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KEY FEATURES OF THE INTEGRATION IN PEDAGOGICAL EDUCATION AND TEACHERS' PROFESSIONAL DEVELOPMENT IN CHINA

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Abstract. *Introduction.* In the current conditions of increasing globalization processes and digital transformation in all spheres of human activities, once-and-for-all education no longer meets society's requirements for the quality of teaching personnel. In this context, integration in teacher education and professional development of teachers becomes one of the necessary and inevitable tasks of reform and modernization of the education system worldwide, largely due to the growing popularity and demand for the modern educational idea of lifelong learning. The practice of separating the idea of lifelong learning from the system of teacher education has hindered the effective improvement of the quality of teaching personnel. By the end of the XX century, however, China had already begun a comprehensive study of different systems integration, the process of teacher education, and professional development. Since then, there have been some experiences of integrating professional teacher education and development at the level of theory and practice, which need to be generalized and reflected upon.

Objective. This study aims to analyze the status of integration trends in modern teacher education and professional development in China, characterize its main features, and identify the main problems.

The materials of this study include academic papers on the problem area of the study (mainly Chinese scholars) and regulatory documents approved at the state level on education in China. The following research methods were used: Analysis of academic papers and documents on Chinese education policy, a study of the experience of integration into the teacher education system and professional development of teachers in China, synthesis, and generalization.

Results and Discussion. Integration in the system of teacher education and teacher professional development in China enables the rational and reasonable design of the objectives and content of education at all stages of teacher professional development, maintaining its continuity and integrity, optimizing the use of educational resources and teaching materials, and promoting the improvement of the quality of teaching staff. Local authorities, higher education institutions, and teacher professional development institutes are the participants and subjects of this integration and contribute to its implementation in teacher education and professional development.

This integration is mainly reflected in the integration of learning objectives, curricula, educational institutions involved in teachers' professional development, and their certification, as well as in the assessment of educational resources. In

the near future, the main tasks of integration in teacher education and teacher training processes in China will remain the promotion of productive professional communication, interaction, and cooperation at all levels of teacher education and among the various subjects of teacher education, the strengthening of the continuity of the goals and content of education, and the improvement of the quality of teachers working in the teacher education system.

Conclusion. The main feature of integration in teacher education and teacher professional development in China is to focus on eliminating and reducing gaps in the professional teacher education process and promoting teachers' continuous professional development. Integration as a resource for improving the quality of teacher education and development can be demonstrated mainly at the levels of the goals in the academic disciplines syllabuses and teacher education programs, educational institutions, teacher certification, and evaluation of educational resources and teaching materials. Eliminating and minimizing the problems and gaps of the above introduction requires further theoretical and empirical research.

Keywords: *pedagogical education in China, Chinese teachers, integration, integration in pedagogical education, integration in teacher professional development*

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Introduction

In the rapidly developing modern world, once-and-for-all education does not always meet the requirements of the state and society for the quality of teachers. In this regard, integration in teacher education processes has become one of the most important trends in the reform and development of the education system in many countries.

As early as 1972, E. James, in his "Report of Committee of Enquiry into Teacher Education and Training," demanded that the educational ideology of "lifelong learning" should be applied in the practice of teacher education and introduced the concept of integration in the process of teachers' professional development [1]. Furthermore, at the XLV International Educational Conference organized by UNESCO in Geneva in 1996, it was stated that training teachers who can adapt to social change had become a real challenge for the world of teacher education [2].

In the current century, integration is considered one of the most important foundations for the formation of an effective mechanism for training a competitive specialist. It is considered that the formation of such a specialist in the conditions of higher education is carried out in stages, depending on the opportunities to accelerate the integration processes. At the beginning (stage 1), the university is considered only an educational institution where the emphasis is on teaching. Later (stage 2), the university becomes an educational and scientific institution. Then there is an integration of the university with its educational and scientific activities with the institutions of science and industry (stage 3). And finally, inter-college educational, research, and industrial centers are formed (stage 4 is the highest stage of the integration process) [3, p. 152].

The main types of integration in education include:

• unproductive, preproductive, productive integration, quasi-integration (classification according to the quality of the integrated system);

• complete and partial integration, disintegration (classification according to the presence of the necessary components of an integrated system);

• episodic, periodic, and systematic integration (classification according to the temporal characteristics of the integrated system);

• sectoral, intersectoral, and allied integration (classification according to the types of integrating entities) [4, p. 30].

According to researchers, the classic manifestation of integration in the field of higher professional education is the unification and consolidation of organizations through their merger and accession, which leads to the emergence of hierarchical systems of interaction [5]. There are two types of integration transformations: classical integration, which involves mergers and acquisitions, and quasi-integration, which means the pooling of resources to carry out joint projects. As a result of the implementation of one of the integration options, the nature of the relationships between the subjects changes, "there is an agreement on complementary resources and key competencies and their further use" [5, pp. 117–118]. These types of integration seem to be characteristic of most educational systems worldwide.

In today's world, integration in teacher education and teacher professional development has become global, and training teachers to meet the demands of educational development and reform has become an important task for every country. China is no exception, as the current status of its education system shows an incredibly high development rate in all fields and indicators. In recent years, the country has implemented a large number of reforms and stands out for its effectiveness. For example, the number of universities and students has increased rapidly. Higher education has shifted from the elite to the masses, the population in higher education has increased, and the proportion of Chinese students who have studied in foreign universities and returned has increased. Chinese universities have received international recognition; the best have made it into the top 100 influential international rankings. This proves the appropriateness and justification of the educational reforms implemented in China in recent decades [6, pp. 89–90].

Now there is a trend of unified education development throughout China, including the central and western regions, to improve the quality of education and the general level of education through the popularization of upper secondary education and the development of lifelong learning [7, p. 162], and this is where education plays an important role.

In modern China, teacher education specifically "trains talents in the field of education and contributes to individual development and social progress" [8, p. 7]. It is regarded as a driving force, a resource for both the state's social development and economic prosperity. Professional development of teachers refers to the process of sustainable growth of teachers not only in terms of their professional competencies but also in terms of their intelligence, experience, mentality, and worldview based on learning, practice, and reflection. [9]. The

teacher is a constantly developing personality, and his or her development is continuous. Every event in teachers' professional development is interconnected and interactive, i.e., what happens at a certain stage of development is determined by previous events, lived and conscious experiences, and also plays a crucial role in future events [10, p. 19]. It can be concluded that teachers' professional development should not be a one-time event limited to a certain period of time but a continuous and lifelong process. The preparation of teachers who are willing and able to continuously learn, improve, and research should be based on the pedagogical concept of "lifelong learning." A profound reform of teacher education is being carried out in accordance with the goal of creating a system of continuous professional development for teachers. In this regard, the requirement for teacher education integration and professional development has been established.

The modern teacher education system in China has traditionally consisted of two parts: university teacher education (pre-service teacher education), i.e., preparation for the teaching profession, and postgraduate teacher education (in-service teacher education), i.e., professional retraining after graduation. It should be emphasized that for a long time, these two parts of teacher education in China were "clearly separated from each other and not connected, which led to irrational use of educational resources and inefficiency in improving teachers' professional quality" [11]. In 1996, in order to follow and analyze the leading trends in the development of teacher education worldwide and improve its own teacher education system, the document "Some Issues on the Reform and Development of Teacher Education" published by the Ministry of Education of the PRC clearly pointed out the need to improve the teacher education system and link the university teacher education system with the teacher training system [12]. This was the first time an official state document of China formulated the idea of creating a continuous professional development system for teachers in China, which became an impetus and stimulus for further theoretical studies and practical implementation of the above idea.

In this regard, since the end of the XX century, Chinese educators have begun to comprehensively study the problems of integration in teacher education and teacher professional development in China, both theoretically and practically, and some significant results have already been achieved. For example, the logic and directions that characterize the creation of a teacher education integration system [13], the problems in creating a teacher education integration system in the new era and the ways to solve them [14], the importance of teacher education integration and the ways to implement it [15], have been described. Nevertheless, it is difficult to claim that all aspects and problems of the above integration issues have been wholly and sufficiently solved in China.

This study aims to identify the main features of integration in teacher education and teacher professional development in China, analyze its key elements, and identify existing problems based on the study and analysis of scientific, pedagogical, and methodological works on the research problem.

Material and methods

The methodological basis of this study was the scientific publications of scholars from China and other countries, as well as official documents on education in China. The following methods were used in the implementation: theoretical analysis, generalization of scientific and educational literature to clarify the concept of "integration" in professional teacher education and professional development of teachers in China; study, analysis, and generalization of the key elements and existing problems in the process of integration of professional education in China.

Integration processes in the education system are a hot scientific and educational research topic in many countries, including China. Based on their scientific research and educational experiences, many scholars have defined the concept of "integration" in terms of teacher education and professional development.

For example, Qiu Xiuhua and Xun Yuan state in their publications that integration in education is a response to the long-standing problem of the lack of close connection between the different phases and stages of education and between pedagogical theory and practice in China. Integration in teacher professional development is a process that aims to create a system of continuous professional development for teachers that improves the quality of education and teaching personnel. Many researchers believe that integration in teacher education means the integration of learning objectives, curricula, and levels of education [16, p. 17].

Integration in teacher education refers to the continuous promotion of teachers' sharing of all the available educational resources. Changing the understanding of traditional once-and-for-all education and reviewing its appropriateness are already the most important basis for the integration of teacher education. In addition, integration can be realized by "integrating learning objectives, curricula, learning processes and standards, models, and learning effectiveness evaluation to effectively reorganize and build a new system of teacher education and train more teachers to meet the needs of social development" [18, p. 63].

Gao Shuren and Song Dan believe that the integration of teacher education is, in a sense, a form of comprehensive and in-depth education reform that promotes scientifically sound and rational development of teacher education and optimizes the distribution of educational resources. It aims to explore new development relationships and models in teacher education and coordinate the development of education in its various stages. The integration of teacher education requires "the implementation of pedagogical activities based on integrated learning objectives and the law of educational development to enhance the effectiveness of teacher education" [19, p. 18].

In China, many scholars believe that integration in teacher education means that the education system must be regarded as a continuous process in which the stages and parts are closely related and influence each other. The teachers' professional development patterns must be considered when designing the goals and content of training in the different stages of education.

In the education system, each training phase is independent and continuous at the same time. The main task in the integration of teachers' professional development is to regulate the relationship between the stages and continuity [20, 21]. And here, we can talk about the need to maintain a harmonious balance in observing the stages and continuity, that is, their harmonization.

Some Chinese scholars believe that integration is a new model for reforming teacher education. According to them, "lifelong learning" is the guiding ideology of integration in teacher education, which determines the overall design of curriculum and learning content and links all levels together. Their goal is to coordinate educational resources and change the current state of division and gaps in the education system. Integration in teacher education means an integrated and perfect education system in which each part has its own characteristics and advantages in training teachers who can meet the demands of society [22, 23].

Many Chinese researchers agree that there are two kinds of integration in teacher education and professional development: internal and external. Internal refers to integration within a discipline, field, or type of pedagogical activity, while external means creating a common educational space, integrating different types of educational institutions, integrating different disciplines, types of pedagogical activity [24–26].

Results and discussion

1. The Essence of Integration in Teacher Education and Teacher Training in China

From the analysis of the scholarly works (especially the Chinese ones), it can be concluded that integration in modern teacher education and teacher training is an absolutely indispensable prerequisite for teachers' professionalism and their continuous professional development, as well as the main trend, a kind of guarantee of success for the reform and development of the teacher education system in China.

Integration in teacher education and teacher professional development is implemented based on the educational ideology of "lifelong learning." Accordingly, it must conform to the principle of the need to combine, accumulate and optimize educational resources. Furthermore, it must contribute to creating a coherent, transparent system of teacher education characterized by integrity, rationality in the structure of the educational process, logic and scientificity of content, continuity, distinct stages, consistency in the organization of educational activities, and rationality in management.

In particular, integration in teacher education and teacher professional development is reflected in the following points.

First, teacher professional development is seen as a continuous, holistic process in which all phases of teacher education, including university and postgraduate pedagogical training, must be integrated, interconnected, and coordinated. This coordination should be transparent and comprehensible for all educational subjects. Secondly, it is important to respect and appreciate the peculiarities of teachers' professional development at each stage, to design and

precisely formulate the goals, contents, and objectives of training at each stage, and to determine the methods and technologies by which they can be achieved. Third, the system of teacher education should be strengthened. In the process of professional development of teachers, pedagogical and general higher education institutions, special organizations (institutes, centers) for retraining and continuing education of teachers, schools, and local authorities are actively and jointly involved. They all interact, cooperate for mutual benefit and use their advantages and opportunities, show genuine interest, and join forces to improve the quality of teachers.

As mentioned above, teacher education integration in China can generally be divided into internal and external integration. Internal integration in teacher education means integrating various elements of the teacher education system, such as the setting of learning objectives, the implementation of the curriculum, the implementation of the educational process, the teaching staff, and the use of various educational resources. External integration, in turn, means connecting different levels of teacher education and creating a common educational space between the participants; it emphasizes the close relationship between the systems of the university teacher education process and general education, cooperation between university teachers and school teachers.

2. The Main Actors of Integration in Teacher Education and Teacher Training in China and Their Role

It is common knowledge that undergraduate teacher education in modern China is usually conducted at higher educational institutions. However, postgraduate training, more precisely, retraining of teachers, is carried out during summer vacations (based on interactions, cooperation with schools, or on behalf of the local government), in special organizations for teacher training, and on weekends directly in schools (taking into account the timetable, school program). At the request of the Ministry of Education of the PRC, the retraining for each teacher is conducted for three years and must include at least 360 teaching hours.

The main participants in professional retraining are local government, universities, teacher professional retraining organizations, and schools. The local government is usually responsible for the teacher contingent (sufficient number, appropriate structure, high quality of training, required qualifications). Therefore, participation in the professional development of teachers is fully in line with the interests and requirements of the government and society. At the same time, the local government can also support teacher education and professional development integration. These are, for example, the current education policy and official regulations for education, which formulate the main directions, general objectives, content guidelines, and requirements for teacher education integration, and determine each participant's responsibilities in this integration. It also provides the necessary means, various material resources, and platforms for communication and cooperation. It can be concluded that the government plays a leading role in building a holistic

mechanism for integrating the continuous professional development of teachers in China.

Higher educational institutions such as pedagogical universities, institutes, and other universities, as important participants in the integration of teacher education, usually provide good theoretical support and guidance for the interaction process in this integration and provide excellent and one of the best teaching staff. In addition, universities usually design and develop the main curricula and teaching materials for teacher education integration.

Unlike universities, teacher education organizations and schools are less involved in the design of teacher education curricula and more often act only as "executors" in the integration of teacher education [10]. In this regard, the practical needs, professional requirements, and general interests of teachers and schools regarding educational content in professional development programs are often ignored in the creation and design of teacher education integration curricula. This should be recognized as a significant problem affecting the quality of professional development and teachers' motivation for professional development.

3. Key Elements of Integration in Teacher Education and Professional Development in China

These elements include the definition of integrated educational goals, the creation of an integrated system of curricula, the certification of teacher qualifications, the integration of educational institutions involved in teacher education (universities, teacher training institutions, and schools), and the integration of educational resources. In the following, we analyze these elements of integration in teacher education using the popular "U-G-S" model (i.e., "university," "government," and "schools") as an example.

(1) Integration of the goals of teacher education and teacher training

The goals of teacher education are a specification of the educational goals of various educational institutions at all levels (colleges, institutes, universities, and teacher training institutions). The formulation of teacher professional development goals is usually influenced by such factors as social needs, reforms and development of general education, and types of schools. Taking into account the specifics of teachers' professional development at each stage, the formulation of teacher education goals should correspond to the main patterns of teachers' professional development.

The integration of the goals of teacher education in China is mainly reflected in the fact that the goals of teacher education for undergraduate and postgraduate studies are related to each other but also emphasize the most important parts of each stage of teachers' professional development to form a meaningful sequence of stages. The overall goal of teacher education is to produce highly professional teachers capable of lifelong learning and research. University education aims to provide a professional (mainly theoretical) foundation for future teachers of all subjects. The curriculum contains pedagogical ideas and concepts that form the basis for achieving educational goals and designing and implementing pedagogical activities. The system of

teacher education curricula determines the quality of teacher education and thus directly impacts it. Strengthening the relationship and promoting the interaction between teacher education curricula at all levels is the core of integration in teacher professional development [27].

The Ministry of Education of the PRC issued the "Teacher Education Curriculum Standards" (2011) and "Professional Standards for Teachers" (2012) documents, which are regarded as the basis for building an integrated teacher education curriculum system. In addition, the characteristics of different levels of education (preschool education, elementary education, general secondary education), levels of educational programs (bachelor's, master's, and postgraduate), and developmental levels (pedagogical university education, activity as a prospective teacher, the activity of an experienced teacher, and finally a teacher researcher) should be taken into account when building teacher education curricula.

(2) The integration of educational institutions that train teachers is an important link in achieving the set goals and implementing curricula for the professional education of teachers. Therefore, the local government, universities, schools, and teacher education institutions collaborate and participate in teacher education and professional development.

The integration of educational institutions is realized by strengthening the overall coordination and management with the help of the local government. In the "U-G-S" integration model, the local government, both as a government agency and as an observer, coordinates the relationships among all participants, provides political and financial support, monitors the fulfillment of its duties and responsibilities by all participants, and protects their rights and interests. As designers and central participants in this integration, universities create a common structure and curricula and provide schools and teacher education institutions with the necessary theoretical guidance and training materials. In addition, both schools and teacher training institutions provide a basis for implementing pedagogical practices and educational experiments in universities, identifying teachers' needs for improving their professional skills, and actively organizing teachers' retraining participation [28].

(3) Integration of teacher qualification evaluation. Teacher qualification evaluation is an important part of the integration of professional education and is closely related to teachers' professional development. China has had a teacher qualification certification system since 1995, which has played an essential role in regulating teacher recruitment standards, promoting professional development, and improving the quality of university teacher education [29]. Certification of teachers' qualifications takes place every five years and is organized by the local education authority. The teacher must first submit an application and other necessary documents to the educational institution where they work so that the teacher's qualification category can be reviewed and approved. Then they submit all the documents to the local education authority. The main content of teacher qualification evaluation is as follows: Teachers' professional ethics and professional knowledge, skills and abilities, innovation ability, reflection, and research ability. The integration of

teacher qualification evaluation focuses not only on the quality of teachers in the initial stage but also on the development of teachers (I, II, III, and the highest category) in accordance with the requirements of different specialties, different education systems and all stages of teachers' professional development.

(4) Integration of educational resources. Integrating educational resources in teacher education aims to optimize their distribution at different educational levels and in different educational institutions to increase the efficiency of their use. In this context, in integrating educational resources, it is necessary to create a mechanism for the management of these educational resources in order to overcome the limitations in their distribution and use. Furthermore, in the information society, it is necessary to fully use modern information technologies to create network resources for professional education and online learning platforms to effectively use existing resources and maximize teachers' continuous professional development.

Teachers and faculty are critical human resources that must be rationally "leveraged" in teacher professional development. Universities that train teachers can invite experienced and outstanding teachers into their classes to participate in university teacher education and share their own practical experiences with students. In a common educational space, teachers and students (future teachers) can attend classes in a school and gain comprehensive knowledge and understanding of the teaching profession and the current state of general education, as well as strengthen the connection between the knowledge acquired in theory and practical activities in schools.

4. Current Challenges in the Practice of Integration in Teacher Education and Professional Development in China

Although the integration processes in teacher education in China have achieved some results in practice, there are still many problems for a number of reasons.

In China, university teacher education and teacher professional development have long been independent and had little to do with each other. In recent years, however, an integrated education space has gradually emerged here, consisting of pedagogical institutes and universities, general higher education institutions, teacher training organizations, and schools. However, most of these actors are not sufficiently aware of the goals and importance of cooperation and association, and they also lack awareness of joint activities (their necessity and potential) in the implementation of teacher education. They are practically separated in the process of professional training of teachers [30]. Many pedagogical institutes and universities have created departments for the professional retraining of school teachers. However, even these departments have little connection with the faculties or institutes that implement "pedagogical training" because they are located in different administrative systems of higher education institutions. Again, this disrupts the continuity of teachers' professional development and does nothing to improve the quality of teachers in China.

Due to the lack of effective communication and information sharing among the various parties involved in teacher education, they tend to focus on their current tasks in determining the purpose and content of education, resulting in a lack of consistency and uniformity in educational objectives and curriculum content at all stages of teacher professional development. Moreover, in the implementation of teacher education in China, there has long been a problem of focusing on theoretical knowledge and neglecting practical skills and abilities, especially in the professional retraining of teachers, resulting in the inability to meet the practical needs and desires of teachers, which is contrary to the original intention of organizing the professional retraining of teachers.

In such retraining, there is also a problem with the quality of the teaching staff conducting it. A retraining teacher must have not only a high level of theoretical knowledge but also a deep understanding of and research into practical activities in general education. However, teacher training is mainly carried out by university teachers. Although they have extensive and rich theoretical knowledge, they usually lack the necessary and effective practical experience in school teaching. Therefore, they cannot use the theoretical knowledge to analyze teachers' problems in school practice. This leads to insufficient efficiency in teachers' professional development and demotivation and does not fully contribute to their professional development.

Promoting effective communication and interaction between all stages of teachers' professional development and various learning participants, strengthening the continuity of teacher education content, and improving the quality of teacher education are among the most important tasks to further enhance integration in teachers' professional development in the future.

Conclusion

The integration of teacher education and teacher professional development in China is carried out due to the state's and society's increased demands on the professionalism of teachers, their continuous professional development, and the influence of the foreign educational ideology of "lifelong learning." Therefore, the integration of teacher education in China aims to create a system of continuous teacher education in which each stage is relatively independent but also integrated and connected with other stages to improve the staging and continuity of teacher education.

In integrating teacher education, local authorities, universities, schools, and other educational institutions are actively involved and play their respective roles. Integration in teacher education is mainly reflected in integrating learning objectives, curricula, educational institutions, teacher qualification certification, and educational resources. However, due to various subjective and objective reasons, there are still many issues with such integration in China. One of them is the lack of effective communication and sharing of important information at different stages of teacher training in educational institutions. This leads to weak continuity in the goals and content of teacher education. In addition, there is a lack of highly qualified teaching

staff who can provide professional, continuous teacher education and training in theory and practice.

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КЛЮЧЕВЫЕ ОСОБЕННОСТИ ИНТЕГРАЦИИ В ПЕДАГОГИЧЕСКОЕ ОБРАЗОВАНИЕ И ПОВЫШЕНИЕ КВАЛИФИКАЦИИ УЧИТЕЛЕЙ В КИТАЕ

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Аннотация. *Введение.* В современных условиях нарастания глобализационных процессов, цифровой трансформации во всех сферах деятельности человека единовременное и окончательное образование (once-and-for-all education), то есть «раз и навсегда», уже не отвечает всем требованиям социума и государства к качеству педагогических кадров. В данном контексте интеграция в педагогическом образовании и профессиональном развитии педагогов становится одной из необходимых и неизбежных задач реформирования, модернизации системы образования во всем мире, что во многом связано также с ростом популярности, востребованностью современной образовательной идеологии «обучение в течение всей жизни». Сложившаяся и реализуемая продолжительное время в системе китайского педагогического образования практика ее разделения от системы профессионального развития учителей препятствовала эффективному повышению качества педагогических кадров. Однако уже в конце XX в. в Китае началось всестороннее изучение вопросов интеграции систем, процессов образования и профессионального развития педагогов. С тех пор здесь сложился определенный опыт интеграции профессионального педагогического образования и развития на уровнях и теории, и практики, который требует обобщения и осмысления.

Цель исследования состоит в том, чтобы проанализировав состояние тенденции интеграции в современном педагогическом образовании и профессиональном развитии педагогов в Китае, охарактеризовать ее ключевые характеристики и обозначить наиболее значимые проблемы.

Материалы данного исследования включили научные работы в проблемном поле исследования (преимущественно китайских ученых), документы об образовании в Китае, утвержденные на государственном уровне. Применялись следующие методы исследования: анализ научных трудов, документов, регламентирующих образовательную политику Китая; изучение опыта интеграции в системе педагогического образования и профессиональном развитии учителей Китая, синтез и обобщение.

Результаты и обсуждение. Интеграция в профессиональном педагогическом образовании и профессиональном развитии педагогов в Китае предусматривает рациональное и обоснованное проектирование целей и содержания обучения на всех стадиях профессионального развития педагогов, сохранение их преемственности, целостности, оптимизацию использования образовательных ресурсов и средств обучения, содействие повышению качества учительских кадров. Местное руководство, учреждения системы высшего образования, институты профессиональной

переподготовки школьных учителей являются полноправными участники, субъектами данной интеграции, по-своему способствуя ее реализации в педагогическом образовании и профессиональном развитии учителей.

Названная интеграция в основном отражается в интеграции целей обучения, учебных программ, образовательных учреждений, которые участвуют в профессиональной подготовке учителей, их аттестации, а также в оценке образовательных ресурсов. Основными задачами интеграции в педагогическом образовании и профессиональном развитии учителей в Китае в ближайшее время будут оставаться содействие продуктивному профессиональному общению, взаимодействию и сотрудничеству на всех стадиях профессионального развития педагогов и между различными субъектами педагогического образования, усиление преемственности целей и содержания образования, повышение качества преподавателей, работающих в системе профессиональной переподготовки учителей.

Заключение. Основная характеристика интеграции в педагогическом образовании и профессиональном развитии педагогов Китае состоит в ее направленности на ликвидацию, сокращение разрывов, лакун в процессе профессиональной педагогической подготовки, а также на стимулирование непрерывного профессионального развития педагогов. Интеграция как ресурс повышения качества педагогического образования и развития прослеживается преимущественно на уровнях целей рабочих программ учебных дисциплин и образовательных программ подготовки учительских кадров, образовательных учреждений, аттестации педагогов и оценки образовательных ресурсов, средств обучения. Устранение и минимизация проблем и пробелов обозначенной ингтрации требуют дальнейшего теоретического и эмпирического исследования.

Ключевые слова: *педагогическое образование в Китае, китайские учителя, интеграция, интеграция в педагогическом образовании, интеграция в профессиональном развитии учителей*

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SCIENTIFIC DISCOURSE ON THE CATEGORIES OF "MATURITY" AND "PSYCHOLOGICAL MATURITY" OF PERSONALITY

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Abstract. The article deals with the theoretical and methodological aspects of the concepts of "maturity" and "psychological maturity" of a personality. Russian and international researchers' psychological approaches and views on various aspects of the category "maturity" are scientifically substantiated. Interim conclusion of the study: the definition of personal "maturity" has not been fully clarified to date and requires further scientific and applied research. The concept of "psychological maturity" is reflected in the context of both ontogeny and socialization. Based on existing scientific views, the psychological components of a mature personality are defined. Psychological approaches to studying mature and psychologically mature individuals are analyzed, drawing a parallel between human and psychological maturity. This analysis systematizes the characteristics of a psychologically mature person from a humanistic perspective and presents different levels of psychological maturity. The paper also states that personal maturity is reflected in activity motives, social competence, a high level of responsibility, and a positive attitude toward society.

Keywords: *maturity, psychological maturity, personality, maturation, approaches to understanding maturity, concepts, ontogeny, socialization, characteristics of a mature person, stages of psychological maturity, approaches, characteristics of a psychologically mature person*

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In recent decades, science has paid special attention to the problem of personal maturity [1–4]. As people become more and more interested in themselves, interpersonal relationships become more complex, and as modern life becomes faster and faster, there is an increasing risk that psychologically underdeveloped people will not have the knowledge and skills to cope with life's difficulties on their own. An analysis of the scientific literature on the psychological maturity problem shows that international researchers and Russian scientists have sufficient experience with this definition [5, 6].

When we discuss the concept of "maturity" scientifically, it is important in the first place to define the methodological approaches that reveal the essence of this category. In psychological science, maturity is usually considered a stage of human development representing the longest and most productive phase of activity [7]. This stage is determined by the end of adolescence and the beginning of adulthood. Moreover, maturity is generally considered an

integral aspect of personality that combines certain characteristics and enables effective problem-solving and harmonious interaction with the environment and oneself.

It should be noted that our study will focus on maturity as a personality trait. Therefore, the first methodological approach will reflect the concept of maturity as a temporal guideline of human development, and the second approach will serve as a basis for scientific considerations.

A psychological approach to human development from the perspective of ontogeny allows us to state that the concept of "maturity" encompasses the development of each of the structural components of the psyche: emotional, intellectual, moral, social, and biological. In this regard, we can assume that the formation of personal maturity occurs through social, biological, intellectual, moral, and emotional development. This is proved by the scientific views of national and international psychologists on the problem of personal maturity.

Thus, we refer to the works of K. A. Abulkhanova [8], who defines it as the ability to consider one's personality type and abilities while trying to solve life tasks. According to Abulkhanova, only people with a mature attitude can consider their efforts from the point of view of what is important and what is not. In such cases, truly mature people can self-regulate. Abulchanova also highlights another remarkable feature of maturity, namely the ability to determine and predict the course of a life event and apply various interpersonal interactions. Clearly, the category of maturity based on these criteria represents the highest level of a person's life achievement.

A. Maslow's concept of maturity focuses on the capacity for self-actualization [9]. He emphasizes that a mature person is able to distinguish between the "I" and the "non-I," which is evidence of authenticity and self-actualization [9]. As a result, a mature person is less susceptible to the influences of the social environment and has greater freedom for self-expression and independence in his or her behavior.

B.G. Ananyev identified six types of maturity, including general somatic, sexual, mental, civic, personal, and labor maturity [10]. Biological criteria determine general somatic and sexual maturity, while mental maturity reflects a person's intellectual development. Civic maturity is achieved when a person attains legal capacity, while labor maturity encompasses physical and mental development. Personal maturity, on the other hand, is influenced by the social and economic structures of society, as well as by traditions and national aspects.

It is also worth mentioning N.E. Kharlamenkova's view on maturity as an indicator of personality formation [11]. She focuses on personal maturity in the context of self-control, where a mature person is able to regulate spontaneity and impulsivity through internal motivation and volitional control functions. A.G. Lieders builds on Kharlamenkova's views of personal maturity and extends them by arguing that it expands the boundaries of personality and enables the formation of new behavior patterns [12].

The above interpretations of the concept of "maturity" provide a basis for further understanding this scientific category. However, it is important to note

that the concept of Psychological Maturity is similarly complex and ambiguous [6, 13].

According to the psychological dictionary, Psychological Maturity is the opposite of immaturity and infantilism [14]. P.S. Gurevich explains that maturity is associated with managing one's needs and emotions, regulating one's feelings, and expressing one's attitude toward inappropriate actions or events. It also includes the ability to accept criticism, the autonomy of one's personality, determination, and a realistic assessment of the situation [14].

Personal evolution includes the development of various cognitive processes, such as thinking and speaking, as well as the conative and emotional-sensory areas, which eventually lead to the formation of consciousness. Consequently, the emergence and formation of psychological maturity take place [15].

For a more comprehensive understanding of the term "psychological maturity," we should examine the conceptual approaches in the psychological literature.

It is important to note that the phenomenon of maturity is multidisciplinary and has been studied from the perspectives of philosophy, biology, psychology, and medicine. In this context, we focus on the psychological dimension of the scientific definition. The term "mature personality" was first introduced by A. Adler, who attributed altruism, self-sufficiency, and the capacity for cooperative activities to a mature personality [16].

Z. Freud, the founder of psychoanalysis, considered the psychologically mature personality as the ultimate goal of psychoanalytic therapy. According to Freud, a mature personality shows initiative and problem-solving skills, is able to deal with challenging situations, strives to improve work-related skills, shows altruism and caring for others, and can defer gratification [17].

K. Jung argued that a mature personality is able to take responsibility [18].

According to E. Erikson, a mature personality naturally passes through all stages of development and emerges as a product of social and intrapsychic events [19]. Thus, Erikson's approach emphasizes that psychological maturity presupposes the ability to recognize one's aspirations and desires, to implement them rationally, and to combine the motivational and emotional-volitional spheres.

As representatives of developmental psychology, E. Erikson, J. Lovinger, and G. Craig have also contributed to the study of maturity. The study of the development of personal characteristics in ontogenesis is of central importance [20].

E. Erikson's approach to studying psychological maturity as a part of personal development assumes that people can achieve psychological maturity only in old age. The essential element of maturity is the coherence and consistency of the personal inner world and social relationships [19]. As people mature, they exhibit new patterns of behavior characteristic of their particular stage of development.

According to E. Erikson, the presence and expression of a sense of identity is also an indicator of maturity. He believed a stable identity is necessary for

true personal maturity [19]. Other characteristics of a psychologically mature person are intimacy with developed autonomy, responsibility, and integrity [21]. By integrity, E. Erikson means achieving success through the following characteristics: Autonomy, strong will to achieve goals, competence, responsibility, individuality, and expression of love [22].

J. Levinger developed a theory of personal maturity that combines cognitive development and ego. The theory identifies several stages of personal maturity: presocial (in which attachment to significant adults is paramount); impulsive (characterized by extreme egoism and dependence on the opinions of others); self-protective (characterized by fear of punishment and manipulation for personal gain); conformist (unconditional acceptance of social rules); conscious (development of moral responsibility); autonomous (tolerance of the views of others and resolution of internal conflicts); integrative (understanding of Self and others) [1]. An essential aspect of this theory is that each stage builds on the previous one and allows the individual to develop new characteristics and skills. According to Levinger, only a small percentage of adults (less than 1%) are able to reach the final stages of development, and biological age is not necessarily a determining factor in this process.

In other words, maturity is determined by the development of an autonomous and independent personality, as well as the ability to become aware of and resolve inner conflicts, display authenticity, consistency, and integrity, and show tolerance and respect for others [10]

In addition, the issue of developing psychological maturity remains relevant from a humanistic perspective, especially with regard to mental health. A. Maslow, a proponent of humanistic psychology, shared this view. He believed that the higher a person climbs in the hierarchy of needs, the greater self-awareness he or she attains, leading to the manifestation of qualities and characteristics of a mentally healthy person. Therefore, humanistic psychology states that psychological maturity is associated with the fulfillment of the need for self-actualization [23]. A. Maslow identified several key characteristics that mature, self-actualizing people possess, including acceptance of reality, autonomy and openness, self-sufficiency, respect for others, empathy, the ability to build deep relationships, moral principles, humor, and creativity [9, 24].

Another perspective on the problems of development and formation of psychological maturity came from G. Allport, who focused on personality's general and individual concepts. Allport considered that personality is an open, self-developing system that reflects the characteristics and indicators of a healthy, psychologically mature person [25]. According to Allport, personality continues to develop throughout a person's life. A psychologically mature personality is qualitatively different from an immature personality and is characterized by autonomous, motivated processes of consciousness. In contrast, an immature personality is characterized by unconscious behavioral motives stemming from childhood experiences. Allport identified six key characteristics that a psychologically mature personality must possess. The first characteristic is an extension of the sense of Self. A person with an extended

sense of Self is well-rounded and pursues a variety of social activities, hobbies, and interests. The second characteristic is the ability warm relating of Self to others. Allport divides interpersonal relationships into two types: friendly intimacy and empathy. Friendship manifests itself in the ability to treat family and friends respectfully without feeling jealous or possessive. This trait manifests itself in friendship and goodwill toward others and includes being patient and accepting others' opinions and points of view. The third characteristic of a psychologically mature person is emotional security (self-acceptance), which is the ability to deal with negative life events calmly and without emotional breakdowns. This characteristic reflects the individual's ability to control his or her emotional states, as well as the ability to reckon with the opinions of others and to influence others with one's own.

The fourth characteristic denotes realistic perception, skills and assignments, and the ability to apply existing experience and adjust one's expectations. Mature people perceive things, phenomena, and other people as they are, not distorted by their fantasies. People with a healthy psyche have specific goals in life that they strive for.

The fifth characteristic of mature people is the ability to self-objectify – insight and humor. According to G. Allport, this characteristic includes the ability to recognize one's strengths and weaknesses. However, it is also important not to use humor for self-promotion or empty talk, as this can hinder personal growth.

A unified philosophy of life characterizes the sixth characteristic of a mature person. This means that the person has his or her own value system and can prioritize meaningful things, people, and activities. G. Allport believed that mature people should have a deeply rooted value system.

C. Rogers examined personal psychological maturity through the lens of self-concept [26]. He identified openness to new experiences, adaptability, and a desire for self-improvement as the most important characteristics of a mature personality. For C. Rogers, personality is valuable, unique, and central. The self-concept is a generalized perception of oneself that consists of organized beliefs and attitudes about oneself. A unique aspect of the self-concept is the formation of values that reflect fixed ideas about what is acceptable, meaningful, and important. The core essence of the self-concept is self-actualization.

Existential humanistic psychologists have also made significant contributions to the study of a psychologically mature personality. F. Perls, for example, believed that maturity is expressed in the adaptation of the environment to oneself and in the ability to self-regulate. He held that the formation of psychological maturity proceeds from the rejection of peer support and the realization of self-help. According to Perls, maturity occurs when individuals use their inner resources to eliminate the frustration and anxiety caused by the lack of support from others. A truly mature person must be autonomous and rely on his or her life experience [27].

Another psychologist, E. Fromm, held that a person's abilities and knowledge are shaped by his or her environment, education, and upbringing.

Fromm viewed psychological maturity as the ability to be self-actualized and productive, which he linked to the ability to love. In addition, Fromm believed that mature love meant caring for others, respecting their interests, and taking responsibility for them. Thus, according to Fromm, psychological maturity involves establishing and maintaining interpersonal relationships [28].

The concept of psychological maturity was first introduced in Russian psychology by N.I. Rybnikov [29]. He defined a mature personality as progressive, developing, and self-actualized in professional and other activities. Later, K.A. Abulkhanova-Slavskaya, D.A. Leontiev, and A.G. Asmolov associated a psychologically mature personality with vitality, the ability to shape life according to one's own ideas, and responsibility [8, 24, 26]. V.I. Slobodchikov and A.G. Asmolov particularly emphasize the importance of responsibility in connection with personal maturity [26, 30].

B.S. Bratus defines maturity as the ability to distinguish between ideal and real-life goals and attitudes [23]. L.I. Bozhovich equates personal maturity with independence [31].

G.S. Sukhobskaya refers to the ability to program one's own behavior, overcome difficulties, motivate oneself to achieve goals, analyze one's own activity, formulate conclusions, and be highly reflective as the main indicators of personal maturity. Therefore, the acmeological concept of A.L. Zhuravlev considers the "psychological maturity of a personality" from the point of view of moral development [32]. The authors of this direction consider psychological maturity as a category that includes the humanistic motivation of a personality, a set of norms, rules of behavior, protective behavior, and attitudes [30, 33, 34].

Based on the scientific understanding of the concept of "psychological maturity," stages of personality development are defined.

Thus, the level of psychological maturity should be developed through an adequate reflection of reality, the ability to focus on an object, retain and use information in memory, and logical and critical thinking.

Our study suggests cultivating psychological maturity by focusing on key factors such as emotional stability, emotional and affective maturity, appropriate responses to age and situational demands, maintenance of physical and psychological well-being, cognitive development, and the ability to experience pleasure and heightened states of enthusiasm.

The next level of maturity is personal and social maturity. A mature personality at this level possesses characteristics such as optimism, balance, an appropriate level of ambition, awareness of goals and one's desires, a high degree of self-control, benevolence, purposefulness, appreciation, and meaningful participation in the world.

The highest level of personal maturity is characterized by responsibility, spirituality, morality, and understanding of Self and others.

It is worth noting that the level of personal development correlates with socialization, and the criteria of maturity are manifested in social relationships, motivations, social competence, and activity. Moreover, a truly mature person

is characterized by high responsibility and a developed inner positive attitude towards society.

Thus, the scientific discussion of the concepts of "maturity" and "psychological maturity" of a personality has shown that this problem requires further scientific and applied research, possibly within the framework of interdisciplinary approaches.

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НАУЧНЫЙ ДИСКУРС КАТЕГОРИЙ «ЗРЕЛОСТЬ» И «ПСИХОЛОГИЧЕСКАЯ ЗРЕЛОСТЬ» ЛИЧНОСТИ

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Аннотация. Статья посвящена теоретико-методологическим аспектам рассмотрения понятий «зрелость» и «психологическая зрелость» личности. Научно обоснованы психологические подходы и взгляды отечественных и зарубежных исследователей на различные аспекты категории зрелости. Промежуточный вывод по проблеме исследования: на сегодняшний день дефиниция «зрелость» личности до конца не раскрыта и требует дальнейшего научного и прикладного изучения. Понятие «психологическая зрелость» отражено как в контексте онтогенеза, так и социализации. На основе существующих научных взглядов определены психологические составляющие зрелой личности. Проанализированы психологические подходы изучения зрелой и психологически зрелой личности. Проведена параллель становления зрелости человека и его психологической зрелости. С позиции гуманистического подхода систематизированы черты личности, характеризующие психологически зрелого человека. Доказана стадиальность данной категории. Представлено уровневое становление психологической зрелости личности. Доказано, что зрелость личности проявляется в мотивах деятельности, социальной компетентности, активности, в высокой степени ответственности и в сформированных внутренних позитивных установках по отношению к обществу.

Ключевые слова: *зрелость, психологическая зрелость, личность, становление, подходы к пониманию зрелости, концепции, онтогенез, социализация, качества зрелой личности, уровни становления психологической зрелости, подходы, качества психологически зрелой личности*

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RELATIONSHIP BETWEEN SOCIAL MEDIA ADDICTION, VICTIMIZATION, AND CYBERBULLYING EXPOSURE AMONG COLLEGE STUDENTS

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Abstract. Social media is an integral part of modern life. Internet activity among young people has increased significantly in recent years. However, the extensive use of social media has led to addiction, which has caused numerous problems. This study aims to investigate the possible relationships between social media addiction, the occurrence of cyberbullying exposure, and the victimization of social media users in the Russian-speaking community. The study collected data through an online survey of 211 Slonim State Medical College students. The average age of participants: M = 17.5 (SD = 3.7). Addiction to social media was measured using the "ЗСС-15" questionnaire developed by V.P. Sheynov and A.S. Devitsyn. Victimization was measured using the "Adult Victimization Assessment Technique" developed by V.P. Sheynov. Smartphone addiction was measured using the short version of the "CAC-16" questionnaire developed by V.P. Sheynov. The study also assessed the exposure of individuals to cyberbullying using the approach of V.P. Sheynov.

This study includes a factor analysis: 1) a victimization questionnaire containing propensity factors for aggressive, self-destructive, addicted, careless, and risky behavior, as well as an integrative index of victimization (V.P. Sheinov); 2) a three-factor model of social network addiction: the psychological state of the network user, communication of the network user, and information (V.P. Sheinov). The authors found a correlation between social media addiction among college students and their susceptibility to cyberbullying, victimization, and smartphone addiction. The positive correlation between social media addiction and victimization is supported by the corresponding correlations between most factors that shape these complex constructs. These findings can be used to educate students about the dangers of excessive social media use.

Keywords: *social media addiction, cyberbullying, cyberbullying exposure, victimization, smartphone addiction, adolescents*

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Introduction

Social networks are an integral part of modern life. Young people's participation in online activities, in particular, has increased noticeably. The popularity of social media has shifted much of interpersonal communication from the physical world to cyberspace. Much of this social media communication is positive, and anyone with Internet access can now connect with a large audience.

However, excessive use of social networks often leads to addiction, which causes a number of problems.

Thus, an analytical review of international studies shows "positive correlations between extensive use of social networks and depression, anxiety, stress, neuroticism, emotional problems, low self-esteem, cyber-victimization, physical health problems, mental disorders, loneliness, procrastination" [1, p. 607].

In the Russian-speaking community, "social media addiction was also found to be positively correlated with Internet addiction, stress, procrastination, and low self-control, and negatively correlated with self-esteem" [2, p. 566)].

In college students, a direct correlation was found between social media addiction and anxiety, depression, loneliness, extraversion, and dissatisfaction with life [3, p. 98].

Statistically significant factors associated with social media use were found in both genders. Positive correlations were associated with impulsivity and narcissism, and negative correlations with assertiveness [4, p. 83].

Theoretical analysis of the current problem

Social media is taking an increasingly large place in the daily lives of modern people, and many people now communicate online rather than in person. The use of social media is growing rapidly, and the number of social media users has already reached more than one-third of the world's population. This number is increasing by 10% annually. Since the coronavirus pandemic, people have been spending more and more time on social media and more and more time on their work and studies. For example, before the pandemic, most social media time was spent on Sundays (which is logical), and now, it is Tuesdays, including work and school hours.

Social media has a dramatic impact on people's lifestyles and psychology. Therefore, studying this phenomenon and its impact on all aspects of modern life is very important.

Research by international psychologists has shown that excessive use of social media leads to cyberbullying and victimization. Given the importance of these connections, we will study them in more detail to prepare the ground for our research aimed at possibly discovering similar connections in Russian-speaking society.

The connection between social media addiction and cyberbullying

The accessibility and widespread use of social media has led to new opportunities for online aggression that negatively affect online users. Online aggression has led to a significant number of social media users in different

countries becoming victims of cyberbullying. Indeed, certain users' anger, hatred, and bullying on social media platforms have become commonplace.

Cyberbullying is the use of technology to harass, threaten, shame, or bully another person. While bullying itself is not a new problem, cyberbullying is a new phenomenon with similarities and differences to real-life bullying.

Cyberbullying takes many forms, from aggressive and threatening behavior to social stigma. It negatively affects overall well-being, which can be more severe for people focusing on social media connections.

J. Huang et al. conducted a study among college students in China. Participants were 20.43 ± 1.513 years old, ages 15 to 25 years. 64.32% of respondents reported having suffered from cyberbullying, and 25.98% reported having been bullied online by others during the semester. Gender roles, anxiety symptoms, Internet addiction, time spent playing video games, and violent game elements were associated with cyberbullying on social media. The authors found that social media cyberbullying is common among Chinese students [5].

Factors contributing to susceptibility to cyberbullying were found. In a K. Kırcaburun et al. survey, 44% of 344 university students exhibited at least one behavior associated with cyberbullying. Furthermore, cyberbullies showed higher scores in problematic social media use, childhood depression and emotional trauma, and lower self-esteem. The analysis showed that after adjusting for gender and age, childhood emotional trauma was directly or indirectly associated with cyberbullying, and depression was directly associated with problematic social media use [6].

S. Jain & S. Agrawal's empirical study among 365 social media users found a correlation between social media addiction and exposure to cyberbullying and corresponding gender differences [7].

A.L. Giordano, E.A. Prosek, and J.C. Watson describe a cross-sectional study that surveyed a national U.S. sample of 428 teenagers. Results showed that higher levels of addiction to social media, more hours spent online, and self-identification as male were strong predictors of cyberbullying. Accordingly, individuals who spend more time on social media show signs of addiction, and male users are more likely to engage in cyberbullying [8].

A study by G.W. Giumetti & R.M. Kowalski identified several potential predictors of cyberbullying on social media, including controversial postings, time spent on social media, and personality characteristics. In addition, the authors focus on the potential negative well-being consequences associated with cyberbullying on social media, including psychological distress, lower life satisfaction, and suicidal ideation [9].

In the article by K. Kırcaburun et al., two studies are described: The first involved 804 high school students (48% girls, average age 16.2 years), and the second involved 760 university students (60% women, average age 21.5 years). The results showed that problematic social media use and cyberbullying (more common among high school students) were directly related. In addition, the analysis showed that younger age was a significant factor in predicting problematic social media use and cyberbullying among university students but not among high school students. In both samples, depression was a direct

predictor of problematic social media use and an indirect predictor of cyberbullying. However, most of these relationships were relatively loose [10].

In a study by E. Yildirim, C. Çalici & B. Erdoğan, the sample consisted of 198 Turkish university students aged 18–25. 65% of the participants were female, and 35% were male. Cyberbullying and cyber victimization were positively correlated with anxiety, depression, somatization, hostility, impulsivity, and Internet addiction. At the same time, cyberbullying was negatively correlated with empathy. From this, the authors concluded that cyberbullying and cyber victimization go "hand in hand": both variables show similar correlations with the same psychological aspects [11].

Cyberbullying in the workplace is a widespread phenomenon that has a negative impact on employee well-being. This was shown in a study by A. Oksanen et al. using a sample of employees in five Finnish expert organizations (N = 563) and a representative sample of Finnish employees (N = 1817). The monthly prevalence of cyberbullying victimization at work was 13% in expert organizations and 17% among Finnish workers. The victims were young, active users of social media. They reported more severe psychological distress, exhaustion, and technostress than other respondents [12].

Empirical data from 1,003 adults who had been cyberbullied, according to a study by P.B. Lowry, J. Zhang & C. Wang, led the authors to conclude that heavy social network use combined with anonymity promoted cyberbullying in social networks, which contributed to the prevalence of cyberbullying [13].

One hundred female students from a university in Malaysia participated in a study conducted by N. Hazlyna using an online survey. The results showed that female students are exposed to cyberbullying on social networks. The author explained this by the fact that female students use social media daily, are not confident, and are sensitive to words on social media [14].

A study conducted by K. Kircaburun, P.K. Jonason, and M.D. Griffiths, with 761 participants, found that cyberbullying fully supported the association between problematic social media use and Machiavellianism in both the overall sample and male participants [15].

V.W. Craig et al. conducted a meta-analysis using data from the 2017–2018 "Health Behavior in School-aged Children" international study, which included adolescents aged 11–15 years (n = 180919) from 42 countries. Results showed that problematic social media use was strongly and consistently associated with victimization and cyberbullying. The stratified analysis revealed that problematic social media use was associated with cyber victimization in 45% of the countries studied and with cyberbullying in 86%. The study also found that the amount of time adolescents spent problematically using social media and interacting with strangers online was directly related to cyberbullying. Therefore, problematic social media use is the strongest and most consistent risk factor for cyberbullying [16].

Relationship between social media addiction and cyber victimization

An alarming number of youth between the ages of 11 and 14 are reportedly affected by cyberbullying, bullying through computer technology or online

platforms. Moreover, the online environment creates new opportunities for criminal activity and deviant behavior, according to a study by E. Marttila, A. Koivula & P. Räsänen based on data from nationally representative surveys conducted in Finland in 2017 and 2019. The authors found that problematic social media use is strongly associated with cybercrime victimization and that an increase in problematic social media use increases the risk of victimization. Moreover, problematic social media use, along with several other factors, significantly affects victimization [17].

A study by D.V.S. Kaloeti et al. included 456 children between the ages of 11 and 13 years from nine different elementary schools. The study found that all subjects were active on social media and that bullying, victimization, and gender roles were significant predictors of anxiety in elementary school-aged children. Girls were found to be more affected by anxiety than boys. In addition, boys were more likely than girls to be affected by physical abuse, while girls were more likely to suffer from panic disorder, generalized anxiety disorder, separation anxiety, and social anxiety [18].

M.A. Peláez-Fernández et al. studied a sample of 1,211 high school students (657 girls, 554 boys aged 12 to 18 years, mean age = 13.74). A correlational analysis revealed significant associations between their cyber victimization and their problematic use of social media and smartphones [19].

In a study by H. Sampasa-Kanyinga & H.A. Hamilton, the sample consisted of 5126 respondents aged 11 to 20 years, of which 48% were girls, and the mean age was 15.2 ± 1.9 years. After accounting for age, gender, ethnicity, subjective socioeconomic status, and parental education, the researchers found a correlation between social media use and psychological distress, suicidal ideation, and suicide attempts. Furthermore, cyberbullying victimization mediated the relationship between social media use, psychological distress, and suicide attempts. These findings suggest that addressing cyberbullying victimization and problematic social media use among adolescents could potentially help reduce the risk of mental health problems [20].

The study by M. Erdoğdu and M. Koçyiğit aimed to investigate the extent of cyber victimization among social media users. The researchers collected online test data from 390 Generation Z respondents. The results of the study showed significant correlations at the $p = 0.01$ and $p = 0.05$ levels between the sub-parameters of social media use (communication, information gathering, sharing, following, and leisure use) and the sub-parameters of cyber victimization (cyber harassment, fraud, deception, and obtaining personal information, and virtual fighting and fear). These findings suggest that certain patterns of social media use may increase the risk of cyber victimization [21].

An article by S. Kim et al. based on a study of 316 sixth graders in a public high school in the Midwestern United States showed that problematic social media use was associated with higher levels of cyber-victimization [22].

In the study by C.T. Barry, S.M. Briggs & C.L. Sidoti, the sample consisted of 428 respondents (214 teens aged 14 to 17 years and parent pairs) from the United States. The subjects tended to experience a variety of psychosocial

difficulties in their online interactions. The teenagers' reported victimization was related to their loneliness and lower self-esteem. In addition, social media aggression and victimization were related to self-perception and adjustment to circumstances: Adolescents who reported aggression and victimization on social media were more likely to be rated poorly adjusted by their parents [23]. The above findings are of interest both theoretically and practically. However, there are no similar psychological studies in Russia. Therefore, conducting corresponding studies in the Russian-speaking society seems obvious to investigate the existence of similar correlations. In this case, working hypotheses could be assumptions about the existence of similar correlations.

The correlations found between the problematic use of social media and cyberbullying show that it is a serious problem. Therefore, it is important to try to prevent cyberbullying. To this end, a cyberbullying vulnerability questionnaire was developed to raise social media users' awareness of the risk of becoming a victim of cyberbullying.

Thus, this study aims to determine the perceived relationships between social media addiction in the Russian-speaking community and social media users' victimization and vulnerability to cyberbullying.

Research Methods

Study participants and data collection

Data for the study were collected through an online survey of 211 Slonim State Medical College students. The sample included 181 young women and 30 young men who were second-year medical students (qualification: "Feldsher midwife. Ambulatory and polyclinic care") and "Nursing" Age data of the subjects: M = 17.5, SD = 3.7.

Methods used

The degree of addiction to social networks was measured with the "ЗСС-15" questionnaire [24], the degree of victimization was assessed with the Adult Victimization Assessment technique [25], and smartphone addiction was measured with the short version of the "CAC-16" smartphone addiction questionnaire [26]. In addition, the questionnaire "Assessment of the Degree of Insecurity of Individuals Towards Cyberbullying" was used [27]. This study includes factor structures: 1) a victimization questionnaire containing tendency factors for aggressive, self-destructive, dependent, inarticulate, and risky behaviors, as well as an integrative indicator of victimization [25]; 2) a three-factor model of social network addiction with the factors "psychological state" of the network user, "communication" of the network user, and "information" (information acquisition) [28, p. 145].

Statistical analysis was performed using SPSS-22 software. The level of statistical significance $p \leq 0.05$ was accepted.

Results and discussion

Inspection of the initial data for agreement of the samples with the normal distribution according to the Kolmogorov-Smirnov criterion has shown that the distributions of all samples deviate significantly from the normal distribution.

Therefore, we search for the expected correlations using Kendall correlations, which reveal both linear and nonlinear relationships.

The found correlations of social network dependence are shown in Table. 1–7.

Table 1

Kendall's correlations between social media addiction and personality traits of its users (total sample of male and female)

	Insecurity due to cyberbullying	Victimization	Smartphone addiction
Correlation coefficient	**0.423**	**0.220**	**0.443**
Relevance	0.000	0.000	0.000

Table 1 shows a positive correlation between social media addiction and insecurity due to cyberbullying, victimization, and smartphone addiction in the pooled sample.

The correlations found in the pooled sample may not be present in the subsamples that comprise it. Therefore, we calculate the correlations of smartphone addiction separately for the subsamples of women and men.

Table 2

Kendall's correlations between social media addiction and personality traits of users (female).

	Insecurity due to cyberbullying	Victimization	Smartphone addiction
Correlation coefficient	**0.415**	**0.195**	**0.440**
Relevance	0.000	0.000	0.000

Table 2 shows that in the girls' sample, social media addiction is positively correlated with insecurity due to cyberbullying, victimization, and smartphone addiction.

Table 3

Kendall's correlations between social media addiction and personality traits of its users (male)

	Insecurity due to cyberbullying	Victimization	Smartphone addiction
Correlation coefficient	**0.524**	**0.361**	**0.439**
Relevance	0.000	0.007	0.001

Table 3 shows that in the male sample, social media addiction is positively associated with insecurity from cyberbullying, victimization, and smartphone addiction.

Thus, there is a directly proportional relationship between social media dependence and insecurity due to cyberbullying, victimization, and smartphone addiction in both females and males.

The patterns of social media dependence found in this study are consistent with the findings of international researchers regarding 1) victimization [17–23]

and 2) insecurity due to cyberbullying, which indicate a relationship between social media dependence and cyberbullying [5–16].

The demonstrated positive correlation between social media addiction and smartphone addiction is also reflected in the results previously obtained abroad and in Russian-speaking societies [1, p. 697; 2, p. 566].

Since the correlations found relate to both men and women, they can be further examined on a combined sample. This offers the additional advantage of a higher statistical significance of the results, which is given by the large size of the sample studied.

Factor models of the personality traits studied allow for a more in-depth examination of a number of the relationships found. For example, table 4 shows the result of the study of the relationship between addiction to social media and the victimization components of the users of these media.

Table 4

Kendall's correlations between social media addiction and victimization components of users (total sample)

	Behavioral styles					Total victimization
	aggressive	self-destroying	dependent	uncritical	risky	
Mental state	**0.282****	–0.010	**0.223****	**0.243****	**0.170****	**0.280****
Communication	0.046	–0.059	**0.164****	0.037	0.010	0.062
Information	**0.157****	–0.051	**0.115***	0.063	0.051	**0.134****
Social media addiction	**0.220****	–0.039	**0.211****	**0.168****	**0.127***	**0.220****

Note. The following notations are used in Tables 4–7: ** – Correlation (two-sided) is significant at the 0.01 level, * – Correlation (two-sided) is significant at the 0.05 level.

Table 4 shows that the positive correlation between social media dependence and victimization is due to the mutual positive correlations between a number of factors that make up these complex constructs. This effect is best illustrated by the strongest correlations between the psychological factor of social media addiction and the components of victimization (in descending order): the tendency to engage in aggressive, non-critical, dependent, and risky behavior. This seems quite understandable, as such behaviors do indeed contribute to the victimization of individuals.

The "information" and "communication" factors play a lesser role in these relationships in social media addiction.

The relationship between social media addiction and the components of victimization is consistent with our previous finding that victimization is positively associated with incompetent, dependent, and aggressive behaviors [29, p. 150].

Examining whether the correlations observed in Table 4 vary between male and female participants is important. Tables 5 and 6 show the results of this analysis.

Table 5

Kendall's correlations between social media addiction and victimization components of users (female)

	Behavioral styles					Total victimization
	aggressive	self-destroying	dependent	uncritical	risky	
Mental state	**0.260****	–0.037	**0.232****	**0.247****	**0.159****	**0.260****
Communication	0.052	–0.105	**0.155****	0.024	0.012	0.045
Information	**0.150****	–0.066	**0.126***	0.059	0.033	**0.121***
Social media addiction	**0.208****	–0.075	**0.218****	**0.161****	**0.114***	**0.195****

Table 6

Kendall correlations between addiction to social media and victimization components of its users (males)

	Behavioral styles					Total victimization
	aggressive	self-destroying	dependent	uncritical	risky	
Mental state	**0.408****	0.100	**0.177***	**0.194***	**0.171***	**0.366****
Communication	0.077	**0.251***	**0.205***	0.127	0.025	**0.222***
Information	**0.173****	–0.048	0.062	0.095	0.109	**0.173***
Social media addiction	**0.316****	0.131	**0.192****	**0.226****	**0.196****	**0.361****

Tables 5 and 6 show that the associations between social media addiction factors and victimization components found in the overall sample occurred in both males and females.

The following table shows the associations between cyberbullying insecurity and victimization components in all samples studied.

Table 7

Kendall's correlations between cyberbullying insecurity and the victimization components (males)

	Behavioral styles					Total victimization
	aggressive	self-destroying	dependent	uncritical	risky	
Total sample	**0.331****	**0.112***	**0.311****	**0.336****	**0.254****	**0.398****
Women	**0.323****	0.096	**0.321****	**0.348****	**0.256****	**0.391****
Men	**0.358****	**0.163***	**0.269****	**0.247***	**0.171***	**0.390****

Table 7 shows that the positive correlation between cyberbullying insecurity and victimization among males, females, and all students is generally due to the positive correlations among all components of victimization.

Conclusion

The study's findings suggest that students more addicted to social media are also more prone to cyberbullying, victimization, and smartphone addiction. These findings are consistent with previous studies by international researchers.

When examining gender differences, a positive correlation was found between cyberbullying insecurity and victimization among girls, boys, and all students in general, driven by positive correlations among all components of victimization.

Overall, these findings have practical implications for educating students about the potential risks associated with excessive social media use.

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ВЗАИМОСВЯЗИ ЗАВИСИМОСТИ УЧАЩИХСЯ КОЛЛЕДЖА ОТ СОЦИАЛЬНЫХ СЕТЕЙ С ВИКТИМИЗАЦИЕЙ И НЕЗАЩИЩЕННОСТЬЮ ОТ КИБЕРБУЛЛИНГА

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Аннотация. Социальные сети – важная составляющая современной жизни. При этом значительно возросла активность молодежи в Сети. Однако чрезмерное увлечение социальными сетями привело многих к попаданию в зависимость от них, что создало многочисленные проблемы. Целью данного исследования является обнаружение в русскоязычной среде предполагаемых связей зависимости от социальных сетей с незащищенностью от кибербуллинга и виктимизацией пользователей социальных сетей. Данные для исследования были собраны посредством онлайн-опроса 211 учащихся Слонимского государственного медицинского колледжа. Показатели возраста испытуемых: M = 17,5, SD = 3,7. Зависимость от социальных сетей измерялась опросником ЗСС-15 (авторы В.П. Шейнов, А.С. Девицын), виктимизация – Методикой оценки степени виктимизации взрослого индивида (автор В.П. Шейнов), зависимость от смартфона – короткой версией САС-16 опросника зависимости от смартфона (В.П. Шейнов), незащищенности индивидов от кибербуллинга» (В.П. Шейнов).

В данном исследовании задействованы факторные структуры: 1) опросника виктимизации, содержащего факторы склонности к агрессивному, саморазрушающему, зависимому, некртитчному и рисковому стилям поведения, а также интегративный показатель виктимизации (В.П. Шейнов); 2) трехфакторная модель зависимости от социальных сетей с факторами: «Психологическое состояние» пользователя сети, «Коммуникация» пользователя сети и «Информация» (В.П. Шейнов). В статье установлено, что зависимость от социальных сетей девушек и юношей положительно связана с их незащищенностью от кибербуллинга, виктимизацией и зависимостью от смартфона. Положительная связь зависимости от социальных сетей с виктимизацией реализуется за счет взаимных положительных связей между большинством факторов, формирующих эти сложные конструкты. Практическое значение полученных результатов состоит в возможности использовать их в разъяснении учащимся и студентам опасностей чрезмерного увлечения социальными сетями.

Ключевые слова: *зависимость от социальных сети, незащищенность от кибербуллинга, виктимизация, зависимость от смартфона, факторы, девушки, юноши*

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ADVANTAGES OF TRANSSPECTIVE ANALYSIS IN HISTORICAL PSYCHOLOGICAL RESEARCH

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Abstract. In modern historical and psychological research, conducted in accordance with the post-non-classical methodology, it is necessary to shift the cognitive orientation points: from the directions, schools, research programs, concepts of a certain historical period in the development of psychological science to the ways of thinking and types of rationality implemented in it; from a monological, retrospective description of the processes of formation and transformation of the conceptual apparatus of a certain psychological school to a reflexive-dialogical reconstruction of the conceptual heritage of the relevant scientists in each case in the light of today and tomorrow in the development of psychology; from the usual thematic headings and sections of psychological knowledge to the areas of "overlaping" (metaphor of V.E. Klochko) of different types of scientific rationality, in the moving boundaries of which the processes of "rebirth of scientific tissue" (metaphor of L.S. Vygotsky) of psychology proceeded most actively and fruitfully; from known and accepted theories to concepts previously considered peripheral or even marginal, but containing an underestimated heuristic potential; from the traditions of adaptation of scientific explanatory schemes in psychology to the assimilation by psychology researchers of the philosophical and ideological heritage and of the descriptive potential of literature and art.

In order to compare the traditional and post-non-classical views of historical and psychological research, the author proposes the metaphors of "restoration" and "renaissance," which illustrate different approaches to reconstructing historical forms of scientific thought: the preservation of the conceptual monuments of psychological science and the meaningful reconstruction of the conceptual heritage of psychology with a constructive revision of its heuristic potential.

The productivity of the application of transspective analysis (developed by V.E. Klochko) in historical and psychological research is justified because it allows: to build analytical bridges between conditionally closed scientific systems and schools; to understand the natural tendencies of complication of psychological knowledge, taking into account the competition and coexistence of types of scientific rationality; to identify the correspondence and complementarity of psychological concepts, between which there are significant temporal or paradigmatic distances; to model the dialog and confrontation of scientists who, for various reasons, did not belong to the same circle of referents or opponents.

Keywords: *History of psychology, psychological knowledge, post-non-classical psychology, methodological reflection, conceptual sphere, transspective analysis*

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In the modern history of psychology, the methodological problems of psychological science are interpreted in a concentrated form. Reconstruction of scientific systems, schools, and approaches involves not only revealed and consistent knowledge but also tacit knowledge that is not fully reflected and formalized in coherent theories and rigorous concepts. Historical and psychological analysis is often faced with the task of reconstructing and describing the unfinished conceptual apparatus in its formation and development, especially when it comes to the new and recent history of psychology. In describing moments of crisis (or "eternal symptoms" of a permanent methodological crisis) in the development of psychological science, the psychologist-historiographer is therefore forced to decide for himself the choice of methodological optics and meta-approaches from whose position the entire conceptual and factual landscape of the field that interests him or her is available for analytical investigation. "At the same time, it is impossible not to notice," writes V.A. Mazilov, "that the problems characteristic of Russian psychology are manifested in the modern history of psychology. The main problem is the insufficient methodological elaboration of historical and psychological science and the unsolved number of important questions that have methodological aspects" [1, p. 91]. The problem of subject and method, characteristic of all psychology, is undoubtedly one of the most important methodological problems in the history of psychology. The researcher is inevitably faced with the following dilemma: the history of which psychology should he or she describe and systematize? Thus, E.E. Sokolova notes that the fundamental conflict between spiritualistic and physiological psychology in the struggle over their subject matter has not disappeared from the agenda of the contemporary development of psychological science: "... along with the periodic calls to "bring the soul back into psychology," a seemingly directly opposing trend is intensifying to find a solution. Mechanisms of the psyche by studying neurons, neural networks, mapping the brain, which is an updated version of the same old idea about the psyche as a function of the brain" [2, p. 36].

At first glance, the methodological possibilities that the history of psychology has as an independent complex discipline are more than sufficient to solve most scientific and historiographical questions. T.D. Martsinkowska identifies four main research areas for forming psychological concepts with methodological tools peculiar to these areas [3]. The first, according to the author, "focuses on the study of the general patterns of the development of psychological science. Therefore, the leading research methods here are those introduced by M.G. Yaroshevsky of the concept of logic and the social situation of the development of science" [3, p. 75]. On the one hand, it is necessary to reveal the intrinsic logic of the development of psychological science (so to speak, the immanent, "objective" logic), on the other hand, to

reconstruct the social situation (socio-historical context, "spirit of the times"), which predetermined the change (and sometimes stagnation) of logical, psychological knowledge. The second research direction is "the formation of knowledge about the development of the psyche in the context of history and culture" [3, p. 75]. Here, the analytical focus is on the progress and cumulativity of psychological knowledge in the context of a particular cultural paradigm. In the center of research interest of the third area of historical and psychological analysis "fall the regularities of the emergence and collapse of individual scientific schools and the features of the development of psychology within a particular school" [3, p. 76]. In this direction, T.D. Martsinkovskaya suggests using the methodological tools proposed by M.G. Yaroshevsky and the philosophers of science – K. Popper, I. Lakatos, and P. Feyerabend.

Among these tools that allow strengthening the analytical view of a psychologist-historiographer are: "the circle of opponents," "scientific school," "cognitive style," "discourse," "competition of ideas," and "the concept of assumptions and refutations." The fourth direction focuses on studying "the genesis of psychological knowledge about individual problems" [3, p. 76]. Within its framework, "the concepts of the circle of opponents and cognitive style are also used, as well as the idea of progress, which, however, is presented here more as an accumulation of knowledge" [3, p. 76]. In this historical and psychological research program, the emphasis is on the investigative version of reconstructing the processes of forming psychological concepts within cultural and historical contexts, paradigms, scientific schools, and disciplines. Discursive, polemical practices, competition/complementarity of scientific ideas and hypotheses are considered–however, T.D. Martsinkowska considers the process of formalization and development of scientific concepts cumulatively. The "figures" of historiographic reconstruction and analysis are regularly and constantly formed products (concepts, theories) of the intellectual activity of scientists. In this case, the ways and styles of thinking, personal knowledge, and epistemological attitudes of scientists remain "in the shadow" of the formation of the conceptual field of psychology.

The magnitude of the "eternal" problems of psychology requires the search for appropriate methodological optics, which would make it possible to direct and distribute the attention of research not only to individual local-temporal projections of a particular problem (and ways to its solution within a particular scientific school) but also to the process of transformation of the problem field itself. This process usually coincides with the process of changing scientific attitudes and rationality of scientists. Therefore, the research focus in the history of psychology sometimes has to be transferred from the directions, schools, research programs, and concepts of a particular historical period to the "fundamentally new way of thinking and the kind of rationality" that stood behind them and was implemented in them [4, p. 71], as well as to their dialog and confrontation with the forms of thinking traditional for that period.

The question of methodological elaboration for the history of psychology is very relevant, especially with regard to the determination of that methodological optics, which would be relevant to the scope of the problems

characteristic of psychology as a whole. In general, this is a question of the adequacy of the discipline of the history of psychology (and its methodological tools) for the problems of psychological science, which, as you know, is always broader and more mobile than the former. V.E. Klochko understood this very well when he justified the need to develop and include transspective analysis in the methodological toolkit of post-non-classical psychology: "Going beyond the established field that science has outlined at this stage of its development becomes inevitable when a problem field overlaps that field. The emergence of this "overlap" is due to the limitations of the explanatory schemes explained by the method that has determined the content and configuration of the subject field" [5, p. 99].

The solution to the question raised is to shift the focus of research attention from the usual thematic headings and sections of psychological knowledge to these "overlaps" within whose moving boundaries the process of "rebirth of the scientific fabric" (L.S. Vygotsky's metaphor) of psychology is most active and fruitful. However, in order to shift this analytical focus, it is necessary to understand methodology not as a set of predetermined principles and methods of cognition that supposedly exist independently of the researcher but as "a kind of rational-reflexive consciousness embodied in methodological analysis and aimed at investigating, improving, and constructing methods in various fields of spiritual and practical activity" [6, p. 535]. From this, the principle of conjugation of the methodological tools the researcher uses and the nature of his or her thinking becomes evident in the context and "force field" of which these tools become appropriate and effective organs of knowledge for the researcher.

The primacy of rational-reflexive consciousness and thought over the instrumental and normative components of methodological analysis allows us to view methodology from a different, anthropological angle: not as a set of principles and methods of cognition, but "as a self-reflexive ascent of the researcher to his or her own philosophical and methodological position" [7, p. 6]. Since methodology itself fulfills the function of a "reflexive mirror" and is a special form of "self-consciousness of science" [8], this requires special reflexive-analytical equipment and elaboration on the part of the researcher. "It can be assumed," writes V.M. Rozin, "that modern intellectual, scientific discourse presupposes a clear reflection on the features of thought within which it is constructed" [9, p. 149]. The researcher must know the theoretical value and the personal (implicit) foundations of scientific activity: "... by clarifying the formal structure of knowledge, the methodologist explains the substantive conditions for the meaningfulness of knowledge as a product of conscious activity" [7, p. 18]. Reconstruction of the movement of scientific thought, and the history of its formation, requires the researcher to explain and expand the methodological foundations and conditions for understanding these processes because the question of clarifying the conceptual origins of a particular theory sometimes finds its solution only in the context of the zone of the nearest or even extremely distant development of this theory.

The solution to the problem of reconstructing psychology and its individual fields of study requires the use of means of perception appropriate to: a) the discipline itself; b) the tendencies in scientific knowledge inherent in the current and immediate periods in the development of psychological science; c) the type of rationality from which it is studied; d) the methodological guidelines and standards from which the significance of the theory and event in the retrospective of psychological knowledge is judged. The definition of key and turning points in the development of scientific thought and the method of historiography are primarily determined by the methodological orientations peculiar to the researcher. This dependence has been described in great detail by I. Lakatos [10]. Thus, for the inductivist historian, only the judgments of his predecessors about "established facts" and generalizations derived by induction have historiographical value. Only such scientific discoveries receive due attention in his or her historiographical notes. They form the "backbone of the internal history of science" [10, p. 261]. In parallel, he or she will describe the history of pseudoscience and attempt to separate beliefs and ideas not based on solid empirical facts from genuine scientific discoveries. Conventional historians are more tolerant of speculative and false assumptions (no matter how fantastic they seem) if they have sufficient predictive power, conceptual coherence, and heuristic potential. Historians' falsifiers are of value in reconstructing the development of scientific knowledge only if they posit theories that contradict the "basic claims" at a given point in time and predict the occurrence of such facts that are new and "unexpected from the standpoint of previous knowledge" [10, p. 269]. A historian who adheres to the methodology of research programs views the development of scientific thought through the prism of theoretical and empirical rivalry between the "main research programs" [10, p. 291] and points out the moments of scientific progress and regress that have accompanied this struggle.

In psychology, since its beginnings, as in any other science, "protracted" problems and epistemological leitmotifs have been preserved (subject areas in which the scientific fabric is constantly "born" and "reborn"). Their reconstruction and productive rethinking are possible through the application of the method of theoretical research, which allows recreating the logic of the emergence and transformation of scientific thought, its "pillars," its "detours," and the moments when they intersect. W. Reich once made an exact remark that coincides with our reflections: "The history of science is a long chain of continuations, developments, deviations from the beaten path and return to it, restoration of knowledge on a new basis, criticism of other views, new deviations from the pillar path and return to it, and creation of something different, new. It is a long, hard path" [11, p. 16]. If we adhere to such an understanding of the historical path of psychology as a science, then not only well-known theories inevitably come into the researcher's field of vision, but also the so-called marginal theories that stand on the edge of scientific knowledge without adequate reflection. The analytical focus must not be on the declarative version of historical reconstruction, which is concerned with restoring the chronology of change in the scientific systems of the past and

establishing the continuity of scientific ideas and methods of cognition. The growth of knowledge in psychology was by no means always progressive in nature and rarely obeyed the cumulative principle: "The development of science, including psychology, is not a linear but a very complex process, on the path of which zigzag courses are possible, unrecognized discoveries, return to already existing solutions, stagnation, crises [12, p. 136]. Therefore, the focus should be on the reconstruction of the plan of rethinking [13] in order to reconsider the conceptual heritage of those scientists whose thinking was ahead of the times in the light of modern research trends and methodological tendencies in order to re-examine their prognostic and heuristic potential through methodological reflection: "The truly great among them were able to climb the escalator of their own thinking so high that, having been ahead of us, they are still above us today" [14, p. 23]. The main methodological reference point here is "a 'conversation' with psychologists and philosophers of the past...in which the contours of a new methodology are drawn" [7, p. 7]. Arming the researcher with such a reflexive lens allows non-obvious, implicit, peripheral, or even marginal concepts to become the focus of methodological analysis (as O.V. Lukyanov [15] has done), in which the contours of future psychology shine through, and post-non-classical rationality is embodied. The moments associated with the anthropological turns of psychological thought are particularly valuable for research within such a perspective view. Moments when classical psychology deviated from its pillar ways and, contrary to the prepared positive heuristics, rushed to grasp the whole human being and focused the search on subject areas of human scale.

The history of psychology in its modern version is not only and not so much about retrospective description and analysis of the theoretical and conceptual heritage of psychological science, about establishing the continuity and relatedness of scientific ideas, about reconstructing the "conceptual palette" of one or another historical period in the development of psychological thought. All this is necessary, of course, but apart from the need to understand the trends and prospects for the development of psychology and to reconsider this conceptual and theoretical heritage in the context of new methodological guidelines, there is a danger that it will become a very fruitless archiving of supposedly already existing and closed files of scientific knowledge. The history of psychology cannot be limited to digging up conceptual fossils and fixing and storing historical evidence of the multilinear process of formalization and transformation of psychology's specialized knowledge, its categorical and conceptual apparatus. "In other words, in order to reconstruct the developmental tendencies of science, to identify the process of progressive growth of scientific knowledge, the rebirth of forms and styles of scientific thinking, the natural transformations of the scientific subject in the process of its self-development, there are not enough of the traditionally established means of historical and psychological knowledge" [5, p. 91]. This explains the necessity of the transspective analysis, which turns out to be almost the only method adequate to the dynamic processes accompanying psychological knowledge. To use a well-known literary metaphor, it is a kind of "Mobilis in

mobili" or moving in a moving thing dynamic analysis of open, self-evolving systems (to which psychological science itself belongs) is, according to the founder of transspective analysis, V.E. Klochko, one of the main tasks in the development of post-non-classical psychology: "Two key tasks of post-non-classical science, among which we include a dynamic analysis of the development of psychology through the prism of understanding it as a self-evolving scientific system and a theoretical (systemic) redefinition of the subject of science, are so far outside the methodological problems discussed in psychology" [16, p. 157].

If we take into account that some concepts only today receive the due understanding and fall into the long-awaited circle of opponents, then it is more correct to speak not of completed acts of cognition but of continuous scientific thinking (for example, the continuous thinking of L.S. Vygotsky or V.P. Zinchenko). Here it would be appropriate to contrast the metaphors of the Restoration and the Renaissance to highlight the essential differences between the traditional and the post-non-classical understanding of the history of psychology. In the first case, scientists are concerned with the restoration of "monuments" in strictly defined historical periods of the development of scientific thought with dates, with the establishment of a more or less strict chronological sequence of scientific ideas, and with the reconstruction of the intellectual situation of the time (Zeitgeist) to which these ideas corresponded. At the same time, the emphasis is on the analytically neutral reproduction of the scientific views and concepts of the past. This is a kind of attempt to realize the ideal of objective and impartial review and revision of psychological doctrines in their historical chronology. If there is any interpretation here, it bears the stamp of rigorous exegesis. In the second case, the emphasis is on the revival of scientific ideas, on the rereading of the works of scientists, especially those whose conceptual and heuristic potential becomes fully intelligible only from today and tomorrow in the development of psychology (its inherent trends). It seems that the obvious and established views of the scientists of the past are given a second life, become relevant and fresh again, and acquire a constructive-dialogical orientation. "To understand Vygotsky," notes A.A. Bubbles, "is to make him a partner in thinking about the problems we face in our own work in the situation that is developing in modern psychology" [4, p. 84]. Here the effect of mutual reinforcement of viewpoints and methods of scientific thinking can occur: On the one hand, we strengthen our own theoretical and methodological foundations through unexpected rediscoveries of seemingly obvious ideas, and we "draw" new meanings from the texts of our predecessors, we create alienations (a term of V.B. Shklovsky) from the commonly understood conceptual clichés. On the other hand, we project our cognitive attitudes into these texts, giving them a new ideological and semantic potential based on the modern level of development of psychology and on those analytical connections that have become possible only from the standpoint of modern rationality. As a result, the ideological heritage of the scientist begins to acquire a new, non-trivial meaning (as if a completely new facet is found in the already seemingly familiar conceptual prism of their

theoretical constructions), and the one who conducts an invisible dialog with him, in his turn, performs a constructive decentering, overcomes his or her own analytical prejudices, expands his or her exploratory thinking with a new conceptual optics.

It is impossible to pin a scientist's thought (on the principle of assembling an entomological collection) unambiguously on a particular page of the calendar of the history of psychology and to set impenetrable limits to it. This closes the approaches to understanding the movement of scientific ideas, communication, and cross-fertilization processes. Thus, as a basis for building a philosophy of psychology (to which A.N. Leontiev once referred), V.A. Mazilov proposes "the concept of communicative methodology, focusing on the correlation of various psychological concepts" [1, p. 95]. Of course, the communication of scientists overcoming the temporal and conceptual framework is necessary, but only if, according to V.I. Kabrin, it is accompanied by overcoming the "fatal reduction" and the established "conventional templates in which traditional communication is trapped" [17, p. 17]. In order to realize the possibility of building such a fruitful transcommunicative methodology, unencumbered by conventional schemes and templates, it is necessary to go "beyond the method and methodology that provide us with saving procedures and certain interpretive schemes" [17, p. 17]. However, the inertia of the usual mini-paradigm logics and explanatory principles is such that implementing V.I. Kabrina's methodological hopes remains a challenging (and frightening for many researchers) task. According to V.E. Klochko, the conditions for its solution are complicated by the maintenance of the following tendency: "The tattered knowledge multiplies spontaneously, and the conceptual partitions erected by the local paradigms, on which the theories are based, are not permeable enough for constructive dialog" [16, p. 157].

Transspective analysis as an essential methodological tool of systemic anthropological psychology makes it possible to see through these "conceptual partitions" the tendencies to complicate psychological knowledge and to enter into the ongoing dialog of scientists whose scientific views were in conceptual agreement. However, they held them at different historical times (were not contemporaries) or were contemporaries, but for various reasons, were not clear representatives of an opposing circle (as M.M. Bakhtin and L.S. Vygotsky or like A.A. Ukhtomsky and P.A. Florensky). Of particular interest and scientific value is the modeling of the possible communication of such psychological concepts between which there are considerable temporal or paradigmatic distances. V.S. Kubarev made one of the most productive attempts to implement this principle relatively recently [18].

The solution of such research problems is an example of the productive use of transspective analysis as a method for modeling the timeless dialog of scientists, linking their explicit and implicit theoretical points of view and overcoming the usual mini-paradigm logics and explanatory schemes. It makes it possible to make completely new subject areas a figure of historical and psychological analysis: "the discovery of mechanisms for changing attitudes, 'prisms of seeing,' the identification of 'overlapping zones' in

interparadigmatic transitions, the origins of the emergence of new paradigmatic foundations in the space of established methodological principles and approaches" [5, p. 90].

The phenomenon of semantic resonance of value and worldview bases of psychological thinking, their coordination with the worldview of philosophers, representatives of literature, and art made it necessary to introduce a new concept into the methodological toolbox of the history of psychology – the "reference circle" [3]. Already V. Dilthey stated that "in the way great writers and poets approach human life, there is to be found abundant food and a task for psychology" [19, p. 29]. The enrichment of the conceptual apparatus of psychology did not infrequently occur in a "roundabout way" – by absorbing the philosophical and ideological heritage and potential of literature and art. The introduction of such a concept makes it possible to go beyond the monodisciplinary concept of the "opponent circle" and to include in a dialogical field the views of those scientists and artists "whose views, sometimes coming from a completely different field of knowledge, became a stimulus for the development of their own positions, new ideas in their field" [20, pp. 8–9]. Of particular interest is also the conceptual heritage of researchers who were ahead of their time, thinking not from their own concrete historical situation in the development of psychology but from the situation of tomorrow. "The foundations of transspective analysis were laid by those who, earlier than others, could go beyond the established schemes of understanding and explanation dictated by classical rationality" [5, p. 91]. We have already attempted to consider the conceptual heritage of the precursors of post-non-classical psychology (A.A. Ukhtomsky and P.A. Florensky) [21, 22].

The method of theoretical reconstruction, description, and critical analysis of scientific systems of the past with a pronounced emphasis on logic, the social situation of the development of science, and categorical analysis (A.N. Zhdan, T.D. Martsinkovskaya, M.G. Yaroshevsky) allow us to fully recreate the historical and epistemological situation of one or another historical stage in developing psychological thought. Thus, it is possible to imagine the historical path of psychology as a chain of discrete stages of its history (considering its temporal, paradigmatic boundaries). However, at the same time, this proves insufficiently effective in solving the problem of reconstructing the types of scientific thought in their constant complication, collision, and rebirth. Therefore, the main focus of historical and psychological research should be on the analysis of the process of formation of such theories that can consistently assimilate different ideals of rationality [5]. However, the realization of this research goal is possible only with a post-non-classical view of the history of psychology, which considers it "as a process of progressive complication of science understood as an open system" [5, p. 90]. Therefore, in order to understand how the central methodological problems of psychology, the problems of subject and method, were solved at each stage of the development of psychological knowledge, a perspective review and reconstruction of the transformational tendencies (processes) that took place at one or another stage of the development of psychology is required, including the reconstruction of

those "anomalies" (T. Kuhn) that persistently testified to the need to include phenomena related to human-sizedness in the subject matter of psychology.

In this respect, the Transspective analysis is the optimal method of post-non-classical science. It allows directing the research focus on the processes and mechanisms of self-organization "in self-developing systems" on the dynamic moments of self-motion and self-development of these highly complex functional systems [16]. In this case, the method itself is compared with the subject of research (which is a rather rare case), which allows to capture the complex dynamics of formation and redefinition of the subject. The founder of this method, V.E. Klochko, described the advantages of this method: "As a dynamic, transspective analysis, it is also temporal, taking into account the determination of the future; trendy, i.e., it identifies tendencies in the formation of open systems by considering them as gradients – directions in which possibilities gain strength to be implemented; prognostic, in that on this basis it is possible to make fairly reasonable predictions about the formation of the system; systemic, in that it takes into account the determination resulting from psychological (system-wide) neoplasms produced by the system in acts of interaction with the environment" [16, p. 163]. In terms of historical and psychological research, these aspects of transspective analysis include: the filling of conceptual gaps in the dynamic picture of the complication of psychological knowledge; the identification of stylistic and ideological-semantic correspondences between the specific historical formations of the scientific thought of scientists that have determined the field of the current and immediate development of psychology; the identification of tendencies in the development of psychological thought that are still implicit, including those tendencies that go beyond the established paradigms and are perceived as anomalous processes of knowledge transformation; an assessment of the theoretical significance and heuristic value of the conceptual heritage of psychology (in the form of individual schools and representatives of psychology), starting from the constructive role it has played not so much in its historical time but in the distant future; the consideration of the determinism of psychological knowledge through moments of polemical and synergistic interaction of carriers of academic and practical knowledge (including the identification of moments of complication of scientific and psychotechnical thought).

The essence of transspective analysis is not reduced to a retrospective description of the scientific systems of the past but is revealed in the researcher's ability to fix the moments of the interpenetration of realized, ongoing, and emerging knowledge. In the case of the history of psychology, "...the part of historical analysis necessarily includes not only the "past," but also the present and the future, and is primarily fixed in relation to a particular action (which is also subject to some reconstruction) – organized in the present situation in view of the underlying goals in the future" [4, p. 81]. The part of historical-psychological analysis endowed with a perspective view is not a specific historical concept (as, e.g., the concept of thinking Yesterday, Today, and Tomorrow), but such a concept, in the semantic content of which are

contained the processes and results of interpenetration of various historical forms and conceptions of the problem field of the psychology of thinking, including those whose conceptual contours are just maturing in the living, conceptually incomplete discourse of researchers, dictated by the tasks of the psychology of thinking of tomorrow.

To summarize the original outcome of this paper, we turn once again to the key concept whose meaningful disclosure sets a post-non-classical milestone in the planning and conduct of historical and psychological research. Transspective, according to V.E. Klochko, "is not retrospective (a view from the present into the past), not perspective (the design of the future from the present). It is such a view, thanks to which each point on the way of human development (the steady progress of becoming human) is understood as a place of coexistence of times, their interpenetration, and mutual transition, where the tendency to complication of a human as a systemic organization is realized. Each of these places is interesting because it is located in the habitat of particular people who lived in different epochs" [23, p. 12]. By applying the transspective analysis, we get the opportunity to discover certain places of convergence and interpenetration of styles of scientific thought of conceptual fields: a historical perspective pervades the scientist, whether he wants to admit it or not, in the "fabric of scientific knowledge" (L.S. Vygotsky): he writes himself, but his hand is guided by those who were before him, and to no less extent by those who will be after him. ..." [16, p. 159]. In other words, a researcher conducting a transspective analysis must make the temporal counterpoints of evolving and increasingly complex scientific thought (including his own thought) the object of his methodological considerations in order to find points of attraction for consonant, complementary ideas that have been either realized, then forgotten, and then recognized again by scientists as conceptual guidelines for the positive heuristics of a particular psychological theory. Solving such a problem requires a completely different understanding of the logic of the development of scientific knowledge. The cumulative-progressive growth of the conceptual sphere of psychology and the linear progress of scientific and psychological thought are the components of an epistemological myth that is convenient for scientists and characterizes their cognitive attitudes to a greater extent than the actual process of psychological knowledge transformation.

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ПРЕИМУЩЕСТВА ПРИМЕНЕНИЯ ТРАНССПЕКТИВНОГО АНАЛИЗА В ИСТОРИКО-ПСИХОЛОГИЧЕСКИХ ИССЛЕДОВАНИЯХ

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Аннотация. В современных историко-психологических исследованиях, проводимых в русле постнеклассической методологии, назревает необходимость перемещения познавательных ориентиров: с направлений, школ, исследовательских программ, концепций определенного исторического периода развития психологической науки на реализуемые в них способы мышления и типы рациональности; с монологического, ретроспективного описания процессов оформления и трансформации концептуального аппарата той или иной психологической школы на рефлексивно-диалогическую реконструкцию концептуального наследия вечно актуальных ученых, в свете сегодняшнего и завтрашнего дня развития психологии; с привычных тематических рубрик и разделов психологического знания на области «перекрытия» (метафора В.Е. Клочко) разных типов научной рациональности, в подвижных границах которых наиболее активно и плодотворно шли процессы «перерождения научной ткани» (метафора Л.С. Выготского) психологии; с общеизвестных и признанных теорий на концепции, признававшиеся ранее периферийными или даже маргинальными, но содержащими недооцененный эвристический потенциал; с традиций адаптации в психологии естественнонаучных объяснительных схем на ассимиляцию учеными-психологами философско-мировоззренческого наследия и описательного потенциала литературы и искусства.

С целью сопоставления традиционного и постнеклассического взгляда на историко-психологическое исследование автором предлагаются метафоры «реставрации» и «ренесанса», которые иллюстрируют разные подходы к реконструкции исторических форм научной мысли: сохранение концептуальных «памятников» психологической науки и осмысляющее воссоздание концептуального наследия психологии с конструктивным пересмотром его эвристического потенциала.

Обосновывается продуктивность применения трансспективного анализа (разработанного В.Е. Клочко) в историко-психологическом исследовании, поскольку он позволяет: наводить аналитические мосты между условно закрытыми научными системами и школами; понимать закономерные тенденции усложнения психологического познания с учетом конкуренции и сосуществования типов научной рациональности; выявлять соответствие и комплементарность психологических концепций, между которыми существуют значительные временные или парадигмальные «расстояния»; моделировать диалог и конфронтацию ученых, которые в силу разных причин не входили в один референтный или оппонентный круг.

Ключевые слова: *история психологии, психологическое знание, постнеклассическая психология, методологическая рефлексия, концептосфера, трансспективный анализ*

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THE EFFECTIVENESS OF USING A CONGRUENT VISUALIZATION FRAMEWORK ON LEARNING A DATA STRUCTURES COURSE

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Abstract. The majority of computer science (CS) educationists agree that learning the Data Structures course (CS2) is very difficult among novices due to its complexity. Consequently, learning the Data Structures course has been associated with a high failure rate. To enable learners understand data structures, algorithms visualizations (AVs) were proposed. Despite the long-term use of AVs in teaching and learning data structures, research shows that such tools have not been as pedagogically effective as expected. This study aimed to evaluate the effectiveness of using a congruent visualization (CV) framework on learning data structures. The framework employs a combination of two congruent program visualization tools, which involve machine-driven and learner-driven approaches. The effectiveness of using the CV framework was evaluated using a combination of experiment, grade analysis, and questionnaire methods. The subjects of the study were 887 first-year undergraduate students from the College of Informatics and Virtual Education (CIVE) of the University of Dodoma in Tanzania, studying the CS 122 Data Structures course. Results show that the use of the CV framework improved both students' test performance and examination pass rates compared to the traditional approach. Students' responses from a follow-up survey showed that the use of the CV framework increased students' motivation and confidence in learning the Data Structures course.

Keywords: *Data Structures course, Visualization, Program visualization, Algorithm Visualization, Congruent visualization framework*

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Introduction

Data structures is one of the prerequisite courses in CS education. Data Structures course is crucial as it enables students to apply computer programming skills to solve real-life problems. However, the subject has been associated with high failure rates due to its abstract and dynamic nature [1–4]. The authors in [2] report of high failure rate in data structures ranging from 30%-40% among CS undergraduate students. In another study, the authors in [5] report the students' dropout rates of over 70%. Currently, teaching data

structures in most universities and colleges worldwide is done through the traditional approach based on lectures, tutorials, and lab sessions along with algorithms visualization (AV) tools [6–8]. This approach is rife with the split attention effect because the content, working environments, and demonstrating tools are separate, leading to a high extraneous cognitive load [9]. There are also difficulties due to the mismatch between the illustrations provided in the textbook and those provided by the instructors and AV tools [10]. In addition, the use of static images/diagrams in several data structures textbooks to convey a dynamic process has little effect on reducing students' cognitive load [6]. The major question that has preoccupied researchers in CS education is how to reduce the cognitive load in learning the Data Structures course in order to increase comprehension and ultimately reduce the failure rates.

Numerous studies have shown that the use of AV in teaching and learning data structures can help improve data structures understanding for students and ultimately improves comprehension [11, 12]. However, despite the claimed educational benefits of using AVs in teaching and learning data structures, studies show that the sole use of AVs for teaching data structures is not pedagogically effective in learning data structures for two main reasons; Firstly, such tools are still incompatible with standard textbooks used for teaching data structures and algorithms [10][13]; and secondly, these AVs have focused mainly on demonstrating algorithmic steps instead of showing the programming logic behind those steps while manipulating data structures elements [10, 14–16]. In order to address this deficiency, this study introduces a new congruent visualization (CV) framework that combines the use of two congruent program visualization (PV) tools, one of which is machine-driven while the other is learner-driven, working in tandem. The proposed framework works as AV, PV, and compiler. The rest of this paper is organized as follows: It starts with the literature review; then the overview of the CV framework, followed by the study methodology. Lastly, it presents the results, discussion, and the conclusion.

Literature review

Visualization Overview

According to the authors in [17], visualization refers to the "use of graphical representation of information to assist human comprehension of, and reasoning about, that information." Visualization in programming is grouped into two fundamental categories, namely, software visualizations and manual or learner-driven visualizations. Software visualization applies "the use of the crafts of typography, graphic design, animation, and cinematography with modern human-computer interaction technology to facilitate both the human understanding and effective use of computer software" [18]. Software visualization is further classified into three main categories, which are AV, Program Visualization (PV), and Visual programming language (VPL).

PV visually shows the program state, its execution, and data structures when the program runs inside the computer memory. AVs, on the other hand, are intended to help learners clearly understand conceptually how the algorithm

works but do not go as far as illustrating how each program component executes when the program runs in the memory. For this reason, AVs have mostly been used to complement lectures. According to the author in [19], AVs are easier to follow than textbooks and are alternative representations for visual learners who understand materials in a visual or graphical format more quickly than in text format. Unlike AVs and PVs, VPL programs use visual images to help learners develop a computer program (Myers, 1990). VPLs are also known as "visual languages" or "visual programming." Examples of PVs, AVs, and VPLs are Balsa [20], Scratch [21], and Jeliot 3 [22], respectively. PVs and AVs are more helpful for both instructors and students; since they improve teaching efficiency; and help students understand programming logic more easily and efficiently by presenting learning materials graphically compared to textually [23].

PVs and AVs are subdivided into; dynamic, interactive, static, learner-driven, and machine-driven [24, 25]. In dynamic visualization, the visual image is updated whenever the line of code or program data executes. An interactive visualization provides an environment in which a user can manage and manipulate the visualization behavior of a program, such as stopping, forwarding, and controlling how the program or parameters should be executed and displayed. It also enables users to input data and control the visualization process. Interactive animation differs from computer animation since it is not interactive. Such a program is intended for "passive viewers "of the computer programs [26]. In static visualization, the displayed visual image just appears in a single view and does not change with time. Printed and soft images or sketches are examples of static visualization [26]. Finally, in learner-driven or manual visualization, learners use their own hands to draw the visual images on paper to show how the program execution occurs in a notional machine [13, 25, 27]. This visualization can work as AV or PV, depending on their construction. Unlike traditional static diagrams, learner-driven visualization provides full control to the learner and promotes the learner's computational thinking, confidence, and problem-solving skills [25]. Typical examples of learner-driven visualization tools are; Memory Transfer Language (MTL) [25] and Program Working Storage (PWS) [13].

The Need to Use Complementary Visualization in Teaching and Learning

Using more than one type of visual support learning is common in computer science education. The benefit of using a complementary visualization approach has been explained by Buckhard Knowledge Visualization Model [33]). Figure 1 shows the Burkhard knowledge visualization model [33].

The model describes inter- and intrapersonal iterative processes: The sender initiates the knowledge transfer process by imparting some of his knowledge (knowledge) to a recipient [33]. The knowledge of the senders as perceived by him (mental model sender) will be externalized into various explicit and complementary visual illustrations and can be divided into three

sub-processes (1, 2, 3) following a temporal sequence: First, the sender must ensure the attention (1) of the leaner (recipient), for instance by using a provocative image. Second, the sender will illustrate the context (2), provide an overview (2), and then provide alternative ways to accomplish the task (act) (2). Only then can the sender point to selected details (3), which ideally happens in a dynamic dialog with the recipient (D), who re-constructs (C) similar knowledge (knowledge') with these complementary visualizations and an own mental image (mental model recipient). However, due to different assumptions, beliefs, or backgrounds, inferences can occur, and this leads to interruptions and failures in knowledge reconstruction (E). If the receiver is aware of the misinterpretation or misunderstanding or simply desires more information, questions may arise, and a feedback loop may be initiated. The sender then has to refine or modify the used visual representations, add further complementary visualizations, or use other formats to achieve a concise reconstruction of the knowledge as intended and thus make successful communication possible (F) [33].

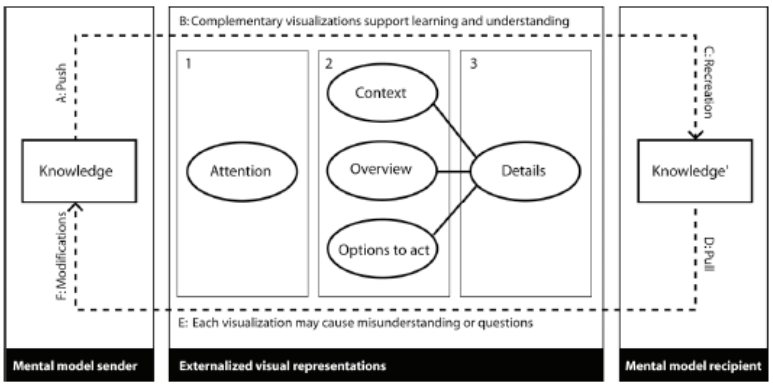

Fig. 1. Knowledge Visualization Model [33]

Related Works

Several studies have examined the impact of using visualizations in learning data structures. Some of the few works which are closely related to our works are those of the authors in [28–30]. The authors in [28] conducted an experimental study to compare the effect of using text-based instructional materials, interactive software visualization, or their combination on learning data structures. Results showed that using a combination of text and interactive visualizations improved knowledge retention and performance compared to using either text or visualization in isolation.

The authors in [29] studied the impact of using a PV tool called Courseware in learning data structures. Results showed that students who used the Courseware outperformed those who used the traditional lecture approach. Another experiment conducted by [30] to evaluate a tool called DS-PITON which combines both PV and AV functionalities in one package, showed that using DS-PITON improved students' performance compared to those who used the traditional approach.

According to the authors in [31], most of the existing PV systems have been built with less interactive and engaging pedagogical features for novice learners. Similar results have also been reported by the author in [32]. Several studies report the use of PV in teaching and learning data structures to improve comprehension. However, none of these studies employed congruent PVs. Likewise, The insights highlighted in Bukhard knowledge Visualization model are essential if applied in teaching and learning programming [33]. Currently, there is no well-known study that has investigated the effectiveness of using complementary visualization tools in learning programming. In this study, MTL, a PV tool based on learner-driven instructional materials that also works as an animator and compiler, is employed along with a new machine-driven PV tool called CeliotM. The two PVs are congruent to one another and are used in tandem in teaching and learning data structures. The study hypothesizes that using the framework, which employs two visualization tools, of which one is machine-driven, and the other is learner-driven, which are congruent and complementary to each other, will help improve students' motivation and understanding in learning the Data Structures course.

An Overview of the Congruent Visualization Framework

The CV framework is an instructional approach intended for teaching introductory programming and Data Structures courses. The approach consists of two congruent components, the learner-driven, and the machine-driven components. Being congruent implies that images used in the learner-driven approach are similar to those used in the machine-driven approach. The two approaches (learner-driven and machine-driven) are mutually reinforcing, and their order of application is inconsequential. This implies a combination of a single manual approach and a similar machine-driven animation with embedded questions so that learners can perceive the view, construct the view, respond to questions, and construct the visualization as desired.

The Learner-driven Component

The learner-driven components comprise the instructional materials prepared in MTL visual format [25]. Such materials are congruent with machine-driven visualizations. The CV framework combines human computational thinking, manual and machine-driven compilation, and visualizations. When solving a programming problem under the CV framework, a novice programmer has to read the written code in a high-level language line-by-line visually using memory diagrams. Using MTL, novices can visualize program behavior by showing the memory status for each line execution. Figure 2 shows a simple code, *Program 1*, that captures the *name* and *age* of a *Person* sending/printing the output on the computer screen. This program is designed to declare a *structure* (a record), feed data, and output/read data from a record to the screen.

Figure 3 shows how *Program 1* is visualized statically using the MTL RAM diagram. As shown in Figure 3, the execution of instructions line numbers 4, 5, 6, and 7 deals with the structure definition. The definition

instantiates the *struct* called *Person* with two-member- fields, *name* of type string, and *age* of type *int*. After defining the structure, the memory status will remain free. Line number 8 begins the execution in the *main function*. Line number 9, *Person Tanzanian,* instantiates a structure labeled *Tanzanian,* reserving space in the RAM to hold a *name* (string) and *age* (integer) concerning any *Person*. At line number 10, data (Salum) is entered in the field *name*, and 28 is entered in the field *age*.

```
1   #include <iostream>
2   #include <cstring>
3   using namespace std;
4   struct Person {//program definition
5   string name;
6   int age;
7   };//the end of program definition

8   int main() {
9   Person Tanzanian; //declaration
10  Tanzanian.name = "Salumu"; //data feeding
11  Tanzanian.age = 28;
12  return 0;
13  }
```

Fig. 2. Program #1

		Proram #1 statement	RAM Status
1	#include <iostream>		Free
2	#include <cstring>		
3	using namespace std;		
4	struct Person {//program definition		
5	string name;	string name;	free
6	int age;	int age;	free
7	};//the end of program definition	//the end of program definition	free
8	int main() {		reserved
9	Person Tanzanian; //declaration	Person Tanzanian;	reserved
10	Tanzanian.name = "Salumu"; //data feeding	Tanzanian.name	Salum
11	Tanzanian.age = 28;	Tanzanian.age	28
12	return 0;		
13	}		

Fig. 3. Visualization of Program #1 by using MTL visual format

The Machine-driven Component

The machine-driven component consists of a CeliotM, compiler, and tutorial module. CeliotM enables a learner to write a program; compile it; visualize and debug the program that consists of pointers, structures, arrays, linked lists, queues, and stacks. CeliotM further incorporates sort and search modules. As shown in Figure 4, CeliotM consists of four main areas: – (i) *Method Area*, (ii) *Expression Evaluation Area*, (iii) *Constant Area*, and (iv) Instance and *Array Area*. These subdivisions are separated by white-dashed lines appearing as margins between them. Each subdivision has a heading on top of it, describing what type of actors it is displaying. The *Method Area* displays the functions as these are called by the program. The *Expression Evaluation* module shows all actors animating the program expressions and their evaluations. The *Constant Area* generates the constant values in the

programs. Finally, the *Instance and Array* module enables the user to see the *Actors* of arrays and data structures instances.

After manual visualization, *Program #1* can be visualized and compiled in CeliotM. CeliotM compiles both linear and nonlinear structures.

Fig. 4. The Theatre, with its four parts

Figure 5 shows how *Program #1* in Figure 2 is compiled and visualized in CeliotM. In addition, CeliotM shows the memory status after the execution of lines 9 and 10, respectively. This visualization is congruent with its learner-driven version depicted in Figure 3.

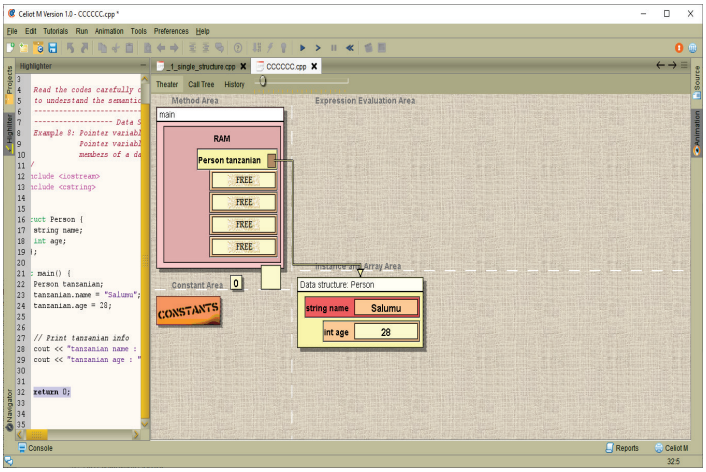

Fig. 5. Visualization of the Program 1 in CeliotM

In using a CeliotM, a learner can effectively engage with the tool. He/She can control the speed of the animation, receive an informative error message, view the dynamic behavior of the program, input new values, and compile and debug the program. While the learner-driven component involves the learner mentally and enhances critical thinking, the machine-driven component provides learners with the actual working and coding space for writing, debugging, compiling, and visualizing programs.

Methodology

Research Approach

This study aimed to evaluate the effectiveness of using the CV framework in learning the Data Structures course. The study employed a mixed-research design approach, combining experiment, documentary review, and survey questionnaire. The experiment evaluated the effectiveness of using the CV framework based on students' test performance scores. The grade analysis method [19][34] was used to evaluate the effectiveness of using the CV framework on students' pass rate (exams final grade). Finally, the survey questionnaire method was used to evaluate students' perceptions on the effectiveness of using the CV framework in learning the Data Structures course.

Study Location and Sample Size

The study was conducted at the College of Informatics and Virtual Education (CIVE) of The University of Dodoma in Tanzania. The experimental sample was 887 first-year students from CIVE enrolled to study CS 122 (data structures) course in the 2018/2019 academic year. These students were pursuing an undergraduate degree in computer science and other ICT-related programs. They all had studied an introductory programming course (CS 110) in C++ in the first semester. Such students, therefore, had basic skills in programming. The examination results of first-year undergraduate students for the academic year 2017/2018 and 2018/2019, respectively, formed the samples for the control and experimental groups. The examination results for the academic year 2017/2018 belong to students who were taught the CS122 course using the traditional lecture method, while the 2018/2019 academic year examination results belong to students who were instructed CS 122 course using the CV framework. Out of 887 students who participated in this study, only 853 completely filled the questionnaire. They were thus considered to be the valid sample for the survey questionnaire.

The Experiment

This study used a single factor within the experiment design, with pre-test and post-test measures based on the test score. The subjects were 887 first-year students studying Data Structures course in the 2018/2019 academic year. The same sample size was used as a control and experimental group, where students' pre-test and post-test performance scores were used as dependent variables. The independent variables were (i) the traditional lecture method and (ii) the CV framework.

Hypotheses

Null hypothesis:

(i) The mean test performance between the traditional lecture method and a combination of the CV framework and lecture method is equal (Hp0): $\mu_{\text{lecture method}} = \mu_{\text{CV framework+leture method.}}$ This implies no statistical difference in the students' mean data structures performance between the two approaches.

Alternative hypothesis

(ii) The mean test performance between the traditional lecture method and a combination of the CV framework and lecture method is not equal (Hp1):

$\mu_{\text{lecture method}} \neq \mu_{\text{CV framework+lecture method.}}$ This implies a significant statistical difference in the students' mean data structures performance between the two approaches.

Materials and Tools

The materials and tools used included the data structures syllabus; CeliotM; Borland C++ compiler; learner-driven instructional materials notes, pre-test examination, post-test examination, end-of-semester examination reports, and survey questionnaires.

Procedure

The experiment took place at CIVE between April and July 2019. Each week comprised 8 hours (4-hour lectures, 2 hours of tutorial, and 2 hours of laboratory work. During the experiment, the students were first taught topics of pointers, records, linked lists, recursions, and bubble sort algorithms for three (3) weeks by using the traditional lecture method. Such students were given a set of exercises for review. The students had access to the lab, where they were doing exercises and discussing together in the lab. They were using Borland C++ compilers.

Since all first year, undergraduate students were involved in the experiment, and lecture sessions were done during the weekend, the students were allowed to practice 4 hours per week; i.e., one hour per week was used for lab time under the instructor's supervision; one hour in the laboratory for self-study; and two hours using their computers during class time. Borland C++ compiler was installed in all computers in all laboratories at CIVE. The lab was also available for students to practice what they were learning at their own pace. To ensure that the students were doing laboratory work, the researcher participated in the laboratory sessions. Students were also filling in an activity log to record the exercises they did in the lab. During the laboratory sessions, the students were required to do exercises and review examples using the traditional approach with a Borland C++ compiler.

After learning these topics for three (3) weeks, students were given a class assignment as a pre-test to judge their understanding before learning data structures using the CV framework. Then, the researcher trained all participants on how to use the CV framework and provided learner-driven instructional materials on the selected topics of pointers, records, linked lists, recursion, and bubble sort algorithms. CeliotM was installed on all computers in all five laboratories, including the libraries at CIVE.

The students used the CV framework for another three (3) weeks to practice for the given data structures topics. They sat for a post-test to verify if the use of the CV framework provided better knowledge gain than the traditional lecture method in the selected topics. Both pre-test and post-test were marked out of 30. The test duration was 60 minutes. Out of 887 students who participated in the experiment, 879 students did both pre-test and post-test. After doing the pre-test and post-test, the mean performance data obtained

before and after using the CV framework were recorded for analysis. Figure 6 shows the pre-test and post-test arrangement.

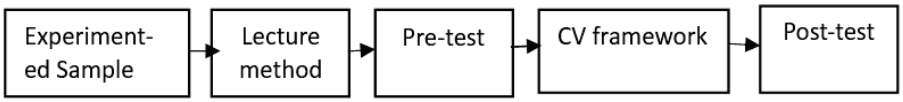

Fig. 6. Pre-test and Post-test Arrangement

The students continued using the CV framework for eight more weeks covering insertion sort, merge sort, quick sort algorithms, queue, and stack. Later, they did the end-of-semester examination. After doing the end-of-semester examinations, the data pertaining to final examination performance were collected for analysis.

Data Collection Methods

In this study, a questionnaire with closed-ended questions was used to collect data on students' perceptions of the effectiveness of the CV framework in teaching and learning data structures. The questionnaire was self-administered and was given physically to respondents and collected within twenty minutes after being filled in. Data from the experiment were collected by using pre-test and post-test. Students' examination reports for the academic years 2017/2018 and 2018/2019 were obtained from CIVE examination office after getting a data collection permit from the University of Dodoma. Data pertaining to the student's examination pass rates (final examination grades) was extracted from examination reports for analysis.

Data Analysis

Pre-test and post-test data were statistically analyzed using the paired t-test. Data from examination reports were analyzed by using the grading analysis method. That is, the data pertaining to the 2017/2018 academic year students' final examination grades (control group) was analyzed by comparing it with the data of 2018/2019 academic year students' final examination grades (the experimental group). This method has been adapted from [19, 34]. The results of the comparison were conveyed using descriptive statistics (percentages). Quantitative data from the questionnaire were analyzed by calculating the average score per question based on a 5-point Likert scale. Likert scale scores were calculated based on the average score per question. Questions were assigned responses from 0 to 4, with 0 representing "strongly disagree," 1 representing "disagree," 2 representing "undecided," 3 representing "agree," and 4 representing "strongly agree." "Final scores were then normalized and calculated as an average and then normalized as a percentage of the mean maximum score. The closed-ended questions, which were later coded and analyzed, were expressed as percentages using descriptive statistics.

It was predicted that using the CV framework in learning data structures would improve students' test performance compared to the traditional approach. It was also expected that using the CV frameork would improve students' pass rate (final examination grades) and their perfection in learning data structures

and thus reduce failure rate compared to the previous year when only the traditional lecture method was used.

Results

This section presents the results of the study from the experiment, document analysis, and questionnaire survey.

Results from the experiment

Table 1 shows the group statistics between the post-test and pre-test results. Table 2 summarizes the significance levels between the pre-test and post-test (i.e., the p-value is) 0.000 with t=38.325, with a mean difference of 7.2179 in students' classwork scores. Since the p-value is below the significance level (i.e., 0.05), the difference between the two means is statistically significant. Therefore, the alternative hypothesis is accepted, i.e., a significant statistical difference was found between the two means of classwork performance. These results indicate that the use of the CV framework had an impact on data structures cognition.

Table 1

Group Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	POST	18.761	879	6.2372	0.2104
	PRE	11.543	879	5.0226	0.1694

Table2

Paired Sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	POST – PRE	7.2179	5.5838	0.1883	6.8482	7.5875	38.325	878	0.000

Results from the Documentary Analysis of the Students' Final Examination Grades

Table 3 presents the comparison of students' pass rate and final examination grades at CIVE for the 2017/2018 academic year (when only the traditional lecture method was used) and the 2018/2019 academic year (when a combination of both traditional lecture methods and CV framework was used).

Table 3

Comparison of CS 122 Grades between the 2017/2018 and 2018/2019 academic years at CIVE

	YEAR	TOTAL	A	A, %	B+	B+, %	B	B, %	C	C, %	D	D, %	E	E, %
CIVE	2017/2018	826	1	0.1	43	5.2	206	24.9	346	41.9	115	13.9	115	13.9
	2018/2019	887	19	2.1	114	12.9	254	28.6	332	37.4	80	9.0	88	9.9

Table 3 shows that the percentage of A, B+, and B grades were largely improved after using the CV framework in the academic year 2018/19. The total number of A's for students who did the final examination increased from 0.1% in 2017/18 to 2.1% in the academic year 2018/19, while that of B+`s increased from 5.2% to 12.9%. Furthermore, the pass rate also increased from 71.1% to 81.2% in the academic year 2018/19. While the students' failure rate was 27.8% in the academic year 2017/18, there was a failure rate of 18% in the academic year 2018/19, which implies that after using the CV framework, the failure rate in the CS 122 (data structures) course at CIVE was reduced by 9.0%. These results suggest that the use of the CV framework improved data structures comprehension among the students; and hence the overall pass rate.

Students' perceptions towards learning data structures after Using the CV Framework

Table 4 summarizes the results of students' perceptions of learning data structures after using the CV framework. As shown in Table 4, the students' average responses for each question was above 70%, implying that students' responses from the questionnaires concerning students' perceptions after using the CeliotM framework towards learning the CS122 course have largely improved

Table 4

Students' perceptions towards Learning CS2 after Using the CV Approach

Question statement	Average Score, %	No of respondents
Using the CV approach motivated me to learn the CS122 course	75.9	852
Using the CV approach helped me to learn the CS122 course without rote learning	71.2	852
Using the CV approach improved my confidence in learning the CS122 course	75.8	853
Using the CV approach helped me learn the CS122 course with less mental effort	72.4	853
I found learning the CS122 course easier after using the CV approach	70.4	852

Discussion

Findings from the study have shown that using the CV framework among the students who were studying a CS122 Data Structures course at CIVE has helped improve the pass rate up to 81.2% while improving upper grades by 10.44% compared to the traditional approaches. Findings from the study have further revealed that the use of the CV framework assisted students in improving their CS122 comprehension, confidence, and motivation to learn CS122. It also helped them learn CS 122 with less anxiety and less mental effort than the traditional lecture method. One possible reason that the CV framework improved students' academic performance is that the CV framework provides the maximum level of learner engagement. This is because

the CV framework requires learners to manually write algorithm steps, apply pseudocode, visualize programming threshold concepts based on the MTL approach, and then use CeliotM for visualization and compilation. This dual working style helped learners understand the inner workings (programming logic) of programming constructs in terms of algorithm steps and thus helped them easily convert algorithms into codes when writing computer programs. These results suggest that the dual use of a congruent pair of learner-driven and machine-driven instructional materials improves student success rates while decreasing failure rates, as shown in these research findings. The results of this study confirm [35], multimedia learning theory [36], and [37], that the dual use of visual and nonverbal channels enhances learning.

Conclusion

This study evaluated and confirmed the effectiveness of the CV framework in data structures teaching and learning. The CV framework is both manual and machine-driven. Machine-driven systems combine AV, PV, and compilation. Learning-driven systems use MTL RAM diagrams to visualize the dynamic properties of the code. Results show that using the CV framework increases motivation and reduces CL, leading to better performance. The results suggest that PV tools can be better used in learning data structures if they are integrated with common compilers and compatible with learner-driven teaching materials. However, the evaluation of the effectiveness of the proposed approach was conducted within a short period of time. Therefore, further longitudinal studies with real experiments are needed to validate further the effectiveness of the CV framework in teaching and learning data structures.

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ВЛИЯНИЕ ИСПОЛЬЗОВАНИЯ КОНГРУЭНТНОГО ПОДХОДА К ВИЗУАЛИЗАЦИИ НА ИЗУЧЕНИЕ КУРСА CS2

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Аннотация. Большинство преподавателей информатики (И) согласны с тем, что изучение курса структур данных и алгоритмов (CS2) является сложным процессом из-за его высокой когнитивной нагрузки. Следовательно, изучение CS2 было связано с высоким уровнем неуспеваемости. Чтобы помочь снизить высокую когнитивную нагрузку, возлагаемую на учащихся изучающих CS2, были предложены алгоритмы визуализации (АВ). Несмотря на длительное использование АВ в преподавании и изучении CS2, исследования показывают, что такие инструменты не были столь педагогически эффективными, как это ожидалось. Это исследование было направлено на изучение влияния использования подхода конгруэнтной визуализации (КВ) в преподавании и изучении CS2. В этом подходе используется комбинация двух совместимых инструментов визуализации программ, которые включают подходы, управляемые машиной, и подходы, управляемые учащимся. Воздействие использования КВ-подхода оценивалось с использованием комбинации экспериментов, анализа документов и методов анкетирования. Объектами исследования стали 887 студентов первого курса бакалавриата Колледжа информатики и виртуального образования (CIVE) Университета Додомы в Танзании, изучающих CS2. Результаты показывают, что использование подхода КВ улучшило как показатели непрерывной оценки учащихся, так и показатели результатов сдачи выпускных экзаменов по сравнению с традиционным подходом. Ответы учащихся на последующий опрос показали, что использование подхода CV повысило мотивацию и уверенность учащихся в обучении CS2.

Ключевые слова: *структура данных и алгоритм, курс CS2, визуализация программы, визуализация алгоритма, конгруэнтная визуализация*

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