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PEDAGOGICAL-PSYCHOLOGICAL MODEL STRUCTURE BASED ON THE METHODOLOGY OF FORMATION OF 4K SKILLS IN THE TEACHING OF INFORMATICS AND INFORMATION TECHNOLOGIES

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Abstract: The 21st century has ushered in a digital era where competencies such as critical thinking, creativity, communication, and collaboration (collectively referred to as the "4K skills") are crucial for success. These skills are particularly relevant in informatics and information technologies, fields that require innovative problem-solving, effective teamwork, and robust communication. This article presents a pedagogical-psychological model structure to systematically incorporate 4K skill formation into the teaching of informatics and IT. By combining theoretical insights, practical strategies, and technological tools, the model provides educators with a framework for nurturing well-rounded, future-ready learners.

Key words: critical thinking, communication, collaboration, pedagogical-psychological model, constructivist learning, collaborative learning activities, teacher training, curriculum design

Introduction. The rapid advancements in informatics and information technologies (IIT) necessitate a shift in pedagogical approaches to equip students with the necessary skills for the 21st-century workforce. This scientific research proposes a pedagogical-psychological model structure focused on the formation of 4K skills – critical thinking, communication, collaboration, and creativity – within the context of IIT education. This model integrates psychological principles of learning and development with innovative pedagogical strategies to enhance student engagement, knowledge acquisition, and practical application of IIT skills.

Education systems worldwide are shifting focus from rote memorization to fostering higher-order thinking and collaborative abilities. The "4K skills"—critical thinking, creativity, communication, and collaboration—represent essential competencies for navigating the complexities of modern society. These skills align closely with the demands of the informatics and IT fields, where professionals must solve novel problems, design innovative solutions, and work in interdisciplinary teams.

Despite their importance, integrating 4K skills into informatics education often poses challenges due to traditional pedagogical structures, limited teacher training, and inadequate technological infrastructure. This article addresses these challenges by proposing a comprehensive model for the effective teaching of informatics and IT.

Materials and methods. The Pedagogical Model describes what effective teachers do in their classrooms to engage students in intellectually challenging work. It provides an overview of the learning cycle and breaks it down into five domains or phases of instruction: Engage, Explore, Explain, Elaborate and Evaluate.

The 4K Skills Framework in Education. The 4K skills—critical thinking, communication, collaboration, and creativity—represent a fundamental set of competencies essential for success in the modern world, particularly within the rapidly evolving landscape of IIT. Their application within IIT education translates to:

- **Critical Thinking:** Analyzing information critically, evaluating sources, identifying biases, solving complex problems using algorithmic thinking, and debugging code effectively. This includes understanding the ethical implications of technology and data privacy.
- **Communication:** Effectively conveying technical information both verbally and in writing, collaborating using digital tools, explaining complex concepts to diverse audiences, and presenting project findings clearly and concisely.
- **Collaboration:** Working effectively in teams using online platforms, sharing information and resources, coordinating tasks, resolving conflicts constructively, and contributing equally to group projects. This requires understanding and utilizing various collaborative software and platforms.
- **Creativity:** Developing innovative solutions to problems, designing user-friendly interfaces, creating original digital content, exploring creative applications of technology, and thinking outside the box in programming and problem-solving.

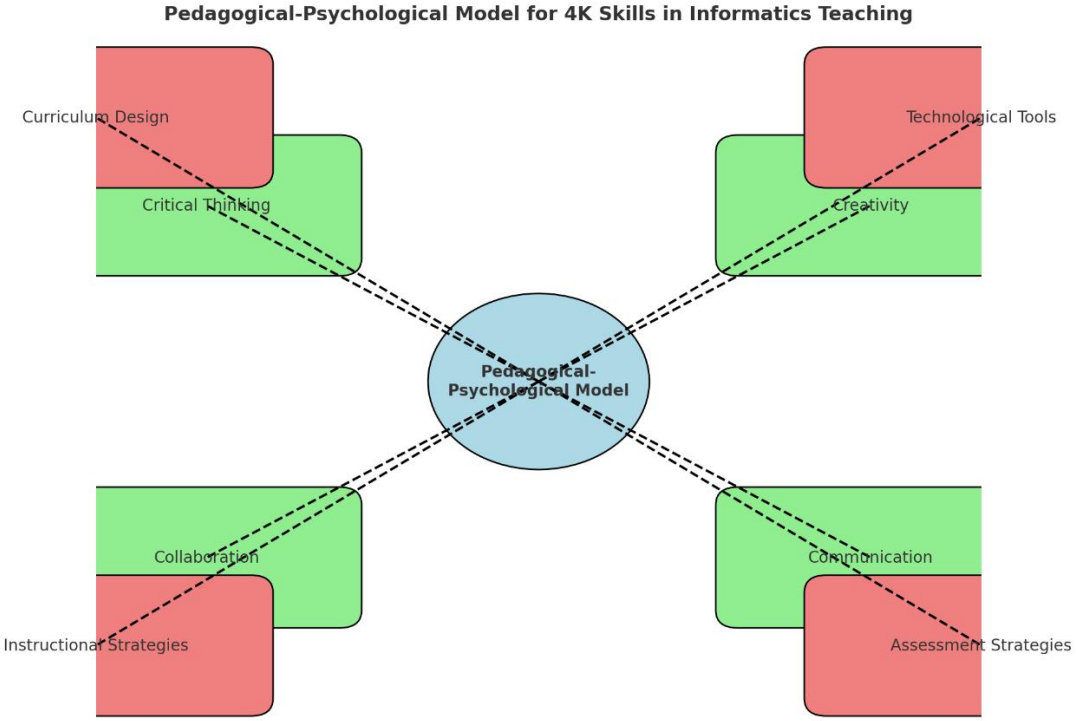

Figure 1. Pedagogical-Psychological Model for 4K Skills in Informatics Teaching

This figure represents the Pedagogical-Psychological Model Structure Based on the Methodology of Formation of 4K Skills in the Teaching of Informatics and Information Technologies. The model consists of a central focus on the pedagogical-psychological framework, surrounded by the 4K skills (Critical Thinking, Creativity, Collaboration, and Communication) and supported by four key players: Curriculum Design, Instructional Strategies, Technological Tools, and Assessment Strategies. Each component is interconnected to emphasize their collaborative impact on the educational process

Components of the Pedagogical-Psychological Model

The proposed model integrates three core components:

A. Cognitive-Developmental Framework: This component focuses on the psychological aspects of learning, acknowledging the diverse cognitive styles and learning preferences of students. Key aspects include:

- **Constructivist Learning:** Emphasizing active learning, knowledge construction, and problem-based learning, where students actively participate in the learning process, rather than passively receiving information.
- **Differentiated Instruction:** Tailoring instruction to meet the diverse learning needs and styles of students, offering varied activities and assessment methods to cater to different strengths and weaknesses.
- **Metacognition:** Encouraging students to reflect on their own learning processes, identify their strengths and weaknesses, and develop strategies for improving their learning outcomes. This includes self-assessment, peer feedback, and teacher guidance.
- **Zone of Proximal Development (ZPD):** Providing appropriate scaffolding and support to help students reach their full potential, challenging them with tasks slightly beyond their current capabilities but within their reach.

B. Pedagogical Strategies for 4K Skill Development:

This component outlines specific pedagogical strategies aimed at fostering the 4K skills:

- **Project-Based Learning (PBL):** Engaging students in complex, open-ended projects that require them to apply their knowledge and skills in creative and collaborative ways. PBL naturally fosters all 4K skills, particularly problem-solving and teamwork.
- **Inquiry-Based Learning (IBL):** Encouraging students to investigate questions, formulate hypotheses, gather data, and draw conclusions, promoting critical thinking and problem-solving abilities.
- **Collaborative Learning Activities:** Designing activities that require students to work together, share ideas, and learn from each other, enhancing collaboration and communication skills. Examples include pair programming, group projects, and peer teaching.
- **Creative Problem Solving:** Presenting students with challenges that encourage them to think creatively, generating multiple solutions and evaluating their effectiveness.
- **Gamification:** Utilizing game-like elements to enhance student engagement and motivation, incorporating challenges, rewards, and feedback to promote active participation and skill development.
- **Use of technology as a tool:** Employing various digital tools and platforms to enhance teaching and learning, promoting digital literacy and fostering creativity.

C. Assessment and Feedback Mechanisms:

This component outlines strategies for assessing student learning and providing timely and effective feedback:

- **Authentic Assessment:** Using real-world tasks and projects to assess student learning, ensuring that assessment aligns with the skills and competencies being developed.
- **Formative Assessment:** Providing ongoing feedback throughout the learning process, using various methods such as observation, questioning, and peer assessment to guide student learning.

- **Summative Assessment:** Evaluating student learning at the end of a unit or course using methods such as exams, presentations, and project evaluations.
- **Self and Peer Assessment:** Encouraging students to reflect on their own learning and provide feedback to their peers, promoting self-regulation and collaboration.
- **Rubrics and Checklists:** Using clear and specific rubrics and checklists to provide students with guidelines for completing assignments and projects, promoting transparency and clarity in assessment.

At the present stage of development of school education, the problem of taking into account regional characteristics when organizing the educational process is becoming increasingly relevant. Educational practice shows that national-regional specifics play a big role in the selection and construction of content-technological education, which makes it possible to introduce the process of establishing regional characteristics, determine the content and form of school education, thereby bringing education closer to the specific conditions of social life in a given region.

Model Implementation and Evaluation

The successful implementation of this model requires:

- **Teacher Training:** Providing teachers with professional development opportunities to develop their skills in implementing the pedagogical strategies outlined above.
- **Curriculum Design:** Integrating the 4K skills into the IIT curriculum, ensuring that learning activities and assessments align with these competencies.
- **Technological Infrastructure:** Providing access to appropriate technology and digital resources, ensuring that students have the tools they need to succeed.
- **Ongoing Evaluation:** Regularly evaluating the effectiveness of the model using both quantitative and qualitative methods, such as student performance data, teacher feedback, and student surveys. This iterative process allows for continuous improvement and refinement of the model.

Addressing Potential Challenges

The implementation of this model may present certain challenges:

- **Resistance to Change:** Some teachers may be resistant to adopting new pedagogical approaches, requiring strong leadership and ongoing support.
- **Resource Constraints:** Implementing the model may require significant resources, including technological infrastructure, teacher training, and curriculum development.
- **Assessment Challenges:** Developing authentic and effective assessment methods that accurately measure the 4K skills can be challenging.
- **Time Constraints:** Integrating all components of the model effectively may require additional time and effort from both teachers and students.

The pedagogical-psychological model for integrating 4K skills into the teaching of informatics and information technologies addresses the growing need for well-rounded, adaptable learners. By combining theoretical insights, practical strategies, and technological tools, this model offers a comprehensive framework for modern education. Although challenges exist, they can be overcome through thoughtful implementation and continuous refinement. Ultimately, this model

not only equips students with technical expertise but also prepares them to thrive in a rapidly evolving world.

Conclusion. This pedagogical-psychological model structure provides a framework for fostering 4K skills in IIT education. By integrating cognitive-developmental principles with innovative pedagogical strategies and robust assessment mechanisms, this model aims to equip students with the essential skills and competencies needed to thrive in the 21st-century world. The successful implementation of this model requires a commitment to teacher training, curriculum reform, resource allocation, and ongoing evaluation. Addressing the challenges proactively will maximize the potential of this approach to transform IIT education and empower the next generation of innovators and problem-solvers.

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