



Competency-Based Methodological Model Of Developing Students' Mathematical Literacy Based On The Pisa International Assessment Program

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ABSTRACT

The article examines scientific and methodological approaches to developing students' mathematical literacy based on the PISA international assessment framework. A competency-based methodological model is proposed to improve mathematical literacy through problem solving, mathematical reasoning, modelling, and real-life applications.

Keywords:

PISA, mathematical literacy, competency, functional literacy, assessment, mathematics education, innovative technologies.

КОМПЕТЕНЦИОННАЯ МЕТОДОЛОГИЧЕСКИ ОБУЧЕНИЕ МАТЕМАТИЧЕСКОЙ ГРАМОТНОСТИ УЧАЩИХСЯ НА ОСНОВЕ МЕЖДУНАРОДНОЙ ПРОГРАММЫ ОЦЕНКИ PISA

Аннотация. В данной статье научно рассматривается содержание международной программы оценки PISA, факторы развития математической грамотности и внедрение компетентностно-ориентированных образовательных технологий в преподавание математики в общеобразовательных средних школах. В ходе исследования были проанализированы критерии оценки PISA, международный опыт и современные педагогические подходы, а также разработана компетентностно-ориентированная методическая модель развития математической грамотности.

Ключевые слова: PISA, математическая грамотность, компетентность, функциональная грамотность, методическая модель, математическое образование, международная оценка, качество образования, творческое мышление, математическое моделирование.

TALABALARNING MATEMATIK SAVODXONLIGINI PISA XALQARO BAHOLASH DASTURI ASOSIDA RIVOJLANTIRISHNING KOMPETENSIYAVIY METODIK MODELI

Annotatsiya. Mazkur maqolada umumiy o'rta ta'lim maktablarida matematika fanini o'qitishda xalqaro PISA baholash dasturining mazmuni, matematik savodxonlikni rivojlantirish omillari hamda kompetensiyaga asoslangan ta'lim texnologiyalarini joriy etish masalalari ilmiy jihatdan yoritilgan. Tadqiqot davomida PISA baholash mezonlari, xalqaro tajribalar hamda zamonaviy pedagogik yondashuvlar tahlil qilinib, matematik savodxonlikni rivojlantirishning kompetensiyaviy metodik modeli ishlab chiqilgan.

Kalit so'zlar: PISA, matematik savodxonlik, kompetensiya, funksional savodxonlik, metodik model, matematika ta'limi, xalqaro baholash, ta'lim sifati, kreativ fikrlash, matematik modellashtirish.

Today globalization under the circumstances education to the system being laid requirements fundamentally changing The 21st century is economy, digital technologies and artificial of intellect intense development as a result human capital in formation not only theoretical knowledge, maybe knowledge in practice application to the competence has to be important to the criterion became. Therefore of the world developed countries education quality in evaluation traditional knowledge not, maybe students' real - life in situations from knowledge use level to determine separately attention Education quality international on a scale assessment programs between Economic cooperation and progress by the Organization for Economic Cooperation and Development (OECD) organization The PISA Programme for International Student Assessment study separately place This program is for 15 year old [1]. students reading literacy, mathematics literacy and natural sciences according to functional competencies to evaluate aimed at is, their at school received knowledge daily in life application opportunities to determine goal does. Last one in years Education in the Republic of Uzbekistan quality international criteria based on to evaluate separately attention Public education standards competency-based approach based on improvement , modern pedagogical technologies current international assessment in programs active participation to grow and of the students functional literacy develop according to wide extensive reforms done is being increased. This in the direction reforms mathematician education the content is also fundamentally requires updating. With this together, practice this shows that mathematics in their classes many students theoretical memorized formulas Although they are real - life in situations application, problems modeling, results analysis to do and logical conclusions in the release to difficulties face are coming . This situation mathematics education content and methodology to PISA requirements suitable accordingly improvement necessity to the surface This point of view from the point of view mathematically literacy develop only mathematician knowledge increase not, maybe

in students critical thinking, creative approach, information analysis to do, mathematics modeling and decision acceptance to do competencies formation with closely is related [2]. Modern mathematics education main the purpose is exactly the same so competent person from preparation consists of.

This the article PISA international assessment of the program theoretical basics, mathematics literacy concept, international experiments and to competence based methodological model scientific in terms of analysis will be made . Offer done methodological model mathematics science education efficiency increase, students functional literacy develop and PISA international in research high to the results achieve for scientific and methodological basis to be service does [3].

World education in the system of the students knowledge assessment content last twenty year inside noticeable at the level changed. Previously assessment system mainly theoretical knowledge to determine aimed at if so, today on the day main attention apply knowledge to real life in situations application competencies The PISA program is focused on this approach in the room embodied mathematics literacy to form modern of education priority from the duties one as defines .

Mathematician literacy develop of the students not only mathematics from science success , maybe their future professional activity , economic decisions acceptance to do , information analysis to do and digital in society successful activity to conduct provides . Therefore mathematician literacy today's on the day human capital development important structural part as is being considered .

Education quality international criteria based on assessment issues last twenty year during pedagogy science priority scientific from directions one It is considered . In particular , by the OECD done The ongoing PISA international assessment program general middle education quality evaluation the most influential from mechanisms one as confession This is being done . research not only of the students knowledge level , maybe their real life in

situations mathematician from knowledge use also assesses competencies .

International scientific in literature mathematician literacy concept various interpretation OECD experts mathematician " literacy is a human mathematician from knowledge various vital in situations use , problems mathematician modeling , results analysis to do and reasonable decisions acceptance to do ability " as also explains . Also Blum, Kaiser, Freudenthal, Niss, Stacey, Schoenfeld, etc. scientists mathematician literacy development theoretical the basics working They came out . scientific in their views mathematician modeling , reflective thinking , logical conclusion release and problematic situations solution main component as Uzbekistan scientists also by mathematician

literacy develop according to row scientific research take gone .

In particular , the PISA tasks national education to the system integration to do to competence based education methodologies working exit and of the students functional literacy develop according to scientific and methodological recommendations working was released [4].

However there is scientific research analysis this shows that general education PISA assessment in schools system requirements complete suitable coming complex methodological model is still enough at the level working not released . Especially , mathematical literacy development integral methodical system , lesson process design algorithm and assessment criteria into a single system to bring necessity there is .

Table 1
PISA and traditional assessment system comparison

No.	Indicator	Traditional Assessment	PISA Assessment
1	Type of knowledge	Theoretical knowledge	Applied knowledge
2	Questions	Formulas and rules	Real-life situations
3	Answer	Ready algorithm	Problem solving
4	Main goal	Memorization of knowledge	Assessment of competence
5	Result	Score	Functional literacy
6	Thinking	Reproductive	Critical and creative

Table 2

Mathematician literacy develop stages

Stage	Teacher's Activity	Student's Activity	Expected Outcome
1. Motivation	Creates a problem situation	Recognizes the problem situation	Interest is generated
2. Analysis	Asks questions	Analyzes the information	Analytical thinking develops
3. Modelling	Provides guidance	Constructs a mathematical model	Model creation
4. Calculation	Gives advice	Performs calculations	Mathematical solution
5. Interpretation	Organizes discussion	Interprets the results	Draws conclusions
6. Reflection	Evaluates	Analyzes their own performance	Competence is formed

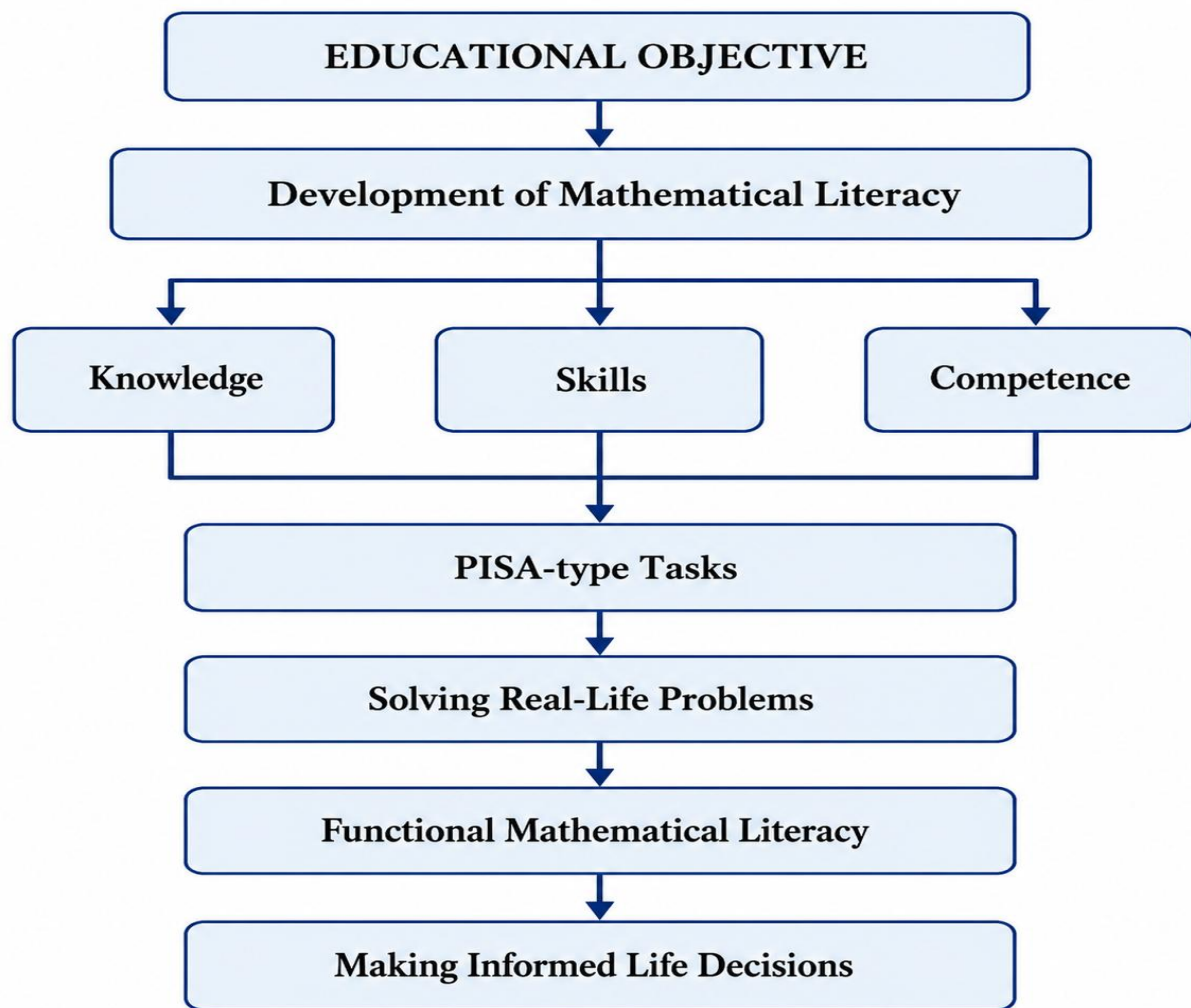


Figure 1. Mathematician literacy development conceptual model

This research within working PISA international based on the evaluation program competency-based methodical model efficiency experimental in terms of justification for the purpose pedagogical experiment works organization was tested . main task mathematics science education in the process of PISA requirements suitable methodical approach application through of the students mathematician literacy develop level from determining consists of it has been .

Pedagogical experience during of the students mathematician literacy assessment following competencies based on done increased :
 mathematician concepts understanding and from them use ;
 logical and critical thinking ability ;
 mathematician modeling skills ;
 real life situations mathematician methods using solution competence ;

PISA format assignments to perform efficiency ; the results analysis to do and based conclusions release qualifications .

Pedagogical experiment works three in stages organization was :

Diagnostic in stages of the students elementary mathematician literacy level identified and available knowledge and skills diagnostic tests and observation methods based on was evaluated .

Shaper in stages working issued based on the methodological model in the PISA format tasks , problematic situations , mathematics to modeling directed practical training and to competence based education technologies lesson to the process integration was done . Control in the phase experience in the end of the students mathematician literacy level again evaluated , experienced and control groups results statistic in terms of compared .

Pedagogical experiment in the process working issued assessment criteria of the students functional mathematician literacy , logic thinking ability and real life in situations mathematician knowledge application competencies complex assessment opportunity gave .

Mathematician literacy level determination international PISA assessment concept and competency-based approach principles based on working issued criteria through done increased . Evaluation in the process of the students theoretical knowledge with one in line this knowledge practical in situations application skills analysis was done . Evaluation criteria three main direction cover took .

Knowing competence . This criterion of the students mathematician concepts , formulas and laws to know and their content understanding level describes . This in stages mathematician from the terms right use , theoretical knowledge explanation and mathematician links determination ability was evaluated .

Application competence . This criterion of the students mathematician knowledge practical in situations application , mathematics models create , graphic and diagrams analysis to do , calculations to perform and problematic situations solution skills to determine service did [5].

Analysis and interpretation competence . This criterion through taken the results explanation , mathematics solutions assessment , based on conclusions release and various solution options compare abilities was evaluated .

Also , students reflexive thinking , independent decision acceptance to do and creative approaches are also complex in a way analysis was done .

Pedagogical experiment works in the end taken results working issued competency-based methodical model efficiency confirmed .

Analyses this showed that the PISA requirements suitable organization done lesson training of the students mathematician literacy to develop noticeable positive impact In particular , the experience group in students : mathematician modeling skills noticeable at the level developed ;

complicated vital situations mathematician methods using solution competence formed ; logical and critical thinking level increased ; mathematician proof and the results interpretation to do qualifications improved ; group activity and in cooperation work skills developed ;

PISA format assignments to perform efficiency control to the group relatively high it has been . Statistical analyses experience group of the results all main indicators according to control to the group relatively stable high that Especially in real life to situations based mathematician assignments in solution of the students independent thinking and creative approach noticeable at the level development observed .

Received results working issued methodological model mathematics science to competence based approach based on in education effective methodical tool that scientific in terms of confirms [6].

Experiment-test results analysis this showed that mathematics PISA international science assessment program requirements based on organization to grow of the students mathematician literacy in development high efficiency provides Offer done methodical model main advantage is that it is mathematics science in education theoretical knowledge practical activity with integration opportunity gives . This approach in students mathematician modeling , problematic situations analysis to do , critical thinking , reflexive approach and based decision acceptance to do competencies complex accordingly develops .

Also, digital education technologies , interactive methods and PISA format of tasks harmonious application mathematics of lessons efficiency noticeable at the level to increase service to do determined .

Research results based on PISA international assessment of the program theoretical principles and competency-based approach based on mathematician literacy development scientific and methodological model working It was released .

Pedagogical experiment results this methodical the model mathematics science education to practice current to grow of the students

functional mathematician literacy in development high to efficiency has that confirmed.

PISA international assessment to the concept based competency-based approach mathematics education quality increase effective scientific and methodological basis organization will reach.

Production issued methodological model of students mathematician apply knowledge to real life in situations application competencies systematic accordingly develop opportunity gives.

Problematic education, mathematics modeling and reflexive evaluation integration of the students critical thinking, creative approach and functional mathematician literacy noticeable at the level develops.

Digital education from technologies Use PISA format assignments effective organization to grow and individual education trajectories formation opportunities expands.

Pedagogical experiment results working issued methodical model scientific based on and practical efficiency confirmed [7].

Offer done methodical recommendations general middle education in schools mathematics science education methodology improvement, students mathematician literacy develop and in the international PISA studies high to the results in reaching effective scientific and methodological basis to be service to do possible.

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