

## REVIEW

**of a dissertation for the acquisition of the educational and scientific degree "doctor"  
in a professional area 4.1. Physical Sciences (Optometry) by defense procedure at the  
Faculty of Physics of Sofia University "St. Kliment Ohridski" (SU)**

The review was prepared by: Prof. DSc. Elena Stoykova, Institute of Optical Materials and Technologies - Bulgarian Academy of Sciences, in her capacity as a member of the scientific jury according to Order No. RD 38-448/25.07.2022 of the Rector of Sofia University.

**Title of the dissertation:** "VISION SCREENING IN SCHOOL-AGE CHILDREN."

**Author of the dissertation:** Mila Tonieva Dragomirova

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

#### **1. Description of the submitted documents**

The applicant, Mila Dragomirova, has submitted a dissertation and an Author's abstract, as well as the mandatory tables for Physical Science from the Regulations for the Terms and Conditions for Acquiring Scientific Degrees and Holding Academic Positions at SU "St. Kliment Ohridski". A total of 8 other documents are also presented (author's abstract in English, master's degree diploma from Sofia University, curriculum vitae according to the European model, declaration of authorship, 4 publications on the dissertation topic) supporting the applicant's achievements. The documents submitted by the applicant for the defense correspond to the requirements of the Law on the development of the academic staff in the Republic of Bulgaria and its Regulations and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski".

#### **2. Applicant's data**

The applicant Mila Dragomirova has extensive professional experience in the field of dissertation research. After graduating from the Technical University as a Master of Engineering, she received a Master's degree from the Department of Optics and Spectroscopy of the Faculty of Physics of Sofia University "St. Kliment Ohridski", where she worked from 2016 until now as a physicist and assistant. She is the author and co-author of courses for the Bachelor of Optometry program. She is engaged in scientific research in the field of optometry, optics and vision sciences. She is the author of articles, presentations and posters for conferences in the country and abroad. She participated in 3 scientific projects. She carried out two specializations being invited as a lecturer at Dublin Institute of Technology (DIT), Dublin, Ireland in October 2017 and at Anglia Ruskin University of Cambridge (ARU), Cambridge, UK in February 2018. She conducts methodological organization and management of vision screenings. Since 2018, applicant Dragomirova has been a member of the accreditation commission for the European Qualification in Optics and the European Diploma in Optometry at the European Council of

Optometry and Optics (member of the subcommittee on optics). From 2014 to now, she is the chairman of the Bulgarian Union of Optometrists. As such, she is the founder and chairman of the Organizing Committee of two national, with international participation, conferences "Optometry and Eye Health" in 2016 and 2018. From 2012 until now, the applicant Dragomirova has also been developing an optical business as a manager and owner of Optometrist, Aversis OOD, Prooptica, with the subject of activity being the organization of an optical business, consulting users, prescribing and fitting high-tech means for optical vision correction and conducting optometric examinations and measurements.

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

The dissertation presented for review is dedicated to a very important task for society: analysis of the methodological and organizational aspects in conducting children's vision screening at school age. The analysis is based on an organized and conducted real screening in several schools in Bulgaria and includes the selection of appropriate optometric tests, accumulation and statistical processing of empirical data and the preparation of recommendations and protocols for school vision screening. The main purpose of such screening is to detect in time children with visual disorders who have not visited an ophthalmologist, and to apply the necessary therapy, as well as to alert parents and teachers to the need for more effective control in children who do not strictly comply the prescriptions of the ophthalmologist. The research conducted in the dissertation is particularly relevant in connection with the increase in the number of people with myopia throughout the world. At the same time, it fills a niche in health screening programs due to the lack of publications and practices with developed methodologies for children's vision screening. Along with the social significance of the presented dissertation, it contains specific scientific results as follows:

- 1) Development of a methodology for screening children's vision at school based on the analysis of the specific features of children's vision development and adaptation of reliable and inexpensive optometric tests that can be carried out on site in school settings.
- 2) Accumulation of a database on the prevalence of myopia in school-age children, in which the risk factors for each child are accounted for.
- 3) Comparative analysis using statistical methods of the frequency of visual disturbances in school children depending on various risk factors, including anomalous data on color vision deficiency in children and youth in a small town in Bulgaria.
- 4) Development of an info-structure concept in the system for managing the knowledge obtained from vision screenings for the purpose of training specialists, prevention of vision in school-age children and interaction with health authorities.

Four publications are included in the dissertation, of which 1 publication is from Group I (Q2), 1 publication is from Group III (SJR) and 2 publications are in reputed national journals. Mila Dragomirova is first author on both publications with impact factor and SJR. Three oral reports and 1 poster were presented at international conferences in Spain, Germany and Croatia. The scientific publications included in the dissertation meet the minimum national requirements

(according to Art. 2b, paragraphs 2 and 3 of the Law on the development of the academic staff in the Republic of Bulgaria and its Regulations) and, accordingly, the additional requirements of the SU "St. Kliment Ohridski" for the acquisition of the educational and scientific degree "doctor" in the scientific field 4. Natural sciences and professional area 4.1. Physical sciences. The scientific publications included in the dissertation 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.

#### **4. Characteristics and assessment of the applicant's teaching activity**

Applicant Mila Dragomirova is the author and co-author of courses and exercises for the bachelor's program "Optometry" such as "Introduction to Optometry", "Clinical Refraction 1", "Clinical Refraction 2", "Contact Lenses 1", "Contact Lenses 2", "Practical Optometry" .

#### **5. Content analysis of the applicant's scientific and applied achievements contained in the dissertation**

The dissertation submitted for review contains 120 pages, 14 tables, 22 figures and 115 cited sources. The content covers introduction and 6 Chapters. The dissertation is the result of several years of efforts by the author to achieve an ambitious and socially significant goal by applying physical and statistical methods. Based on many years of experience, effective optometric tests have been selected and methods for conducting vision screening in schools have been proposed, supplemented with a plan for assimilation and management of the acquired knowledge. The developed methods have been validated in the conditions of real screenings. A rich database of optometric data has been created and correlations between various risk factors and the degree of visual disturbances have been established through the methods of mathematical statistics. This allows me to evaluate the presented dissertation as an undoubted scientific and applied achievement. The contributions of the dissertation can be characterized as new approaches for screening research, enrichment of existing knowledge in the field of eye health of school-age children, application of scientific achievements in optometry in practice. The dissertation materials have been published in 4 publications, two of which have impact factor and SJR, respectively. Dissemination of results also includes 3 oral presentations and one poster at international conferences. So far, no citations have been noticed.

The dissertation contains 6 chapters, of which Chapter 1 is a survey. The purpose of the survey is to describe the visual disorders in childhood and to justify the need for screening children's vision in Bulgaria.

In Chapter 2, a methodology for vision screening in school is developed based on a variety of optometric tests used to detect various visual disorders. The main requirement for the inclusion of a given test in the screening protocol is its effectiveness and the possibility of being resourced. An analysis of the advantages and disadvantages of the various tests was made, on the basis of

which non-invasive relatively quick tests with high sensitivity and specificity were selected. The methodology includes objective and subjective tests. The methodology ensures the detection of the maximum possible number of visual disturbances during screening outside a healthcare facility and helps the practical training of students and optometrists. A protocol form and screening questionnaire were developed. To speed up the screening procedure, a circular arrangement of the posts with the individual tests has been proposed and successfully tested in practice. Very good efficiency was achieved with the developed methodology, with the number of examined children being around 150 per day with a team of 6-7 students and two specialist ophthalmologists or optometrists. The developed methodology is a significant scientific and applied result.

In Chapter 3, a methodology for developing additional practical skills in optometry students is developed. The methodology includes a preliminary stage of familiarization with optometric tests, practical work at school and discussion of the obtained results as a final stage. The training of the students is supplemented by conducting simulation experiments in order to diversify the studied health cases, especially in binocular tests. Practice protocols have been developed for optometry students. The developed methodology combined with field work is a significant contribution to the training of optometrist students.

Chapter 4 of the dissertation is devoted to the study of the prevalence of myopia among school-aged children in Bulgaria, analyzing the influence of various risk factors. The research is based on optometric measurements carried out in several schools in three cities in Bulgaria (Sofia, Veliko Tarnovo and Devnia). As a very successful research approach, the screening in an ordinary and sports school in Sofia should be noted, as well as the comparison of the conditions in the big and small city. A questionnaire was compiled, with the help of which data were collected on the influence of such factors as age, sex, heredity, playing sports, time in front of screens, the availability of health care such as previous examinations, prescribed optical correction, regular wearing of prescribed glasses. 1401 children were studied, of which 236 or 16.85% had myopic objective refraction less than or equal to -0.75 D and decimal visual acuity less than or equal to 0.8. The collected data were subjected to statistical analysis using the RStudio software package. It was clearly established by the  $\chi^2$ -squared statistics that all but one of the considered factors had an effect on the percentage of children with myopia. The percentage of children with myopia is significantly higher among children from Sofia who do not play sports, compared to those from a smaller city. In children aged 11 - 15 years, this percentage is also greater compared to children aged 6 - 10. An interesting result is that the factor that does not lead to statistically different percentages of children with myopia is the time spent in front of different screens. The percentage is statistically the same for less than 4 hours per day as well as for 4 and more hours per day. Using a logistic regression model in which the percentages of myopic children for each group of factors (variable) were used as predictors, the odds ratio of myopia and absence of myopia was estimated, indicating the most significant risk factors. The carried out detailed statistical analysis definitely gives very valuable information about the

prevalence of myopia in the country and shows the need to carry out large-scale screening both in large cities and in small settlements in order to take appropriate preventive measures. The new knowledge obtained about the prevalence of myopia in school-age children, with consideration of the factors that influence this prevalence, is an undoubted contribution to the field of optometry and the prevention of this most common visual disorder.

Chapter 5 presents the results of a children's vision screening conducted for 203 children aged 6 to 18 years in Sapareva Banya, with the aim of detecting color vision deficiency. To increase its precision, the screening includes three independent tests. After processing the data, a very high rate of cases of hereditary color blindness was obtained, and this rate in both boys and girls was higher than the world average. The significance of the results was confirmed by a comparative statistical analysis of the data from the three tests. The unique results obtained are another testimony to the need to conduct regular vision screenings of school-age children with a view to increasing their quality of life and their future professional orientation. Chapter 6 is devoted to knowledge management in the pediatric vision health care system. The main factors to consider when designing a knowledge management system to increase the effectiveness of an organization related to children's vision health care are analyzed. Chapter 6 addresses such problems as the practical lack of scientific publications offering research on the frequency of various visual disorders in school-age children in Bulgaria, and lack of access to methods and results of other screenings. The author suggests ways to overcome the weak communication between the various organizations interested in the field of children's vision. Also discussed is the issue of organizing a database to be used for research and training material for specialists. The conclusions and recommendations formulated by the author and the developed concept for managing the information obtained during the screenings help to improve the organization of future screenings of children's vision.

## **6. Critical notes and recommendations**

The dissertation is a step forward in the field of eye health care for school-aged children. It offers valuable methodological solutions and provides a rich database. The dissertation is very well written and carefully formatted (practically typographically free). The methodological level is high and the empirical data are divided into groups in the created database for statistical computer processing. The material is presented as 6 chapters, and each chapter ends with conclusions. The dissertation is structured largely as a monograph. In order to fully respect the monographic style, I would recommend to the author a more thorough physical description of the optometric tests (e.g. the parameter  $\Delta$  is not described in the Hirschberg test), as well as the addition after the list of references of a brief description of the used formulas from mathematical statistics and the statistical meaning of the obtained parameters in the context of the study conducted (for example, what the confidence interval or odds ratio indicates). I have the following questions:

1.) What does "Average age is  $(9.73 \pm 2.11)$  years" mean? The second number is it a standard deviation? How is this number determined?

2.) To what extent is it correct to view sports activity as binary? Children who play sports three times a week belong to which group?

3.) How does the statement "in the world about 8% of all men suffer from congenital color deficiency" correlate with the data in fig. 5.3?.

### **7. Personal impressions of the applicant**

I do not know the applicant personally.

### **8. Conclusion**

After having considered the presented dissertation work, Abstract and other materials, and based on the analysis of their significance and the scientific and applied contributions contained, I confirm that the scientific achievements meet the requirements of Law on the development of the academic staff in the Republic of Bulgaria and its Regulations and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski" and the Regulations for its application and the relevant Regulations of the SU "St. Kliment Ohridski" for the acquisition of the educational and scientific degree "Doctor". In particular, the applicant satisfies the minimum national requirements in the professional field and no plagiarism has been found in the dissertation, abstract and scientific works submitted for the defense.

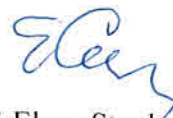
I give my positive assessment of the dissertation work.

### **II. GENERAL CONCLUSION**

Based on the above, I recommend to the Scientific Jury to award the educational and scientific degree "doctor" in professional area 4.1- Physical sciences to Mila Tonieva Dragomirova.

Date: 31.08.2022

Signature:



(prof. Elena Stoykova)