# STATEMENT REPORT

**In connection with a procedure for the acquisition of the educational and scientific degree "Doctor" by candidate Ralitza Ljubomirova Stamenkova,**
**Title of the PhD Thesis: "The Role of Applied Problems from the School Mathematics Course for the Learning Purposes ",**
Scientific field: **1. Pedagogical Sciences**
Professional field: **1.3. Pedagogy of learning in …**
Doctoral program **"Teaching Methodology of Mathematics and Informatics"**
Department „**Education in mathematics and Informatics**",
**Faculty of Mathematics and Informatics (FMI)**, **Sofia University "St. Kl. Ohridski" (SU),**

The statement report has been prepared by: Prof. Doctor of Mathematical Sciences Petar Stoyanov Kenderov (pensioner) as a member of the scientific jury for the defense of this PhD thesis according to Order № РД-38-669 / 20.12.2023 of the Rector of Sofia University.

1. **General characteristics of the dissertation thesis and the presented materials**
   Ralitsa Stamenkova was a full-time doctoral student in the aforementioned Doctoral program in the period 01.02.2019 - 01.02.2022, after which she left the program "with the right of dissertation defense". On November 15, 2023, she turned to the head of the department, Assoc. Prof. Dr. Filip Petrov, with a request for admission to a preliminary discussion of the dissertation work prepared by her on the topic "The role of applied tasks from the school mathematics course for the learning purposes" under the supervision of Prof. Dr. Ivan Tonov. From the documents attached to this procedure, it becomes clear that she has fulfilled her doctoral duties and passed all the necessary exams. Another document shows the national requirements under Art. 26, para. 2 and 3 of ZRAS of the Republic of Bulgaria are fulfilled as well. The Similarity Report finds no reason to suspect plagiarism.
   The dissertation begins with 8 "service" pages, in which the Introduction and the seven Chapters and their subsections are described. Indexes of figures and tables are provided, as well as a list of abbreviations. The main part of the work consists of 178 pages with an average of over 2400 characters per page. Converted to standard pages (of an average of 1,800 characters), this is equivalent to well over 200 pages. The bibliography at the end of the work contains over 150 titles of articles and books, as well as 30 Internet sites and digital applications. 6 links are given to the electronic resources of the Ministry of Education and Science since some strategic documents of the Ministry have been used (and cited) in the text: curricula for profiled preparation, curricula and programs by classes, materials related to independent external evaluation, etc.

   If one has to characterize the dissertation work in a few words, the first ones that come to mind are: high awareness of the subject, adequate scope of the problems under consideration, a broad front of research, well-defined goals, hypotheses, research methods, and results.

2. **Short CV and personal impressions of the candidate**

My personal impressions of the candidate are negligible. From the materials presented during the procedure, it appears that she has a good secondary education (German high school in Sofia), a good university education in Informatics, and a teacher's qualification (from FMI). She has practical experience working in the Real sector of the economy (including at the managerial level), as well as solid teaching experience in higher education. Fluency in foreign languages has facilitated her work on the dissertation, where the comparative analysis of individual aspects of our educational reality and their corresponding equivalents in other countries is the basis for raising and substantiating hypotheses, finding research approaches, and presenting appropriate illustrative examples.

3. **Content analysis of the scientific and applied achievements of the candidate, contained in the presented Ph.D. thesis and the publications to it, included in the procedure.**

The presented dissertation work has a monographic character. The central theme is the role of applied tasks in mathematics education. This role is too multifaceted in content and too diverse in character. Covering all its aspects is a difficult task, but the dissertation shows that successful progress in this direction is quite possible.

Examining and solving applied problems in mathematics education does not simply (and not only) cultivate abilities to solve such problems. It does much more. It is shown in the dissertation that it leads to the development of personal qualities that directly correspond with the European Union's reference framework for key competencies and the skills necessary for successful personal realization in the 21st century. The topic is very actual, especially for the Bulgarian education system, whose product today is the functional illiteracy of a dangerously big part of the country's adolescents.

The literature review, which essentially accompanies all the considerations throughout the dissertation, is quite impressive. It shows a good knowledge of the results of other researchers (and especially the classics). In-depth comparisons cover countries where German, English, Russian, and, of course, Bulgarian are spoken.

The determination of the goals, the object, and the subject of the study, as well as the numerous raised hypotheses, upon first familiarization with the Abstract, leave a certain feeling of chaos and fragmentation. However, the dissertation work itself erases this feeling, because it reveals deep interconnections that make the work a coherent whole.

An important feature of the work is that it not only outlines the problems, but also indicates ways to overcome them through the demonstration of examples of educational practices in other countries and the use of digital technologies. The results of a pedagogical experiment with students from several metropolitan schools are also described, which schools, however, have a special status and the conclusions of such an experiment are hardly authoritative for our entire educational system.

The content of the dissertation is presented very well and in a concentrated form in the "internal" review of the head of the department, Prof. Dr. Filip Petrov.

Finally, it is appropriate to note the purely linguistic merits of the work - a rich vocabulary, accurate expression, and care for the reader.

4. **Approbation of the results**

Three publications related to the presented material are indicated in the dissertation:

*Ralitza Stamenkova*, DO WE NEED THE APPLICATION PROBLEMS IN MATH CLASSES, EDULEARN21 Proceedings, 2021, pages:11686-11694, ISBN:978-84-09- 31267-2 2.

*Ralitza Stamenkova*, DISTANCE EDUCATION IN BULGARIA DURING COVID-19 IN A SMALL EDUCATIONAL ORGANIZATION – METHODOLOGY AND TOOLS, ICERI2020 Proceedings, editor/s:L. Gómez Chova, A. López Martínez, I. Candel Torres, Publisher:IATED Academy, 2020, pages:5523-5532, ISBN:978-84-09- 24232-0, doi:10.21125/iceri.2020, Ref, IF ( - 2020)

*Ralitsa Stamenkova*, Electronic education for the purposes of training future mathematics and informatics teachers, Electronic education in higher schools, publisher: University Publishing House "St. Kliment Ohridski", 2020, pp.:215-226, ISBN:978-954-07-5028-6

In the documentation accompanying this procedure, there is a list of six participations in conferences, some of which are related to the issues considered in the dissertation work.

**5. Qualities of the abstract**

The abstract correctly and fully reflects the facts and conclusions in the dissertation work. As stated above, considered alone, it does not give a full and adequate idea of the depth of the discussions in the dissertation work.

**6. Critical notes and recommendations**

The repository of applied tasks that are considered in school is already well-researched, used and, in a sense, worn out. New tasks are usually "dressing up" an already-known idea. Applied problems that would certainly interest students today usually require higher-level mathematical apparatus (differential equations, theoretical mechanics, nonlinear optimization). This makes them unsuitable for school consideration. However, there is a very wide range of interesting tasks that allow the formulation of an adequate mathematical model by using only school knowledge, but the rigorous solution of the thus obtained mathematical model is beyond the capabilities of school mathematics. On the other hand, the numerical solution of the model with good (from the point of view of practice) accuracy is entirely within the strengths of systems such as GeoGebra. Considering such tasks has the potential to spark students' interest in mathematics as well as significantly improve their functional literacy. A team from IMI-BAN has long promoted this idea in a series of publications on the Inquiry-based approach in Mathematics Education, including through an invited section report at one of the World Congresses on Mathematics Education (Hamburg 2016) and through a publication in one of the leading journals in Mathematics Education (ZDM, 2022). Such tasks are often given to the "VIVA Mathematics with Computer" competition mentioned in the dissertation and are met with

interest by the participants. The Virtual school mathematics cabinet (www.cabinet.bg) also contains many such tasks in the STEAM section. An expansion in this direction of the research in the dissertation work would give a new added value to the work of the doctoral student. What has been said so far in this section of the Opinion is by no means a criticism, but rather a recommendation and suggestion for further work.

The role of digital literacy in the discussions in the dissertation seems to me to be slightly underestimated. It is reduced to "Text and presentation formatting, using digital tools for visualizing graphs and formulas" (p. 99). This is hard to agree with. GeoGebra-type systems allow a significant part of the mathematical facts and phenomena studied at school to be learned, explored and even discovered by the learner in a purely experimental way. Just as all other natural science disciplines are studied. In this also lies a serious potential for mastering mathematics to the extent of being able to solve applied problems.

Several times in the text of the dissertation work, I came across gaps of the "spelling error" type, which would be good to remove in a possible future publication in the form of a monograph. Here are some of them:
(given in Bulgarian because a description in English would take much more space and because these errors are insignificant for the main considerations in the dissertation work)
***„Творческите“ задачите*** *са характерни за сериозни математически състезания и олимпиади и не са тема на настоящата дисертация.*
***което се само дава*** *директното решение, но то е придружено с разбито на стъпки*
*България* ***не е сама разглеждания*** *проблем. Стр 59*
*Все още* ***популярните проектно-ориентираните*** *задания в училище*
***Анализно е мястото*** *на приложните задачи при (стр167 т.3)*

**7. Conclusion**

Having become acquainted with the PhD thesis presented in the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, **I confirm** that the presented PhD thesis and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the Sofia University “St. Kliment Ohridski” (FMI-SU) for acquisition by the candidate of educational and scientific degree “Doctor” in the Scientific field **1. Pedagogical Sciences**, Professional field **1.3. Pedagogy of learning in …**In particular, the candidate meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition.

Based on the above, **I strongly recommend** the scientific jury to award Ralitza Ljubomirova Stamenkova, the educational and scientific degree “Doctor” in the Scientific field **1. Pedagogical**

**Sciences**, Professional field **1.3. Pedagogy of learning in …**, Doctoral program **"Teaching Methodology of Mathematics and Informatics"**

Date: 08.03.2024 Signature: .....

/Professor Petar Kenderov/