

**The written report from the official reviewer, Doctor of Biological Sciences,
Professor Raikhan Beisenova on the thesis of
BOLATOVA ZHANERKE ERLANOVNA
on the topic "Assessing access to water, sanitation and hygiene in schools", submitted for the degree of Doctor of
Philosophy (PhD) in the educational program 6D110200 - "Public Health"**

№	Criteria	Compliance with criteria (one of the answer options should be marked)	Justification of the official reviewer's position
1.	The topic of the thesis (at the date of its approval) corresponds to the directions of science development and/or state programs	<p>1.1 Compliance with priority directions of science development or state programs:</p> <p>1) The dissertation was carried out within the framework of a project or target program financed from the state budget (specify the name and number of the project or program)</p> <p>2) The dissertation was carried out within the framework of another state program (specify the name of the program)</p> <p>3) The dissertation corresponds to the priority direction of science development approved by the Higher Scientific and Technical Commission under the Government of the Republic of</p>	<p>The dissertation corresponds to the priority direction of science development approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan, namely the direction of "Life Science." The research within the thesis framework aims to study aspects related to water supply, sanitation and hygiene in schools, which is essential for public health and school students' lives.</p>

		Kazakhstan (specify the direction)	
2.	Importance for science	The work does/does not make a significant contribution to science, and its importance is well-disclosed/not uncovered	The thesis contributes significantly to science by providing initial data and estimates of school access to water, sanitation and hygiene services. The work presents a new perspective and expands the knowledge base in the field. Assessing satisfaction with services and identifying factors that influence the hygiene behavior of school students enriches the existing literature and contributes to a better understanding of the dynamics of sanitation and hygiene in educational institutions.
3.	The principle of independence	Level of autonomy: 1) High; 2) Medium; 3) Low; 4) No independence	The level of independence in this dissertation work is assessed as high. Independence is reflected in the choice of research methods, collection of material, data analysis and formulation of conclusions.
4.	The principle of internal unity	4.1 Justification of the relevance of the thesis: 1) Justified; 2) Partially justified; 3) Not substantiated.	Justification of the relevance of the thesis is presented clearly and reasoned. The author outlined the study's relevance, linking it to the existing problems in schools' access to water, sanitation and hygiene services. The importance of the topic was justified, noting its impact on children's health and learning in educational institutions. The data presented in the thesis, including the results of epidemiological analysis, emphasize the need for a better understanding of the problem and active intervention to improve schools' sanitation and hygiene situation.
		4.2 The content of the thesis reflects the thesis topic: 1) Reflects; 2) Partially reflects; 3) Does not reflect	The content of the thesis fully reflects the aim and objectives of the research on the topic of this thesis.

		<p>4.3 The aim and objectives are consistent with the thesis topic:</p> <ol style="list-style-type: none"> 1) correspond; 2) partially correspond; 3) do not correspond 	<p>The aim is clearly stated: to study access to water, sanitation, and hygiene services in schools. The objectives of the study also strictly correspond to the aim and are aimed at systematizing and analyzing data, identifying patterns, assessing satisfaction with WASH services, identifying factors influencing the hygienic behavior of school students and conducting epidemiological analysis of related disease problems, as well as developing recommendations for improving the sanitation and hygiene situation in schools.</p>
		<p>4.4 All sections and statements of the thesis are logically interrelated:</p> <ol style="list-style-type: none"> 1) fully interrelated; 2) partially interrelated; 3) no interrelation 	<p>All sections and provisions of the dissertation are logically interconnected. The dissertation work has a high degree of internal unity. The author conducted a literature review of domestic and foreign literature on the problem of water, sanitation and hygiene in schools and formulated the relevance, goals and objectives of the dissertation work. The work structure is built consistently and logically; each section serves its aim and is put into the general context of the study. The materials and methods are aimed at solving the set tasks. The conclusion and the findings are formulated to be consistent with the study's aim and objectives and reflect recommendations for applying the results obtained.</p>
		<p>4.5 New solutions (principles, methods) proposed by the author are well-reasoned and evaluated in comparison with known solutions:</p> <ol style="list-style-type: none"> 1) it has critical analysis; 2) the analysis is partial; 3) the analysis is not the author's own opinions but quotes from other authors 	<p>The author has developed and implemented the elective discipline course "Water, Sanitation and Hygiene" in schools. The author has argued that such a course can positively affect the school students' perception of water supply, sanitation and hygiene issues.</p> <p>Recommendations on implementing monitoring and evaluation, using questionnaires and observation methods, and introducing a systematic approach to WASH are a logical continuation of the study. These methods allow for systematically analyzing and improving school sanitation and hygiene conditions.</p>
5.	The	5.1 Are the scientific results	This thesis's scientific results and provisions are mainly new and

principle of scientific novelty	and provisions new? 1) entirely new; 2) partially new (25-75% are new); 3) not new (less than 25% are new)	<p>original. For the first time, the study comprehensively analyzed access to water, sanitation and hygiene in schools, distinguishing this work in the context of sanitation and hygiene research.</p> <p>The assessment of satisfaction with services and the isolation of factors influencing the hygiene behavior of school students represent an original contribution to the study of social aspects of sanitation hygiene in educational institutions.</p> <p>The epidemiological analysis of WASH-related diseases among children under 18 years of age provides new data on school students' health. It identifies possible risks and problems in this area.</p> <p>The proposed recommendations for improving school sanitation and hygiene conditions are also essential to the work's innovation. These recommendations can serve as a basis for implementing measures to improve the quality of services in educational institutions.</p>
	5.2 Are the findings of the thesis new? 1) entirely new; 2) partially new (25-75% are new); 3) not new (less than 25% are new)	<p>The findings presented in the thesis are entirely new and represent an original contribution to public health.</p> <p>The findings reveal new aspects of the problem and provide a basis for developing practical measures to improve sanitary and hygienic conditions in schools.</p>
	5.3 Technical, technological, economic or management decisions are new and justified: 1) entirely new; 2) partially new (25-75% are new); 3) not new (less than 25% are new)	<p>The technical, technological, economic and managerial solutions presented in the thesis are entirely new and well-founded. The study proposed innovative approaches to address the problem of access to water, sanitation and hygiene in schools, including the development of an elective course, "Water, Sanitation and Hygiene", and recommendations for the introduction of monitoring and evaluation of important sanitation and hygiene indicators using questionnaires and observation methods.</p> <p>These solutions are innovative and justified by the results of empirical</p>

			research presented in the thesis.
6.	The validity of the main findings	All significant findings are/are not based on scientifically rigorous evidence or are reasonably well supported (for qualitative research and arts and humanities training areas).	All the main conclusions presented in the thesis are based on scientifically justified evidence. The author conducted a detailed study using various methods and analyzing extensive data. It has enabled the development of clear and evidence-based conclusions.
7.	The main points to be defended	<p>The following questions need to be answered for each provision individually:</p> <p>7.1 Is the position proven? 1) proven; 2) rather proven; 3) rather not proven; 4) not proven</p> <p>7.2 Is it trivial? 1) yes; 2) no</p> <p>7.3 Is it new? 1) yes; 2) no</p> <p>7.4 The level for application is: 1) narrow; 2) medium; 3) wide</p> <p>7.5 Is it proven in the article? 1) yes; 2) no</p>	<p>For the first provision, the thesis scientifically substantiates that the water, sanitation and hygiene situation in schools in Kazakhstan is heterogeneous and not all schools, especially in rural areas, have equal access to WASH services. The provision is not trivial as it reflects essential differences in access to sanitation services across schools, which can have severe implications for students' health. The provision is novel based on the research and literature review conducted as part of the thesis. The provision has a broad application level related to school health and hygiene conditions and may be relevant to developing education and health policies and practices. The provision is scientifically substantiated within the thesis, which confirms its scientific validity and relevance.</p> <p>According to the second provision, the thesis scientifically substantiated that the epidemiological situation on infectious morbidity related to water supply, sanitation and hygiene shows a decreasing trend, confirmed by retrospective analysis of data from the annual statistical collection. This new and essential provision is not trivial and has a broad application level, making it scientifically grounded and significant for public health.</p> <p>On the third point, the thesis provides a scientifically substantiated position on the availability of centralized water supply and sanitation systems in most urban schools while revealing insufficient hygiene facilities in these educational institutions. The study involves various methods, such</p>

			<p>as a survey of administration, parents, observation, and a questionnaire for pupils, confirming this position's scientific validity. This new provision is not trivial and can be widely applied, making it relevant and essential to education and health.</p> <p>The fourth proposition put forward for defence in the thesis is scientifically based. The study shows that the hygiene behavior of students depends on several factors, such as school location, student age, availability of water, sanitation and hygiene education, and quality of services in the area. To validate this position, the author used multiple binary logistic regression. This new provision is not trivial as it is a scientifically valid analysis of multiple factors that influence the hygiene behavior of students. The provision has a broad application level and can help develop education and health programs and strategies. It is also scientifically validated and documented within the thesis, which confirms its scientific significance.</p>
8.	<p>Principle of reliability</p> <p>Reliability of provided sources and information</p>	<p>8.1 Choice of methodology - justified or methodology is sufficiently detailed</p> <p>1) yes; 2) no</p>	<p>The methodology chosen to conduct the research in this thesis is justified and described in detail. The paper provides details of the methods used to collect and analyze the data, including interviews with administrators, parents, observation, and student interviews. This provides a clear understanding of the methodology and allows the reader to quickly understand how the study was conducted, an essential aspect of a research paper.</p>
		<p>8.2 The results of the thesis were obtained using modern methods of scientific research and techniques of data processing and interpretation with the use of computer technologies:</p> <p>1) yes; 2) no</p>	<p>The results of the thesis were obtained using modern methods of scientific research and data processing and interpretation techniques, with active use of computer technologies. The data were analyzed using the statistical package IBM SPSS Statistics version 26.0 for Macintosh. Data processing and analysis included descriptive frequency analysis and chi-square statistical test (χ^2) to determine the significance of differences in categorical variables. In addition, multiple logistic regression was used to examine comorbidities and to examine effect variation. The significance</p>

			level for differences was set at $p < 0.05$, and 95% confidence intervals were used to assess the strength of the association. This methodological approach ensures the reliability and scientific validity of the study results.
		8.3. Theoretical conclusions, models, revealed interrelations and regularities are proved and confirmed by experimental research (for the directions of training in pedagogical sciences, the results are proved based on pedagogical experiment): 1) yes; 2) no	References to relevant and reliable scientific literature support the crucial assertions in the thesis. The author actively refers to relevant studies, theoretical works and scientific articles, which enriched the theoretical foundation and ensured the scientific validity of the assertions presented. This approach strengthens the validity of the results and conclusions presented in the thesis.
		8.4 Important statements are confirmed /partially confirmed/not confirmed by references of relevant and reliable scientific literature	References to relevant and reliable scientific literature adequately support essential assertions in the thesis. The author actively refers to relevant studies, theoretical papers and scientific articles, demonstrating the thoroughness and scientific validity of the assertions presented in the work. This strengthens the validity of the results and conclusions presented in the thesis and confirms their relevance in current scientific literature.
		8.5 Used literature sources are sufficient /not sufficient for a literature review	The literature sources used in the thesis are sufficient for a literature review. The author has provided a broad overview of relevant scientific research and theoretical works related to the thesis topic. This allows the reader to understand the current state of scientific knowledge and utilize contemporary sources to support their arguments and conclusions.
9	The principle of practical value	9.1 The thesis has theoretical significance: 1) yes; 2) no	The thesis has high theoretical significance. The study's findings can be used in educational programs to improve schools' water, sanitation and hygiene conditions. The theoretical significance is that the thesis examines access to water, sanitation and hygiene in schools from a public health perspective. The findings and recommendations can be used to develop

			strategies to improve school health and create safe and healthy learning environments, contributing to more successful learning and improving students' overall well-being.
		<p>9.2 The dissertation has practical significance, and there is a high probability that the findings will be applied in practice:</p> <p>1) yes; 2) no</p>	<p>The dissertation has high practical significance and a high probability of applying the obtained results in practice. The findings and recommendations formulated in the work can be widely used by education authorities, school administrations, school teachers and parents to improve students' water supply, sanitation and hygiene practices. The study's findings can raise stakeholders' awareness of the importance of water supply, sanitation and hygiene in schools.</p> <p>The practical relevance is also that the recommendations for educational courses on hygiene skills can promote good hygiene habits among students. In addition, the monitoring recommendations can be applied in school administrators' and teachers' work to improve educational processes and conditions for students.</p> <p>The study's results have already been used in the activities of various educational organizations, such as the specialized boarding school lyceum "Daryn", the general education school named after Akbaev, and the specialized boarding school lyceum named after Zhambyl. This confirms the high practical value of the results of the dissertation and their active application in practice.</p>
		<p>9.3 Are the practice proposals new?</p> <p>1) entirely new; 2) partially new (25-75% are new); 3) not new (less than 25% are new)</p>	<p>The suggestions for practice formulated in this thesis are entirely new. The author has conducted a study that has revealed new aspects of access to water, sanitation and hygiene in schools, as well as factors influencing the hygiene behavior of school students. Based on the findings, new recommendations and suggestions for improving school conditions have been developed, making them entirely new and relevant for practical application.</p>
10.	The	The quality of academic	The quality of academic writing in this dissertation is assessed as high.

quality of writing and design	writing is: 1) high; 2) average; 3) below average; 4) low.	The author clearly and logically states his research conclusions and arguments, uses professional and scientific language, and presents information in a structured form. The formatting and structure of the work meet the requirements of academic style.
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The thesis of Zhanerke Bolatova "Assessing access to water, sanitation and hygiene in schools" is devoted to the study and analysis of the opinions of various age- gender groups of the population about health and illness, about the influence of socio-economic factors on public health, about social models of preservation and strengthening health because of water access.

The thesis of Zhanerke Bolatova on the theme: "Assessing access to water, sanitation and hygiene in schools", submitted for the degree of Doctor of Philosophy (PhD) on the educational program "6D110200 - Public Health", on its relevance and scientific and practical significance of the results obtained meets the requirements of the Committee for Quality Assurance in the field of science and higher education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, and I apply to the Committee to award the doctoral student the degree of Doctor of Philosophy (PhD) on the educational program "6D110200 - Public Health".

Official Reviewer:
Doctor of Biological Sciences,
Professor of the Department of Environmental
Management and Engineering, Eurasian
National University named after L.N. Gumilyov,
Visiting Professor of Landscape
Ecology & Ecosystem Science Lab,
Michigan State University

Handwritten signature

Raikhan Beisenova

