

# The role of outside university institutions in the teaching of chemistry content in the different years of study of natural sciences

Matej Vošnjak<sup>1</sup> and Miha Slapničar<sup>2</sup>

<sup>1</sup>University of Ljubljana, Biotechnical Faculty, Jamnikarjeva 101, 1000 Ljubljana, Slovenia

<sup>2</sup>University of Ljubljana, Faculty of Education, Kardeljeva ploščad 16, 1000 Ljubljana, Slovenia

[matej.vosnjak@bf.uni-lj.si](mailto:matej.vosnjak@bf.uni-lj.si)

## INTRODUCTION

The study of natural sciences contains a lot of chemistry content across different years of study, which can be challenging for students as chemistry is often abstract and therefore more difficult to understand (Kelly et al., 2010). Natural science students are often not given cases that directly relate to the practical application of their studies, and instead learn about chemistry content only in theory (Georgiou & Kyza, 2014). In the case of agronomy study, they are not only present in chemistry subjects but also directly or indirectly in other subjects. For a proper understanding of chemistry content, it is important that it is taught in context (Parchmann et al., 2017), which is more successfully achieved by involving different institutions in students' fieldwork. Fieldwork education is known to be an important and undisputed component that provides the opportunity for integration of theory and practice and allows for the development of professional behaviors in students (Bonello, 2001).

## THE AIM OF THE STUDY

The purpose of this study is to present how agronomy students in different years of study from each cycle of the Bologna program on Biotechnical Faculty, Department of Agronomy (University of Ljubljana) perceive the influence of the involvement of outside university institutions in the teaching of chemical content covered in different subjects.

## Questionnaire

(1) Knowledge of chemistry content

How important do you think it is to have a good knowledge of chemistry in order to be successful in your studies or further career? Explain why you think this is so.

What previous knowledge of chemistry (poor/sufficient/good/excellent) do you think you had before taking up fieldwork in different institutions? Explain your decision.

Do you think that the knowledge of chemistry acquired in the lecture halls is useful, appropriate and important for your work? Explain why you think so.

In what way do you think information about chemistry knowledge could be conveyed more effectively than in the lecture hall?

(2) Chemistry content included in fieldwork in collaboration with outside university institutions

At which institutions have you participated in fieldwork at the current level of education?

In what ways was integration into different institutions organized at the current level of education?

What form of involvement in various institutions did you find most appropriate and useful for the qualitative acquisition of your chemical knowledge and why?

Were the integrations into various institutions more theoretical or practical in nature? Which approach (theoretical or practical) did you find more effective and appropriate to improve your knowledge of chemical content and why?

Do you think that such involvement with different institutions is appropriate, important, and useful for understanding chemical content, or has involvement with different institutions affected your further knowledge or understanding of chemical content? Explain why you feel this way.

What content areas of chemistry do you think have been most touched/addressed by such integrations in different institutions?

Do you think there are too few/too many such inclusions? Explain. Would you like to see more/less of such inclusions as you continue your studies?

## METHODS

The research was conducted in 2021 with final year students from each cycle of the Bologna program on Department of Agronomy, Biotechnical Faculty, University of Ljubljana. Six students participated in the study: two first cycle students, two second cycle students and two third cycle students. The data collection instrument was a structured interview with 11 questions divided into two thematic sections. The interview was performed through the online collaboration environment MS Teams for each student separately.

## RESULTS

The results showed that, in general, all students perceive good knowledge of chemistry as important for their studies and further work, as they are aware that they are enrolled in a natural science study. All agreed that the knowledge taught in the lecture halls is important but the demonstration in practice is crucial. The involvement of outside university institutions in fieldwork is rather missed by the 1st cycle students, while and the 2nd cycle students, who place more emphasis on the chemistry content. Meanwhile, the 3rd cycle students find such involvements sufficient, mainly because they have a greater commitment to these topics through their own research work. The first cycle students place less emphasis on chemistry, find the content less important, and associate fieldwork with the diversity and diversification of the pedagogical process. They find the involvement of outside university institutions in the fieldwork useful, meaningful and important for understanding the chemistry content, but do not see much importance in these connections. In contrast, 2nd cycle and especially 3rd cycle students emphasize the crucial importance of involvement of outside university institutions for proper understanding of chemistry content. The students find this kind of involvement very useful as it gives them the opportunity to better understand the content of organic chemistry, biochemistry and chemistry of natural compounds. The 2nd and 3rd cycle students, due to their longer education, have completed several subjects directly or indirectly related to chemistry content; they have also been involved in numerous researches with the aim of creating a diploma or master's degree. All students interviewed recognized the importance of collaboration with outside university institutions in fieldwork, to whom they demonstrated the seemingly useless theoretical knowledge of chemistry acquired in the lecture halls with practical examples.

## CONCLUSIONS

Students from each cycle of the Bologna program emphasized the importance of collaborating with outside university institutions in fieldwork to better understand the chemistry contents. Especially the 1st cycle students and also the 2nd cycle students miss more such inclusions with more emphasis on chemistry for better understanding of the content. The involvement of outside university institutions in fieldwork seemed useful, meaningful and important for understanding the chemistry content to all the respondents.

## REFERENCES

- Bonello, M. (2001). Fieldwork within the context of higher education: A literature review. *British Journal of Occupational Therapy*, 64(2), 93-99.
- Georgiou, Y., & Kyza, A. E. (2014). »Can you listen to my voice?« Including a student voice in the design of a chemistry module aiming to increase students' learning and motivation. In C. Bolte, J., Holbrook, R. Mamlok-Naaman, & F. Rauch (Eds.), *Science teachers' continuous professional development in Europe. Case study from the PROFILES project* (pp. 94-102). Berlin: Freie Universität Berlin.
- Kelly, R. M., Barrera, J. H., & Mohame, S. C. (2010). An analysis of undergraduate general chemistry students' misconceptions of the submicroscopic level of precipitation reactions. *Journal of Chemical Education*, 87(1), 113-118.
- Parchmann, I., Blonder, R., & Broman, K. (2017). Context-based chemistry learning: the relevance of chemistry for citizenship and responsible research and innovation. In L. Leite, L. Dourado, A. S. Afonso, & S. Morgado (Eds.), *Contextualizing teaching to improve learning* (1st ed., pp. 25-38). New York: Nova Science Publishers, Inc. New York.

## ACKNOWLEDGEMENTS

This research was supported by the ERASMUS+ project 'Diversity in Science toward Social Inclusion - Non-formal Education in Science for Students' Diversity (DiSSI)' (612103-EPP-1-2019-1-DE-EPPKA3-IPI-SOC-IN), funded by the European Union.