

## OPINION

of a dissertation

for the acquisition of the educational and scientific degree "doctor"

in professional direction 1.3 Pedagogy of training in...,

by defense procedure at the Faculty of Physics (FzF)

of Sofia University "St. Kliment Ohridski" (SU)

The opinion was prepared by: **Prof. Dr. Zhelyazka Dimitrova Raykova,**

Plovdiv University "Paisiy Hilendarski", in his capacity as a member of the scientific jury according to Order No. RD 38-617/20.11.2023. of the Rector of Sofia University

Dissertation topic: "**Comparative analysis of educational content in atomic physics in different countries**"

Author of the dissertation: **Konstantin Plamenov Ilchev**

### **I. General description of the presented materials**

#### **1. Data on the submitted documents**

The candidate Konstantin Ilchev has submitted a dissertation and an Author's abstract, as well as the mandatory tables for Physics from the Regulations for the conditions and procedures for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski". A total of 12 other documents are also submitted (in the form of official notes and certificates from the doctoral procedure, author's reference for the contribution nature of the works, declaration of authorship, and references for plagiarism), corresponding to the candidate's status and his readiness to defend a dissertation . I received the documents electronically.

The documents submitted by the candidate for the defence correspond to the requirements of the ZRASRB, PPZRASRB and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski" (PURPNSZADSU).

#### **2. Applicant data**

The candidate is a physics teacher in a secondary school in Sofia and has good professional training received at the University of Sofia "St. Kliment Ohridski" and the University of Innsbruck (Austria). He is a doctoral student at the "Physics Teaching Methodology" department at Sofia University. Unfortunately, the submitted CV contains only this information about the candidate.

### **3. General characteristics of the candidate's scientific achievements**

The relevance of the dissertation research is well argued in the Introduction and Chapter One of the dissertation. The chosen topic is current both for pedagogical theory and educational practice. This is because it examines the ever-current problem of determining the educational content in secondary school as well as the trends and prospects of applying different educational methods in the physics lesson in secondary school when studying the topics of atomic physics. The study was conducted immediately after the introduction of the new physics curriculum 2015 and currently applied curricula from 9 countries are used for comparative analysis. The topic has scientific value.

The dissertation work is well structured in three chapters and has sufficient volume of 182 pages. The used research methods are in a wide range - application of the principles of comparative education, secondary analysis of data from the international study ((TIMSS Advanced 2015), statistical processing of data from empirical research, content analysis of scientific articles on the problem, conducting practical research by testing the results of teaching through an interactive method.

The selected research design is consistent with the set goal and objectives of the dissertation research, defined in the introduction of the dissertation. Theoretical and empirical scientific methods are used in synchrony and complement each other. The chosen research methodology generally allows achieving the set goal and obtaining an adequate answer to the research tasks solved in the dissertation work.

The conducted comparative analysis of curricula of 9 countries was made in accordance with modern pedagogical understandings, which the author knows very well. The purpose of the study is to determine the global trends in the teaching of atomic and subatomic physics, in terms of teaching content and expected teaching time, to determine the place of the Bulgarian curriculum among them and to study the most common teaching methods on these topics. The content indicators for the conducted comparison are competently determined, which are combined with key observations from practice, described in scientific articles and collected through the personal pedagogical experience of the doctoral student.

The author's curriculum comparison activities described in Chapter One can serve as a technological model for subsequent similar studies. The results are successfully summarized in tables and analyzed in depth and purposefully. The conclusions drawn are practically oriented and significant. I find the curriculum comparison very interesting, useful and excellently done. It can be a benchmark for similar research on other physics topics in the school course and a good scientific basis for creating secondary school physics curricula.

Doctoral student Ilchevski knows very well international research in the field of studying natural sciences in secondary school (PISA and TIMSS) and he is able to purposefully analyze data from them by applying statistical methods. The secondary analysis of the TIMSS advance data for 2015 shows the doctoral student's ability to clearly formulate indicators, analyze results in detail and formulate in-depth conclusions. In them, Mr. Ilchevski points out the place of the physics curriculum in Bulgaria among those reviewed, evaluates its content (the number of various topics, the time for studying them) and offers ideas for updating it, related to differentiation through integrative modules and optimal structuring for more time to grasp of basic physics concepts.

As a result of the analysis and synthesis of very well-chosen literary sources (32 articles on the topic), a thorough content analysis was made regarding the teaching methods used of atomic and subatomic physics. Here, doctoral student Ilchevski has shown a very good knowledge of the state of the researched problem in science and skills to critically and creatively evaluate literary sources and to make a complex analysis of theoretical statements and good practices.

The methodological analysis of the educational content of the topics on the quantum properties of light, atomic spectra, atomic nucleus, nuclear reactions and elementary particles is in the context of the set research goal. The methodological interpretations of individual structural elements of physical knowledge described in Chapter 3, their consideration in historical terms, as well as the formulated difficulties and specifics in their study, show the author's excellent theoretical training in physics, as well as his ability to thoroughly investigate methodological problems and, accordingly, to teach effectively by knowing, selecting and applying a variety of interactive methods. I read with great interest the detailed description of the various methods that Mr. Ilchevski uses as a physics teacher. I believe that the text has considerable methodological value and it is a sure indicator of his professional maturity of the doctoral student.

I highly appreciate the performed diagnostic study described in the same chapter. The prepared tests are appropriately constructed and their results precisely processed. The skilful use of statistical methods, the graphical and tabular presentation of the results, as well as the clearly formulated conclusions show the excellent readiness of the doctoral student to conduct pedagogical research.

#### **4. Content analysis of the applicant's scientific and scientific-applied achievements contained in the materials for participation in the competition**

In general, the dissertation wins with its positive features, which can be summarized in several main points:

- Significance and relevance of the developed problem;
- Development and approval of a technological model for conducting a comparative analysis of study programs in atomic and subatomic (high school) physics from different countries;
- Creation and implementation of a methodology for characterizing, by means of key features, the content of publications in the field of educational methods;
- Conducted empirical research at a very good level;
- On the basis of the good theoretical, quantitative and qualitative analyzes realized in the research, the author formulates significant generalizations and recommendations related to the investigated issues.

The dissertation is easy to read, the language and the style are understandable without losing their scientific accuracy. I recommend making a more precise definition of the understanding of "learning content", because the proposed one includes teaching methods that are traditionally associated with the procedural side of the learning process. It is good to use the terms "augmented reality" instead of "enriched reality", "lesson" and not "class".

I do not personally know PhD student Konstantin Ilchev.

The scientific publications included in the dissertation meet the minimum national requirements (according to Art. 2b, paras. 2 and 3 of the RSARB) and, accordingly, the additional requirements of the SU "St. Kliment Ohridski" for the acquisition of the educational and scientific degree "Doctor" (for the acquisition of the scientific degree "Doctor of Physical Sciences") in the relevant scientific field and professional direction.

The scientific publications included in the dissertation work do not repeat those from previous procedures for acquiring a scientific title and academic position.

There is no proven plagiarism in the submitted dissertation and abstract.

## **5. Conclusion**

After having familiarized myself with the presented dissertation work, Abstract and other materials, and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, **I confirm** that the scientific achievements meet the requirements of ZRASRB and the Regulations for its application and the relevant Regulations of the SU "St. Kliment Ohridski" for **acquiring the educational and scientific degree "doctor"**. The candidate satisfies the minimum national requirements in the professional direction and no plagiarism was found in the dissertation, Abstract and scientific works submitted for the competition.

I give my **positive assessment** of the dissertation work.

## **II. GENERAL CONCLUSION**

Based on the above, **I recommend** to the Scientific Jury that awarded the **educational and scientific degree "doctor"** in professional direction 1.3 Pedagogy of training in... to **Konstantin Plamenov Ilchev**.

12.01.2024

Prepared the review: .....

(Prof. Dr. Zhelyazka Raykova)