

## OPINION

by Assoc. Prof. Petinka Radeva Galcheva, PhD  
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regarding a dissertation for awarding a doctoral degree in the field of higher education  
1. Pedagogical sciences; professional area 1.3. Pedagogy of teaching....,  
doctoral program "Methods in teaching chemistry"

**Candidate:** Kalin Nikolaev Chakarov

**Dissertation topic:** Areas of difficulty in the subject matter of chemistry from the perspective of students and teachers. Students' difficulties in learning organic chemistry at a basic level

**Research supervisor:** Assoc. Professor Alexandria Gendzhova, PhD, Sofia University St. Kliment Ohridski

### 1. General presentation of the procedure and the doctoral student

I was appointed as a member of the academic jury in the defence procedure of a dissertation titled Areas of difficulty in the subject matter of chemistry from the perspective of students and teachers. Students' difficulties in learning organic chemistry at a basic level, by order No. PD-38-87 of February 16th, 2023, issued by the Rector of Sofia University St. Kliment Ohridski. The procedure is in the field of higher education 1. Pedagogical sciences, professional area 1.3. Pedagogy of teaching ..., doctoral program Methods in teaching chemistry. The author of the dissertation is Kalin Nikolaev Chakarov, a full-time doctoral student at the Department of physical chemistry (Applied research laboratory for chemical education and history and philosophy of chemistry) at the Faculty of Chemistry and Pharmacy in Sofia University St. Kliment Ohridski, and his research supervisor is Assoc. professor Dr. Alexandria Gendzhova.

The set of materials presented by Kalin Chakarov in electronic format is in accordance with Article 67 (5) of the Regulations on the terms and conditions for acquiring scientific degrees and occupying academic positions at Sofia University "St. Kliment Ohridski".

The doctoral student has submitted 3 co-authored articles and one single-author article.

Kalin Chakarov graduated from the University of Chemical Technology and Metallurgy in 2015 with a major in Fine Organic Synthesis and an additional qualification Teacher of Chemistry and Environmental Protection. In 2018, he obtained a master's degree as a teacher of chemistry from Sofia University.

He worked as a chemistry and environmental protection teacher at PGT, 157 GICHE "Sesar Vayejo" and 39 school "Peter Dinekov". From 2021 to 2022 worked as a chemist in the Department of General and Inorganic Chemistry of the Technical University in Sofia. He is currently an assistant in the same department.

In 2019 he was enrolled as a regular student in a doctoral programme at the Department of physical chemistry (Applied research laboratory for chemical education and history and philosophy of chemistry) of the Faculty of Chemistry and Pharmacy, Sofia University. He concluded his research with a right of defence of his dissertation.

## **2. Relevance of the research topic**

In recent years, there has been a decrease in students' interest in education in general, and especially in natural science education. Education in chemistry and environmental protection is no exception to this trend. The reasons behind this trend are numerous and varied, ranging from reduced number of teaching hours, overly theorized content, to lack of connection between the subject matter and students' life experience and practice. As a result, the attitude of a large number of students towards the subject studied at school is negative. They define chemistry as a very difficult, practically impossible to learn school subject. In this context, the research problem chosen by the candidate has its didactic relevance, given the possibility of using the results in school practice. Until now, no such comprehensive independent study has been described in the Bulgarian methodological literature in the field of chemistry.

## **3. Candidate's knowledge in the research area**

The doctoral candidate has researched the chosen problem in both theoretical and practical aspects. He has carried out an in-depth analysis of specialized pedagogical and scientific-methodological literature, as a result of which important theoretical propositions have been derived. They serve as the basis of his research methodology. His theoretical reasoning is the result of a study of 400 sources, of which 16 are written in Cyrillic and 384 are in languages which use the Latin alphabet. More than half of the references are from the last 10 years.

## **4. Research methodology**

The methodology and carrying out the research are relevant to the overall concept of the study and provide an opportunity to achieve the set goal and tasks, and to arrive at an answer to the formulated research questions. A combination of established and proven research methods are used in the study, among which theoretical analysis, survey method, testing and mathematical-statistical methods.

## **5. Characterization and evaluation of the dissertation and its contributions to research**

The dissertation submitted for review contains 174 pages, of which 121 pages are the main text. It is structured into six chapters, references and six appendices. The structure of the thesis and its main content correspond to the topic of the research and the set goals and objectives. In technical terms, the introduction and conclusion could be taken out of the numbering of the main chapters, but the decision on this is up to the doctoral candidate.

In the introduction (Chapter One) the candidate specifies the research problem, motivating its relevance and practical significance and correctly defining the methodological characteristics of the research – its purpose, tasks, methods, scope, and research questions. The conceptual apparatus used in the text is clarified and the general structure of the dissertation is presented.

In the second chapter, the candidate carries out a comprehensive theoretical review of existing research on the problem conducted by a wide range of specialists in the area. The literature review is comprehensive and sufficiently detailed. In connection with the specific topic of the dissertation, the normative documents which regulate the teaching and the subject matter of organic chemistry at the basic level in the secondary schools in our country are

examined in detail. The approach to selection, systematization and analysis of scientific information shows the doctoral student's very comprehensive knowledge of the discussed topics and his skills in its interpretation in the context of the set goals. The performed theoretical analysis illustrates the complexity and multifaceted nature of the selected problem, which is reflected in the conclusions drawn at end of each paragraph. Based on the analysis and the conclusions, the doctoral student builds the concept of his research.

The third chapter presents the stages and the methodology of the empirical research. The proposed methodology is fully suitable for realizing the goals and tasks of the research. The research questions posed in the introduction are divided and specified for each stage according to its purpose. The sample of the study – a total of 778 students and 76 teachers proves its representativeness. The toolkit used, which includes surveys, testing, semi-structured interviews, expert evaluation, and statistical methods, is suitable for the purpose of the research and guarantee the successful implementation of the tasks set. The survey cards for the students and the diagnostic test are aimed at measuring students' interest in the subject and the difficulties they encounter, which could be of great use to interested teachers. Questionnaire cards for teachers make it possible to measure their awareness of the difficulties encountered by students in the study of organic chemistry, the reasons for these difficulties and the effective ways to overcome them. Comparing the results of the two questionnaires helps to answer one of the research questions - "Is there a difference in the point of view of students and teachers?" regarding their interests and difficult topics of the educational content.

The fourth and fifth chapters of the dissertation present the substantive analysis of the results obtained from the conducted surveys among teachers and students. The obtained data are interpreted quantitatively and qualitatively. They are illustrated by means of tables and diagrams, which facilitates their perception. The qualitative analysis was carried out thoroughly and competently. The quantitative analysis and statistical processing of the data are convincing in their validity and reliability.

My question to the PhD candidate is related to one of the survey results: He states that "Topics perceived as difficult by students, e.g. Organic Chemistry, are also listed as interesting." Have you done any research into whether these findings are random and occasional, or real, well thought out coincidences?

The contribution report is made correctly, includes the strengths of the research conducted, reflects its achievements in a theoretical aspect. As a contribution of a practical-applied nature, I also consider the developed and validated toolkit for identifying students' difficulties.

## **6. Evaluation of the publications and personal contribution of the doctoral candidate**

Kalin Chakarov has submitted three co-authored publications and one single-author article. The content of the publications corresponds with the problem areas covered in the dissertation. I believe that the doctoral candidate has an equal role in writing the co-authored articles.

The dissertation shows that the doctoral candidate Kalin Chakarov has gained experience in independent conducting of scientific research and interpretation of the obtained

results. In this regard, I appreciate the personal participation of the doctoral candidate in the conducted research and consider the obtained results significant.

No plagiarism was found in the dissertation and the publications.

#### **7. Dissertation summary**

The summary of the dissertation covers 44 pages, which corresponds to the requirements for this type of publication. Its content follows the structure of the dissertation and presents the doctoral candidate's work comprehensively, sufficiently completely, in a correct and succinct manner.

#### **8. Critical remarks and recommendations**

I have a critical remark about two of the conclusions drawn. Given the anonymity of the surveys, the fact that not all surveyed students were taught by the surveyed teachers, as well as the number of teachers themselves who participated in the research, I believe that conclusions of the type: "This shows that teachers are not sufficiently aware of cognitive motives of their students" (p. 86) and "This is an indicator that teachers do not sufficiently know the interests and motives of their students." (p. 114) are too extreme and not completely correct. I would recommend that the doctoral candidate do more research into this matter.

This remark is not intended to detract from the undoubted merits of the dissertation, but merely to offer the doctoral candidate another direction for future research.

#### **9. Conclusion**

The analysis of the dissertation shows that the doctoral candidate Kalin Chakarov possesses pedagogical competences in the selected research topic in the area of Methods in Chemistry Education, combined with skills for independent conduct of applied scholarly research. Therefore I positively evaluate the dissertation and suggest that the respected members of the Scientific Jury award Kalin Nikolaev Chakarov the educational and scientific degree "DOCTOR" in the field of higher education 1. Pedagogy, professional area 1.3. Pedagogy of teaching..., scientific specialty "Methods in teaching chemistry".

11.04. 2023

Reviewer: .....

(Assoc. Prof. Petinka Galcheva, PhD)