

STATEMENT

by **Antoanaeta Anastasova Angelacheva, PhD**

Assoc. Prof. at Plovdiv University “Paisii Hilendarski”, Faculty of Chemistry,
Department of General and Inorganic Chemistry with Methodology of Teaching Chemistry
of dissertation for the creation of the educational and scientific degree “**Doctor**”

by field of higher education *1. Pedagogical sciences*
professional management *1.3. Pedagogy of teaching...*
doctoral program *Methodology of teaching biology*

Author: *Kalina Emilova Ivanova*

Subject: *Formation of practical knowledge and skills in students through STEM training*
(Biology and health education – 7th grade)

Scientific adviser: *Assoc. Prof. Delka Vasileva Karagyozova-Dilkova, PhD – Plovdiv*
University “Paisii Hilendarski”

1. General description of the materials submitted and the procedure

The materials presented by doctoral student *Kalina Emilova Ivanova* are in accordance with the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria, as well as Art. 36 (1) of the Regulations for development of the academic staff of University of Plovdiv “Paisii Hilendarski”. The set of documents includes:

- request to the Rector of the University of Plovdiv for disclosure of the procedure for defense of the dissertation;
- CV in European format;
- Minutes of the Department Council, related to reporting on the readiness to open the procedure and preliminary discussion of the dissertation work;
- opinion by the supervisor Assoc. Prof. Delka Karagyozova-Dilkova on the readiness to defend the dissertation;
- dissertation work;
- author's abstract;
- declaration of originality and authenticity of the attached documents;
- reference for compliance with the minimum national requirements;
- list of 5 scientific publications on the topic of the dissertation;
- copies of scientific publications.

The scientific jury for the procedure for the defense of the dissertation was selected and approved by Order № RD-21-1417 of 08.07.2024 of the Rector of Plovdiv University “Paisii

Hilendarski” pursuant to Art. 4 of the Law on the Development of the Academic Staff of the Republic of Bulgaria (LDASRB) and in accordance with Art. 2 (2), Art. 30 (3) of the Regulations for application of LDASRB and Art. 37 (1) of the Rules for Development of the Academic Staff of Plovdiv University “Paisii Hilendarski”.

2. Topicality of the subject

The dissertation research presents an author’s methodological model for the application of STEM education with a leading subject Biology and Health Education. The topic is relevant and corresponds to the needs for the integration of STEM disciplines for the formation of practical knowledge and skills in adolescents set out in state regulations.

3. Knowledge of the problem

An indicator of the scientific awareness of the PhD student on the topic of the dissertation is the rich bibliographic material used in the construction of the theoretical foundations of the research. It consists of 140 literary sources, of which 38 in Cyrillic, 78 in Latin and 24 electronic resources. The bibliography covers different areas of knowledge that are directly related to the problem under study.

An important indicator of *Kalina Ivanova*’s competence in the problem under consideration is the quality of the created model for the implementation of STEM education, which is the result not only of good information, but also of skillful interpretation and creative decisions of the PhD student under the guidance of the supervisor.

4. Research methodology

The research methodology adopted by *Kalina Ivanova* allows for the full construction of both the theoretical analysis, presenting the grounds for the author’s idea and its implementation, as well as for a good organization of the experimental work, through which the research hypothesis is tested.

Adequate methods of scientific research are used, which ensure the achievement of good results and contribute to the reliability and validity of the approved STEM lessons for the formation of practical knowledge and skills in Biology and Health Education 7th class. Undoubtedly, the methodology used is based on high professionalism and ensures thoroughness and scientific precision in conducting the study.

5. Characteristics and evaluation of the dissertation work and contributions

The dissertation is structured in an introduction, three chapters, conclusion and contributions, publications on the topic, bibliography and 6 appendices. The total volume is 245 pages, of which 166 are body text. The dissertation is richly illustrated – 58 tables and 63 figures have been created.

In the Introduction, the choice of the topic of the dissertation is argued in connection with the need to integrate STEM disciplines for the formation of practical knowledge and skills in students.

In Chapter One, the history of the emergence and development of STEM education is traced. Definitions of STEM education are analyzed, and a working definition is adopted for the purposes of the study. A theoretical study of models and good pedagogical practices for STEM integration has been carried out, which are illustrated with appropriate figures. The advantages, difficulties and limitations of applying STEM education are outlined.

In the Second Chapter of the dissertation, the object and subject of the research are clearly indicated, the purpose and research tasks are correctly formulated, and the methods of the research are indicated. The set theoretical and practical research tasks ensure the successful development of the topic and outline the request of the PhD student to achieve scientific, applied and applied results.

On the basis of the theoretical study of the specialized literature, a methodological model has been created for the application of STEM education with the leading subject Biology and Health Education. The model is deployed in its five main components. For the implementation of the developed model, author's methodological developments of STEM lessons and STEM projects for the topics related to unicellular organisms from the kingdom of Monera and the kingdom of Protista from the curriculum in Biology and Health Education 7th grade are proposed. The presented methodological developments of lessons were used in the organized and conducted pedagogical experiment. The created didactic materials can be directly used in the pedagogical practice of biology.

For diagnostics of the knowledge and skills acquired by students, a system of criteria and indicators has been developed. They were used in the construction of two didactic tests to establish the achievements of students before and after the experimental training.

Chapter Three presents the results of the pedagogical experiment, their statistical analysis and interpretation. This chapter is rich in evidence – tables, figures, diagrams. The pedagogical experiment is presented with special attention and precision. The experimental data obtained from the three stages of the study confirm the constructed working hypothesis.

In conclusion, conclusions from the dissertation research are correctly formulated, theoretical and practical contributions are presented.

Appendices present methodological developments and materials for STEM lessons and projects, created surveys, didactic tests and their specifications.

6. Assessment of the publications and personal contribution of the doctoral student

The results of the different stages of the pedagogical survey were reported at 6 conferences and were formed in 5 articles published in various specialized journals. Of the publications, 1 are independent and 4 are first authored. In addition to the list of publications on the topic of the dissertation, a list of other publications of the PhD student is also presented. It contains 4 articles, of which 2 are independent and 2 with a first author.

The proposed publications are evidence of the good promotion of the results of the survey, as well as the ability of the doctoral student to work in a team. The number and quality of publications meet the requirements of the Rules for Implementation of the Law on The Development of Academic Staff in the Republic of Bulgaria.

I have no doubt that the research in the current dissertation and the publications to it are the personal work of the doctoral student *Kalina Ivanova*. I have not established plagiarism in the materials submitted to me for review.

7. Abstract

The author's report reflects the essence of the theoretical staging, the studies carried out, the conclusions and contributions received. The volume of the author is 31 pages, which allows the reader to quickly familiarize himself with the ideas and contributions in the dissertation.

8. Recommendations for future use of dissertation contributions and results

In view of the significance of the conducted research, it is important to popularize it among pedagogical specialists. It would be useful to publish the developed STEM lessons and STEM projects in a textbook.

CONCLUSION

The dissertation contains scientific, scientific-applied and applied results, which represent an original contribution to science and meet all the requirements of the Law on Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for implementation of LDASRB and the relevant Regulations of the University of Plovdiv "Paisii Hilendarski".

The dissertation shows that the doctoral student *Kalina Emilova Ivanova* has in-depth theoretical knowledge and professional skills in the scientific specialty Methodology of teaching biology, demonstrating qualities and skills for independent research.

Due to the above, I confidently give my *positive assessment* of the research presented by the above peer-reviewed dissertation, abstract, results and contributions, and *propose to the esteemed scientific jury to award the educational and scientific degree "doctor" of Kalina Emilova Ivanova* in the field of higher education: 1. Pedagogical sciences; professional field: 1.3. Pedagogy of teaching in ...; doctoral program: Methodology of teaching biology.

09 August 2024

Author of the opinion:

Plovdiv

(Assoc. Prof. Antoaneta Angelacheva, PhD)