Theory and practice in the teaching of organic colorants to chemical engineering students

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Abstract

The paper covers some aspects regarding theory and practice in the teaching of organic colorants to chemical engineering students. There is little in the world of education that is more depressing than bad university teaching. Intellectual development is a product of both internal and external processes. In the paper are presented the importance of teaching and learning, the conditions of learning, and some methods of evaluation, all specific to teaching the subject in question.

Keywords: knowledge, teaching, learning, evaluating, organic colorants

Introduction

Knowledge is a process not a product. Teachers teach, and it can be observed simply by watching the act itself, without the knowledge of the students' learning. The concept of teaching as a success results in the learning process. The evaluation of the professors activity in class should not be influenced too much by the students' performances, because the first ones do not control each and every variables in the process which affect the results.

Theoretical and practical knowledge

"Teaching is one of the most delightful and exciting of all human activities when it is done well and that it is one of the most humiliating and tedious when it is done poorly. There is little in the world of education that is more depressing than bad university teaching. Every teacher can learn how to do better. Anyone who has seen really good teaching in action will not need to invoke the exigencies of performance appraisal and maintaining academic standards as reasons for improvement".(Ramsden, P., 1992)

Intellectual development is a product of both internal and external processes, and the higher thinking reveals from the interrelationship and the dialogue among people. The school is based on accumulating information - which is not enough, it should develop the capacity of thinking in order to solve problems, to understand, to innovate and to take decisions, as well as to communicate efficiently with the students fellows and with the teachers (Danciu,L., 2004).

According to Dona Ogle (1992), the school should form students which will contribute to the development of the society, and as a result, school should become a center for developing of thinking and learning in an agreeable medium, encouraging discussions and cooperation (Danciu,L., 2004).

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Johnson, D., Johnoson, R., Houbec, E.(1991) consider that "learning is something the students do, not something which is done to them. Learning is not a sport where you are a spectator. It requires direct and active implication of students".

According to Pintilie, M. (2002), the notion of *methodology* comes from the Greek words *metodos* - meaning way, line, direction - and *logos* - meaning science. The methodology is considered a method or a sum of methods of teaching, learning and evaluating. It is a subdivision of training technology, a set of principles, methods and processes. The training technology covers some issues:

- the way in which the knowledge is transmitted and accumulated

- the way in which intellectual and practical abilities form and develop

- the control of achieving the knowledge and establishing the level of instruction

The modern methods of teaching, learning and evaluating offer a good opportunity for pedagogical organization of a thoroughly, easily and pleasantly learning, and at the same time has a pronounced active character from the students.

Among the diversity of learning types, according to Margaritoiu, A. and Brezoi, A. there are: learning of notions, learning of principles and rules and solving problems. "*Learning of notions* represents the formation of notions and concepts ant it requires the capacity of a student to classify objects on the base of common properties. *Learning of rules* refers to actually learning a series of concepts and notions. *Solving problems* is based on the thinking process, on learning and applying rules, it is a process which generate a new learning".

In their book, Margaritoiu, A. and Brezoi, A. also present the conditions of learning, which are divided in two categories (according to psychologist R.Gagne):

- "*internal conditions of learning*: depend on the hereditary potential and the cognitive structure of the students, on their motivation, learning skills and individual work techniques;

- *external conditions of learning*: depend on the teachers personality, on their methods and strategies of teaching, on the school curricula, on the subjects particularity, on the interrelationship among teachers and students, and on the time management".

Evaluating students ensure the quality of the teaching process. That means that the feedback the teachers receive after the evaluation permits them to adjust and to modify their activity. Also, the future performances of the students can be evidenced by the evaluating processes.

According to Albu, G. (2001) there are several methods of evaluation. Among them there are:

- "*current observation an oral appreciation*: watching the way in which the students participate in the learning process in class, if they take notes, if they accumulate new concepts and notions

- *oral examination*: the quality of the students knowledge, their understanding level and their ability to operate with the learned notions and concepts are examined, not only by reproduction but also by the interpretation of the data

- *writing examination*: permits the examination of all students in due time with no interference of the professor

- *elaborating papers or projects with a certain theme*: reveals a much deeper appreciation and the identifying of individual performance of the students as well".

The teaching, learning and evaluating processes act together and are indispensable for the educational process.

"The *brainstorming* is a way to elaborate in class, spontaneously, some ideas, models, new solutions in solving theoretical and practical problems". (Kozan-Naumescu, A., 2010)

According to Senos, S., (2013), it can easily be observed "a general divergence between theory and practice".

Problematic issues and method

Learning process is connected with the notions of change or modify, meaning that learning may be defined as a change in individual behavior as a result of a personal experience, determining some change in the knowledge or mental skills. The learning process is an authentic creative act, generating new behavior, offering school the meaning of a live laboratory where human metamorphosis at individual level as well as at group level may occur.

The idea of a process implies the necessity of duality, meaning the existence of a force that favorite the change - the teachers - on one hand, and on the other hand the students - which have an active role and will be transformed during the process of learning. There must be a tight cooperation among them offering the possibility of identifying fundamental acts that define de learning process. Teaching alone, no matter how good it would be, do not lead automatically to the expected results, but is connected and conditioned by the learning activity of the students. Another function of the learning process is the evaluation of the results connected to the overview of the teaching-learning process.

Teaching a certain concept referring to other ones can help students to understand better, based on the previous experiences, learning being in this case an active process. It is also important to reward students along with the learning process in order to motivate and stimulate them. Nevertheless, the students must have some targets to accomplish and the teachers are obligate to support them in the effort of achieving them.

According to Ramsden, P.: "The vital competences in academic disciplines consist in understanding - the way in which students apprehend and discern phenomena related to the subject, rather then what they know about them

or how they can manipulate them. Many students can juggle formulae and reproduce memorised textbook knowledge while not understanding their subjects in a way that is helpful for solving real problems. Merely being able to repeat quantities of information on demand is not evidence of a change in understanding, but learning that involves a change in understanding implies and includes a facility with a subject's techniques and an ability to remember its details. It involves changing in the professors conception of teaching and is based upon their experiences of teaching.

The aim of teaching is simple - to make the student learning possible. Teaching always involves attempts to alter students' understanding, so they begin to conceptualize phenomena and ideas in the way scientists conceptualize them.

To teach is to make an assumption about what and how the student learns; therefore, to teach well implies learning about student's learning. Learning and teaching are constantly interchanging activities. One learns by reaching; one cannot teach except by constantly learning. One can never assume that the impact of teaching on student learning is what one expect to be. Students' thoughts and actions are profoundly affected by the educational context or environment in which they learn. They react to demands of teaching and assessment in ways that are difficult to predict: a lot of their *learning* is not directly about chemistry, but about learning how to please lecturers and gain high marks. These strategies all too often lead to them using methods of study that focus on simplify recalling and reproducing information rather than the actions which lead to changes in their understanding. An important part of good teaching is to try to understand these contextual effects and to adapt assessment and teaching strategies accordingly.

Good teaching involves striving continually to learn about students' understanding and the effects of teaching on it. Precisely because the research into students learning in higher education has studied and described the conditions which are necessary for changes in student understanding, it provides a convenient source of ideas for teaching. Teaching in higher education involves concentrating on various techniques of instruction: how to give a lecture, organize a laboratory class or run a discussion. Professional teachers in higher education posses a broad range of specialist teaching skills, they never lose sight of the primacy of their goals for student learning, they listen to and learn from their students, they constantly evaluate their own performance. They understand that teaching is about making it possible for students to learn".

On the basis of the above presented theory, the practice in the teaching of organic colorants to chemical engineering students involves the following aspects:

- *professional competencies*: Operation of processes and installations with applying knowledge in the field of chemical engineering. The description, analysis and use of basic concepts of structure and reactivity in organic

compounds synthesis. Operation of the equipment and methods of analysis and specific characterization of organic chemicals.

- *transversal competencies*: The execution of professional duties in accordance to the requirements specified in the terms imposed, in compliance with professional ethics and moral conduct, according to a predetermined plan of work and with qualified guidance. Solving professional tasks in line with the general objectives set out by integrating within a working group and distributing tasks to subordinate levels.

- *general objective of the discipline*: Discipline aims to instill the students the knowledge about the relationships between the structure of organic compounds, color and characterization of chromophore groups, classification of organic dyes in different categories, the technologies of these dyes, their characterization, application of dyes on different textiles and their characterization. Considering the notions of technological understanding and application specific synthesis of colorants, chemical substances with very diversified structures, understanding the relationship between structure and biological activity (for the food, drug or cosmetic colorants), the need for intensified research to obtain active substances, no harmful, economic and convenient with biological qualities, as well as the choice of shape and conditioning formula for increasing the effectiveness of the treatments and to reduce the danger of pollution to the environment.

- *specific objectives*: The content of discipline contributes in proportion of 10% to industry-specific essential skills development - "Engineering Sciences"-legislation, economy and 90% at-specific skills development specialization: 40% abilities in designing and conducting chemical processes; 50% to the knowledge and use of the notions of chemical technology and operation of industrial installations. Its share in the training of students is 1.71%.

- *the content of the course*:

Themes	No. of hours	Teaching methods
Raw materials for the synthesis of aromatic intermediaries. Notions about the synthesis of aromatic intermediates	6	Interactive course using modern methods of presentation
Relationships between the structure of organic compounds and their color. The notion of color, mutual influence of the auxocrome and antiauxocrome groups. Characterization of chromophore groups	2	Interactive course using modern methods of presentation

Classification of organic dyes. Azo dyes. Structure, methods of obtaining, properties	4	Interactive course using modern methods of presentation
Azoic dyes	10	Interactive course using modern methods of presentation
Other classes of dyes. Anthraquinone dyes. Disperse dyes. Reactive dyes. Phtalocyanin dyes. Structure, methods of obtaining, properties	10	Interactive course using modern methods of presentation
Characterization of textile fibers and dyeing processes. Cellulose fibers. Protein fibers. Structure, properties. Pre-treatment, dyeing and dyeing finishing	3	Interactive course using modern methods of presentation

- *the content of applied activities*:

Themes	No. of hours	Teaching methods
Synthesis of various azo dyes	8	Participative lecture; Conducting laboratory work, study and interpretation of the results, problem solving, debate
Applications of some dyestuff on textile	5	Participative lecture; Conducting laboratory work, study and interpretation of the results, problem solving, debate
Chromatographic and Spectrophotometric analysis of colorants	8	Participative lecture; Conducting laboratory work, study and interpretation of the results, problem solving, debate

The content of the discipline is consistent with what is being done in other universities in the country and abroad. For a better adaptation to the demands of the labor market to the content discipline study visits to industrial units occurred.

- *evaluation:*

Type of activity	Evaluation criteria	Evaluation methods	Share of the final grade
Course	- the accuracy and completeness of knowledge; - logical coherence; - the degree of assimilation of language; - criteria of attitudinal aspects that concern: conscientiousness, interest in self study	Written examination, test the knowledge presented at the course. The weighted average is calculated only if the student proves sufficient knowledge in the written examination. For the note 5, the student must be familiar with the fundamentals of the theory. For the note 10 the student should demonstrate a thorough knowledge and ability to apply it properly. The student should highlight the essential aspects and show that he has not assimilated them mechanically.	60%
Applied activities	- ability to operate with similar knowledge; - ability to apply in practice; - criteria of attitudinal aspects that concern: conscientiousness, interest in self study	How to make laboratory work and interpretation of results shall be assessed in a continuous way. For the note 5 the student will carry out laboratory work and interpret at a basic level experimental data. For the note 10 student should participate actively in the work of the lab, to problem solving, to answer questions and interpret independently obtained data correctly and completely	40%

Conclusion

Teaching organic colorants to chemical engineering students aims to instill the students the knowledge about the relationship among the structure of organic compounds, color and characterization of chromophore groups, and all the subjects that are previously described.

In order to accumulate theoretical notions of the technology and application of specific syntheses colorants - chemical substances with very diversified structures, and to understand the relationship between structure and biological activity (for the food, drug or cosmetic colorants), as well as the need for intensified research to obtain no harmful active substances, and to reduce the danger of pollution to the environment, the method of teaching must be an interactive one, because the subjects in question are complex and all the notions are based on other courses materials. So the teacher has to link together all the knowledge learned by students so far.

During the experimental applied activities, the students learn how to make a laboratory work, how to interpret the results, and how to solve theoretical problems, which are linked to the real technology in industry.

The evaluation process occurs during the whole semester, in class, during the teaching by answering the questions which appear, during the laboratory hours, by solving theoretical problems, and off course during the examination session at the end of the semester. The students may elaborate a paper regarding an issue of their choice, which is presented in front of the class. The appreciation made by the teacher covers all these aspects.

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