Innovative Method for the Transmission of Knowledge in Food Engineering

Ovidiu TIȚA
University “Lucian Blaga” of Sibiu, Sibiu, Romania
ovidiu.tita@ulbsibiu.ro

Mihaela Adriana TIȚA
University “Lucian Blaga” of Sibiu, Sibiu, Romania
mihaela.tita@ulbsibiu.ro

Adelina Maria CONSTANTINESCU
University “Lucian Blaga” of Sibiu, Sibiu, Romania
adelina.constantinescu@ulbsibiu.ro

ABSTRACT

Pedagogical research is a way of explaining the educational phenomenon. Through this, it develops optimal solutions to the problems raised by the instructive-educational process, by following the social exigencies. The experimental activity took place between October 2018 and February 2019 at the University "Lucian Blaga" of Sibiu, within the Faculty of Agricultural Sciences, Food Industry and Environmental Protection. The main objectives were reducing the percentage of students with weak exam results, developing the intrinsic motivation of students, using of teaching materials in increased efficiency, developing active, realistic, investigative thinking, synthetic and clear expression, encouraging teamwork, using of worksheets and self-evaluation tests. The subjects included in the research were students from the 3rd year of specialization "Food Products Engineering". The methods of research used were direct observation, survey method, school document research method and test method. It concluded that students do not like the classical assessment, but prefer the evaluation with the help of working sheets or self-evaluation. They also preferred working methods such as worksheet discovery, conversation, problem-solving, and assaulting ideas.

Keywords: pedagogical research, active learning, motivation, self-evaluation.

INTRODUCTION

Pedagogical research is a way of explaining the educational phenomenon. It is a strategy that takes place to capture new relationships between the components of educational activities and to develop optimal solutions to the problems raised by the instructive-educational process by following the social exigencies. The pedagogical experiment involves the introduction of some changes in the educational activities, and finally the appreciation of the validity of these interventions (Tița & Calcan, 2014).

In recent years, there have been many studies that have shown the effectiveness of new methods of teaching and assimilation of knowledge, but also many studies illustrating the propitious behaviour of a teacher. In 2014, Horakova and Houska conducted a study by which they demonstrated that it is more productive for students before using an experiment or a practical application to present
traditional or previously used methods. Thus their degree of assimilation and understanding increased compared to those cases in which these examples are not presented (Horakova & Houska, 2014). In 2018, several studies have been carried out to improve teaching methods. The first one was done by Naumkin, Kondratieva, Grosheva and Kupryashkin, which concluded that it is more beneficial for students from technical faculties to use methodical systems (mathematical models, 3D models, cumulative and innovative technologies) during research and design laboratories (Naumkin, Grosheva, Kondratieva, & Kupryashkin, 2018). Cimermanova has conducted a study which showed that teaching online courses is effective, maybe even better than classical, face-to-face courses. Also, there has been a steady and rapid increase in student interest in virtual classes, using online teaching tools or videos (Cimermanová, 2018).

In 2011, Măţă carried out a research in which she concluded that the experience of the teacher, the place of teaching, and the structure of the lesson is very important. Teachers who teach in the urban environment have achieved far better results than those who teach in a rural environment, but in terms of structuring the lesson plan, rural school teachers have achieved far greater results than those teaching in urban environments (Măţă, 2011). Bdiwi, Runz, Faiz, and Cherif (2019) have come to the conclusion that a teacher is more likely to capture the attention of students if they create a smart learning environment that includes new communication and computerization technologies and radio frequency identification based on the positioning system inside (Bdiwi, de Runz, Faiz, & Cherif, 2019).

To lead to the development of modern education methods, the teacher must have a professional and personal development centred on this. A teacher must be capable professionally and pedagogically to develop activities in favour of students (Gilmeeva et al., 2017). Therefore it is very important that from the future teachers’ training schools there are courses with vocational subjects, pedagogy, psychology, modern technical teaching methods and educational teaching systems (Kamak, Rakhmetova, & Imankulova, 2016). Performing scientific research in the field of pedagogy involves the passing of some stages that form the logic of the process of design, development and evaluation of the respective activity. The stages of a pedagogical experiment are:

1. Choice of formulation the research problem – takes place when we want to modernize the instructive-educational process.
2. The motivation of use of the research - presupposes the presentation of the reasons that led to the choice of the respective theme.
3. Documentation - represents the consultation of the specialized literature on the subject.
4. Formulation of the research hypothesis - is an assumption about the results we want, and practice will confirm or refute it.
5. The elaboration of the experimental plan includes the establishment of the sample, the establishment of the procedures and the elaboration of the measuring instruments.
6. Apply the experimental plan - consists in implementing the plan and collecting data.
7. Data analysis and interpretation of experimental results - which specifies the research hypothesis is confirmed or not in practice (Tiţa & Calcan, 2014)

**MATERIALS AND METHODS**

**Research objectives**

The main objectives were reducing the percentage of students with weak exam results, developing the intrinsic motivation of students, using of teaching materials in increased efficiency, developing active, realistic, investigative thinking, synthetic and clear expression, encouraging teamwork, using of worksheets and self-evaluation tests.
Working hypotheses

Depending on the proposed objectives, we have set some working hypotheses:

- Can traditional training be transformed into an autonomous process?
- Can students be able to use their full learning potential?
- Can a pleasant atmosphere be created to develop active, realistic, investigative thinking by creating problem situations?
- Is it possible to develop teamwork with positive effects on communication skills, critical thinking and social skills?
- Is it more effective to evaluate the progress of training if worksheets, assessment and self-evaluation tests are used instead of traditional methods, whose items will be centred on the specific skills of each course?

Methods of research

The research methods used were active methods. At the moment in the courses and labs, lectures and face-to-face dialogue are practised. The use of innovative methods of teaching at the university level can generate much better student results. The research methods used were direct observation, survey method (interviewing and questioning), school document research method and test method. The active observation identified the action of the learning mechanisms, the process of motivation development, the degree of assimilation of some models, norms, values, according to the requirements of the program. The survey method aimed at gathering data (opinions, interests, desires, aspirations) in relation to the motivation of learning, dialogue between teacher and student in the course or laboratory, the information volume and the time needed to assimilate knowledge, the role of general culture and the formation of professional culture, the role and importance of practical training in formatting skills specific to the work in milk processing. The method of the research of the school documents has identified the connection between the students' personality traits and their portrayal in the written works or the portfolios. The test method was aimed at the formative and summative assessment of the progress of the students.

Sample setting

The experimental activity took place between October 2018 and February 2019 at the University "Lucian Blaga" of Sibiu, within the Faculty of Agricultural Sciences, Food Industry and Environmental Protection. The subjects included in the research were students from the 3rd year of specialization "Food Products Engineering" (FPE). In both semi groups there are 16 students aged 21-22 years. In the first semi group, there are 10 girls and 6 boys, and in the second semi group, there are 13 girls and 3 boys. The function of the experimental sample, respectively the control sample, was performed successively. Thus, the results of the students were followed before and after the administration of the experimental factor. The type of assessment that was used as the diagnostic assessment that identifies students' needs, abilities, interests, preferences so that appropriate decisions can be made and individual support can be provided if necessary.

RESULTS AND DISCUSSIONS

Initially, was checked the level of knowledge at the beginning of the "Obtaining Milk Consumption" course. For this purpose, an assessment test was given to the students and included questions from the "Chemical Composition of Milk" course. Following the predictive test correction and the results were presented in Table 1.
Table 1. The results obtained in the predictive test

| Sample           | Number of students | Grade | Grades under 7 | Average |
|------------------|--------------------|-------|----------------|---------|
|                  |                    | 1 2 3 4 5 6 7 8 9 10 |               |         |
| 3rd-year FPE     | 32                 | -    - 1 4 4 6 9 5 2 1 | 15          | 6.43    |

It is found that the results obtained are modest, with some grades of 9 and 10. Weak results obtained by students following the predictive test show that they have shortcomings in preparation. Each student has his / her learning style, so it is necessary to know and understand these styles to help him or her learn more effectively. To attend the “Obtaining Milk Consumption” course, we organized practical laboratory exercises. In this way, students can demonstrate their technical and behavioural abilities, can use documentation sheets, individual worksheets, evaluation sheets, and can practice teamwork. For this purpose, we worked with the students of semi group 1 and 2 of the 3rd year of specialization Food Products Engineering, which we divided into groups of four students. We provided them with documentation and worksheets for the following laboratory tests: determination of acidity, determination of density, determination of milk contamination and determination of lactose content. The evaluation at the end of the laboratory was based on the initial results of the practical activity according to the evaluation sheets. The results obtained from the application test were presented in table 2 and table 3.

Table 2. Results of semi group 1 in the applied test

| Sample                  | Number of students | Grade | Grades under 7 | Average |
|-------------------------|--------------------|-------|----------------|---------|
|                        |                    | 1 2 3 4 5 6 7 8 9 10 |               |         |
| 3rd-year FPE semi group 1 | 16                 | -    - 1 1 2 3 5 4 | 2          | 8.37    |

Table 3. Results of semi group 2 in the applied test

| Sample                  | Number of students | Grade | Grades under 7 | Average |
|-------------------------|--------------------|-------|----------------|---------|
|                        |                    | 1 2 3 4 5 6 7 8 9 10 |               |         |
| 3rd-year FPE semi group 2 | 16                 | -    - 1 2 2 3 5 3 | 3          | 8.12    |

Following the application of the work records and the practical tasks, it was found that the results obtained were visibly better. Although we started at a low initial level, following the Laboratory "Qualitative and Quantitative Reception of Milk" by the modern methods mentioned above, there was an obvious improvement in students' grades.
To verify if the efficiency is only momentary and if the assimilated notions of the students are lasting, at the end of the two courses and three laboratories we applied an evaluation test with items from the verification lesson and items from the chapter "Obtaining Milk Consumption". Students were notified in advance. The results obtained in the final evaluation test were presented in table 4.

Table 4. The results obtained in the final evaluation test

| Sample     | Number of students | Grade | Grades under 7 | Average |
|------------|--------------------|-------|----------------|---------|
| 3rd-year FPE | 32                 | 1  2  3  4  5  6  7  8  9  10 | 1  1  8  10  9  3 | 2  8,06 |

As can be seen in table 4, the average was an improvement compared to the predictive test. There were only two grades under seven, demonstrating that the assimilation of the students was lasting, not just for the moment. For a better comparison of the results, we plotted frequency charts for student’s grades in the control phase, in the experimental phase and the final evaluation phase as well as the frequency histograms.

Figure 1. Frequency chart of grades obtained by students in the control phase, in the experimental phase and the final evaluation phase
Figure 1 and Figure 2 show the frequency of the grades obtained by the students in the control phase, in the experimental phase and the final evaluation phase. As can be seen, the students' results improved during the scoring, which means that the methods presented above were successfully applied. The use of classical teaching methods leads to poor student results. They are not attracted to such methods because they consider them outdated and inefficient. Students need to understand what they are taught and especially to know how to apply this knowledge. The use of modern methods, such as the active methods presented above, is a solution for solving these problems.

CONCLUSION

The main purpose of experimental factor administration in the 3rd year of specialization Food Products Engineering was to increase the efficiency of the training. To verify the successes of this didactic approach, we compared the performances from which it went with those achieved by the involvement of all the factors that made it possible to realize this goal. As we have shown before, the average predictive test was 6.43, a result that corresponds to performances below the standard level. The main reasons for the weak quality of the evaluation results are insufficient testing of the key and practical skills against the theoretical ones, the insufficient number of test items and ambiguous and unclear questions.

By comparing this average to that obtained from laboratory practice in the experimental phase, there is an increase with approximately 1.5 points. The evaluation process found that students quickly and easily mastered their work with assessment, self-evaluation, workbooks, preferring them as verification and assessment tools, to the detriment of conventional ones (oral evaluation, written works, extemporal).

Thus, the set of knowledge, skills and competencies that students have acquired over a period can demonstrate them after completing a learning process.

Following students as subjects of research, it was found that they agree with active learning, centred on individual worksheets. Students prefer working methods: work-based discovery, conversation, problem-solving, assaulting ideas. The teacher should adapt the teaching strategy to the student's
learning style. Learning step by step for students to recover is a strategy to maintain the group at the same level, causing the weaker students to spend more time learning. Students have demonstrated that they do not like classical assessment methods (oral evaluation) that create a stressful condition. They prefer evaluation by evaluation or self-evaluation sheets made of items that contain well-defined tasks. It cannot intervene in changing the intelligence of students, but it can be modelled, creating the motivation to acquire the necessary knowledge, to fix and use them in future situations. Therefore, it is necessary to realize some types of lessons with which to move the focus from the teaching-listening activity to the effective work of the students to acquire the essential notions under the competent guidance of the teacher.

ACKNOWLEDGEMENT

The authors are grateful to the technical staff at the Faculty of Agricultural Sciences, Food Industry and Environmental Protection, University "Lucian Blaga" of Sibiu and all students from the 3rd year involved in this research.

REFERENCES

Bdiwi, R., de Runz, C., Faiz, S., & Cherif, A. A. (2019). Smart learning environment: Teacher’s role in assessing classroom attention. Research in Learning Technology, 27(1063519), 1–14.

Cimermanová, I. (2018). The Effect of Learning Styles on Academic Achievement in Different Forms of Teaching. International Journal of Instruction, 11(3), 219–232.

Gilmeeva, R. K., Solovyova, P. V., Nikonova, E. I., Pak, L. G., Shulga, T. I., Perekrestov, V. N., & Makarov, A. L. (2017). Projecting and implementation of professional-personal environment for future teachers. Eurasian Journal of Analytical Chemistry, 12(7), 1059–1067.

Horakova, T., & Houska, M. (2014). On improving the experiment methodology in pedagogical research. International Education Studies, 7(9), 84–98.

Kamak, A. O., Rakhmetova, N. B., & Imankulova, L. (2016). The requirements for the formation of future fine art teacher’s pedagogical competence. Indian Journal of Science and Technology, 9(22).

Mâţă, L. (2011). Experimental Research Regarding the Development of Methodological Competences in Beginning Teachers. Procedia - Social and Behavioral Sciences, 29(834), 1895-1904.

Naumkin, N. I., Grosheva, E. P., Kondratieva, G. A., & Kupryashkin, V. F. (2018). Training Higher School Students in Rapid Prototyping Technology as a Final Stage of Their Preparation for Innovative Activities. Integration of Education, 22(3), 519–534.

Tița, M. A., & Calcan, M. (2014). Studiu metodie privind predarea capitolului „Determinarea calității laptelui necesar obținerii produselor lactate de tip desert”. Sibiu: Editura Universității „Lucian Blaga”.

168