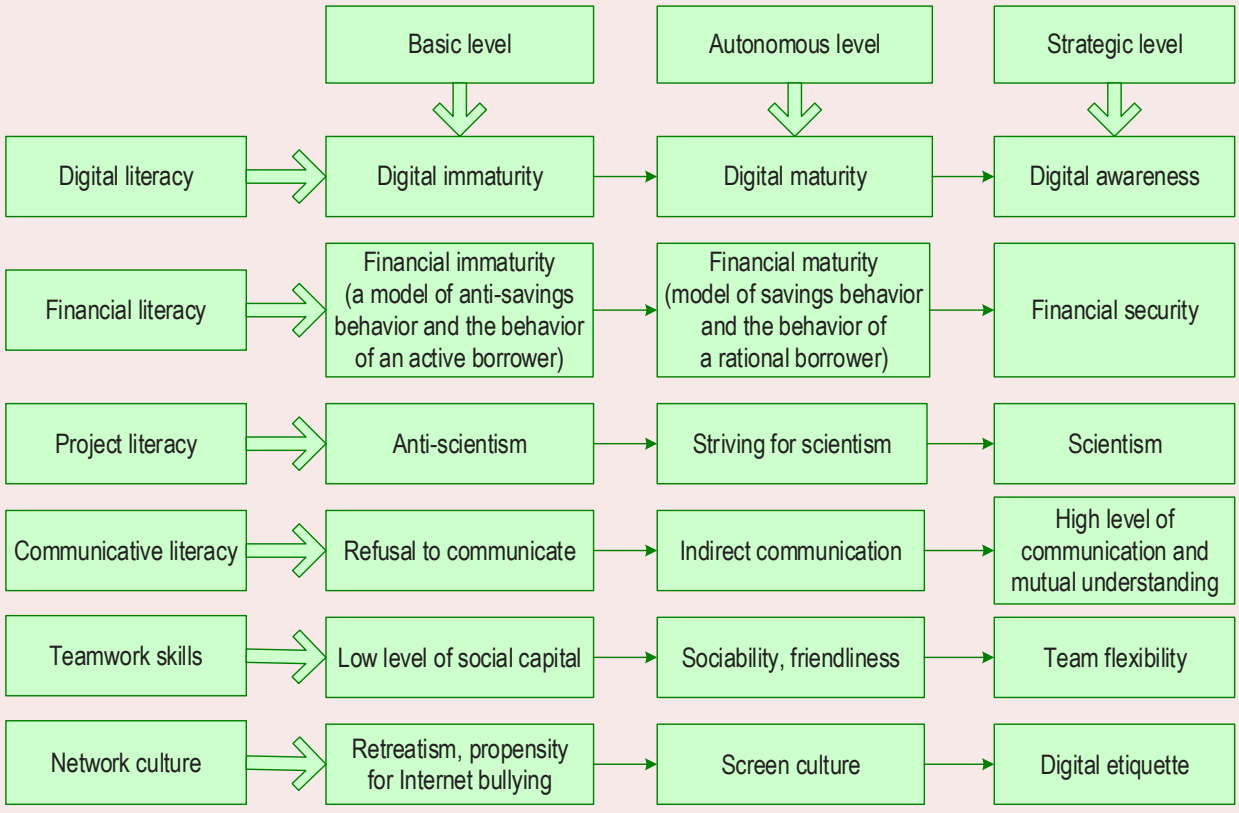
A very important result of the experiment is the proof that the level of smart competencies, which are a tool for the formation of information culture, can decrease over time. The ability to maintain the strategic level of smart competencies is provided only by a controlled formative impact in the form of classical (classroom) studies. Unfortunately, such an effect is still difficult to achieve within the framework of distance learning technologies, since in this case direct contact and personal communication with the subject are important. The Internet environment itself can negatively affect the network culture (as one of the smart competencies), since it often carries ambiguous cultural patterns (Internet bullying, network imprinting, floating consumerism) [16].

This is another advantage of the smart competencies formation process. It usually does not require the use of advanced technologies, but requires taking into account the potential of existing forms and tools.

The decline in the smart competencies becomes especially noticeable in an unmanaged (non-educational) environment, since it is not stable and its influence is formed under the influence of popular culture. Network culture in an unmanaged environment is much more exposed to negative transformations, which poses the risks of formation of ambiguous cultural patterns in young people (among which one can note a tendency toward Internet bullying).

How do smart competencies create patterns of information society culture (cultural patterns)?

Evolution of information culture patterns within the framework of smart competencies development



Source: own compilation.

Depending on the level of competence, these samples will be different *(Figure)*.

We believe that the strategic level of smart competencies, which can become stable only in a managed environment, is the basis for the formation of digital and financial maturity, digital etiquette, scientism (perception of scientific knowledge as the highest cultural value), a high level of communication and mutual understanding, as well as team flexibility and acceptance of pluralism of opinions among the younger generation of Russian society, i.e. the formation of everything that is required from life and work in the modern information society.

The experimental study as a whole allows us to talk about the possibility of taking into account the model of smart competencies in school educational programs. The approbation, however, did not show that the model is effective in relation to all competencies, which is explained by a very short period of formative influence. Education should become a base platform for the development of smart competencies. The development of competencies should take place in the entire range of educational contexts: from formal institutions, such as schools, colleges and universities, to informal learning, as well as various forms of independent and informal learning.

The prospects for the development of the idea of forming smart competencies in the information technology paradigm and the paradigm of the knowledge society are primarily related to the elaboration of the concept of smart competencies as a basis for human potential development. This concept should determine that smart competencies arise in the context of smart education as a system that includes smart agents (smart students, smart teachers, smart administration and smart parents), smart environment (which is based on the use of smart devices, techniques and methods of project activity in education) and smart principles (meta-subject, interactivity, continuity, equality, awareness, activity) [22]. The solution of this task should become part of the development strategy of the country and the global community. In the future, it will qualitatively transform the entire education system and the requirements for workers in economic sectors.

Approaches to the selection of smart competencies should be dynamic and regularly reviewed in connection with the emergence of new technologies. Efforts should be made to study the conceptualization of the required smart competencies and then include them in educational standards. The process of forming smart competencies benefits from the involvement of resources and experience of both the public and private sectors, especially from the participation of actors with in-depth knowledge of skills needed today and relevant in the future.

As part of the study, we tried to propose a methodological scheme for the formation of smart competencies in an educational (managed) environment, as well as an approach to the experimental diagnosis of this process. Based on the results of the experiment, a methodological publication will be prepared with detailed instructions on the use of our own model in educational institutions.

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Received November 16, 2021.