## THE INVESTIGATION OF SUBMICROSCOPIC LEVEL KNOWLEDGE REPRESENTATION SKILLS OF FUTURE CHEMISTRY TEACHERS

*Guliyeva G. N.*, Asgarova A. R., Asadov Kh. A., Naghiyev Kh. J.
Baku State University, Baku, Azerbaijan
gulnarquliyeva2003@gmail.com

It is known that in chemistry education, substances and processes can be described at three levels (Johnstone, 2007): macroscopic, submicroscopic and symbolic. İn chemistry education, the visual representation of objects plays a crucial role. The explanation of objects and the processes in which they are involved is typically carried out at the symbolic and submicroscopic levels.However, according to the literature, the explanation of objects and processes at the submicroscopic level creates significant challenges for students' understanding (Chigheboroh and Greatest, 2007). One of the main reasons for this is the reluctance of teachers to incorporate such descriptions at this level into the teaching process. The primary aim of this research is to examine the accurate understanding of chemical processes at all levels (Kane and Gaulish, 2020). At the submicroscopic level, the size of atoms is the most prominent accept. Thus, the concept of atom size is directly related to concepts such as chemical bonding, the variation of properties in the periodic table, and ionization energy.(Your, Chitin, Gepan, 2013). In a broader, the concepts related to the geometry of molecules at the submicroscopic level are included (Ibrahim and Arun, 2019).

Taking these into account, the main question of the research is expressed as follows:

1) How do chemistry teachers describe the size of atoms, ions and molecules when depicting chemical processes at the submicroscopic level?

2) How do chemistry teachers describe the geometry of atoms, ions and molecules when depicting chemical processes at the submicroscopic level?

The research was conducted among 34 undergraduate students educated in «Chemistry teaching» specialty in 2nd, 3rd and 4th year bachelor degree. For the research, "question-answer" sheets were provided for all participants. The sheet included three-stage-tasks.

Stage 1: Symbolic representations of reactions.

Stage 2: Stoichiometric-mathematical representations corresponding to the reaction.

Stage 3: Tasks related to submicroscopic representations of the reactants and products of the reaction were presented.

Primarily, the assessment focused on the accurate depiction of particle sizes, and the correct notation of molecular geometry.

For the first research question, it can be concluded that almost 59 % of the participants accurately noted the geometric structure of molecules. For the second research question, 71 % of the participants accurately perceived the sizes of atoms, ions and molecules.Overall, the highest results for both research questions were observed among the fourth-year students. In addition, 94 % of all participants correctly completed the tasks of the first and second stages on the "question-answer" sheet.

Thus, emphasizing the importance of broader application of submicroscopic representations in teaching future chemistry teachers, the role of atom's, ion's and molecule's visualization as highlighted. Thus, the role of the relations between the representation levels was further emphasized for future chemistry teachers.