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FORMAL AND NON-FORMAL EDUCATION – NEW ENVIRONMENTS AND CONDITIONS

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Non-formal education and soft competences – from personal experience

Introduction

Education is a complex process that takes place parallel in three different settings: formal at school, non-formal as an organized educational activity outside school, and informal as attitudes, values, skills and knowledge acquired in one's own environment (Okoń, 1992). The symbiosis of these three types of education should warrant full development of a young man that encompasses his/her knowledge, attitudes and competences. The latter ones include hard and soft competences. While hard competences are typically learned at schools and from books, soft competences include personal abilities, behavioral traits and personal motivators.

Soft competences have now been fully recognized as an indispensable element of education. This is because they help prepare young people for their future professional carriers and importantly, for active participation in the life of society. In Poland the soft competences make part of core curricula of all school subjects. From among the competences the following three: the skill of efficient and meaningful communication in all types of situations, the skill of efficient cooperation in a group, and the skill of resolving problems in a creative way, are of crucial importance from the point of view of future employers. Table 1 presents characterization of these competences along the Recommendation of the European Parliament and of the Council of the European Union, OJEC L 394 of 30.12.2006 (EU, 2006).

In this context, in this article we present an example of teaching-learning activity that belongs to non-formal education and we discuss the soft competences resulting thereof.

Good practice in non-formal education – personal experience

Within a 10-year long cooperation with the Children University Foundation we prepared and carried out, among others, five series of thematic workshops and two series of lectures. When preparing a workshop for children, one can exploit on the one hand, within children's perception potential, their natural curiosity, readiness to ask questions, as well as the knowledge they have acquired so far, and on the other hand, the underlying concept of a given series of workshops, as well as the elements

of work based on individual discovery of knowledge (scientific inquiry). In the case of a series of workshops named Discovery (age group 6–7 year-olds), whose motto was: We discover the world, we play and experiment, the classes are effectively "*a gate to a scientific adventure that is experienced in a friendly, safe and innovative manner*". By contrast, in the case of a series of workshops named Inspirations (age group 8–9 year-olds), whose motto was: Let's learn the richness of the world of science, the classes "*will inspire children to action and creative thinking*".

Table 1. Characterizations of competences of importance for future employers

Competence	Learning outcomes	Additional description
The skill of efficient and meaningful communication in all types of situations.	A student should know how to express thoughts precisely; obtain feedback information which should be understood accurately.	Interpersonal communication plays an important role in living and functioning in the society.
The skill of efficient cooperation in a group.	A student should know how to cooperate in a group, be responsible for fulfilling a task, pursue a common goal.	Modern man cooperates with others more and more (at home, in family, at work). Independently of the task he/ she has to perform, he/she is obliged to cooperate with different people. Modern man must be prepared to play a certain function/role in society and, at the same time, to change his/ her roles: of a leader, a partner, a subordinate.
The skill of solving problems in a creative way.	A student should be able to notice unusual matters, problems and search for non-typical, creative solutions.	Modern labor market requires creative people who are able to solve problems and act effectively in unusual situations.

In the academic year 2016/17, in April and May 2017 we ran 18 workshops for children in the Discovery series. Approximately 360 young students, enthusiasts of natural sciences, participated in the workshops. Each workshop lasted 45 min. The idea of each class was to have children work within 4-people groups. Each group worked at its own lab bench under the care of an assistant. As assistants worked students and PhD students of our Faculty, as well as in some cases, high school students, all of them instructed how to work with children.

Below we present a report on the workshop, prepared by Children University (Uniwersytet Dzieci, 2016) and the workshop's full program together with selected teaching aids.

Foaming, hissing and dancing bubbles are a disco on the tongue or a chemical phenomenon?

Fizzy drinks are full of gas bubbles that refresh and delicately tingle our palate. Are they present in a small, hard, effervescent tablet? In class the children will learn how these bubbles are produced and why when dropped into water the tablets bring about foaming accompanied by a characteristic sound. They will also check what parameters affect the dissolution of substances.

A pre-class task:
Consider if you would rather get a medicine in the tablet or syrup form. Which is easier to swallow? In which form does the medicine act more quickly?

The plan of the workshop:

1. Welcome, presentation of the main teacher and assistants – the children are seated in groups of four at their lab benches.
2. Presentation of the safety rules in the laboratory – what should be done to warrant the safe work? What must not be done? How should we work so that we do not disturb each other? – a talk with children.
3. A story about Winnie-the-Pooh – introduction to the subject matter with elements of engagement:
   Winnie-the-Pooh fell sick. He has a sore throat and a fever… How can we help him?
   The children were asked if they know what happens when they are sick. How can they be helped? What do their parents do to speed up their recovery? What formulations of medicine do they know – tablets, ointments, syrups, jelly beans?
4. Effervescent tablets – what do we already know about them? – a talk.
   In the talk the children were asked if they like effervescent tablets and why. Next, it was discussed if every tablet is effervescent.
5. Studying the rate of dissolution of an effervescent tablet – experimental work in groups preceded by a talk (brainstorming) and finished by filling in a worksheet.
   As a starting point to the experimental work the children were asked: Do you prefer to swallow medicine in the form of a traditional or an effervescent tablet? Which tablet acts in a quicker manner – effervescent or classic? Which parameters do you think affect the rate of dissolution of an effervescent tablet? Is the size of the tablet of importance? How many tablets will we use? Will we drop the tablet into water in one piece or in small pieces? Is the size of the pieces significant? What solvent can we use – water, mineral water, milk, oil, juice? What is the temperature of the solvent used? Cold water, warm water, hot water? How much solvent will we use for dissolving the tablet? Which effervescent tablet will we use? What type of medicine? The research groups in the class were given different subjects concerning the above effects (see the list below) for which they were expected to propose the appropriate experiments. The children presented their proposals by formulating their hypotheses and describing the experiments.

The choice of subjects:

- Degree of fragmentation (the whole tablet, ground and powdered)
- Temperature of the solvent (ca. 20°C, ca. 50°C, ca. 90°C)
- Type of the solvent (water, juice, milk, oil, sparkling water)
- Type of the tablet (pharmaceutical preparation)
- Number of the tablets used

Proposed hypotheses:

If I drop a tablet to a hot solvent, it will dissolve more quickly.
If I grind a tablet, it will dissolve more quickly.
One tablet will dissolve in a given amount of solvent more quickly than two tablets.
A tablet will dissolve in juice more easily than in the same amount of water.

In the course of experiments the children collected the data in the worksheets. The experimental part was summarized in an open discussion of the results – each group presented its experiment while the other participants completed the worksheets.

6. How could it be explained that some tablets effervesce when dissolving? – clarification of the effervescence.

What happens when an effervescent tablet dissolves? What do we see? What do we hear? What does it remind us of – hissing, whirring, foaming, fizzing, bubbling? Once in a solvent (water, juice, milk), the tablet first dissolves and the appearing bubbles contain produced gas. The gas, i.e. carbon (IV) oxide is a product of the chemical reaction taking place between the components of the solution.

7. Conclusion of the workshop – a talk with children where the data are presented in a graph. The task given to children is to find an error in the graph and correct it.

Results and conclusions

The objective of the workshops was to answer the following questions: Does the participation of children in this type of teaching-learning activity that takes place outside school, warrants the development of their abilities, attitudes and competences? Is this an easy task for the teachers responsible for these classes? Are children willing to participate in the classes?

Table 2 offers an analysis of the individual parts of the workshop in respect of their objectives and intended development of children's competences.

Table 2. Detailed objectives and competences developed in individual parts of the workshop

Part of workshop	Objectives and developed competences
1	Objective: integration of the group Competence: ability to find his/her place in the newly formed group
2	Objective: analysis of children's readiness and easiness to express themselves Competence: ability to formulate personal opinions and to present them in public
3	Objective: analysis of children's interest in the subject and of their positive emotional involvement Competence: ability to formulate personal opinions and to present them in public
4	Objective: evaluation of children's level of knowledge on the use of effervescent tablets in daily life Competence: ability to formulate personal opinions and to present them in public
5	Objective: development of inquisitive attitudes, e.g. through understanding a problem to be studied Competence: ability to work in a team, e.g. through assuming an appropriate role, abilities to discuss problems, to formulate hypotheses, to plan and carry out experiments, and to make observations and to formulate conclusions
6	Objective: assessment of the understanding of effervescence Competence: ability to analyze the situation based on intensive analytical thinking
7	Objective: verification of the proposed solution of the research problem through the ability to find an error in the graph summarizing the research, done in order to demonstrate that knowledge has a practical significance and is needed in daily life Competence: ability to carry out independent problem-solving

In order to assess the effectiveness of the workshop in achieving the objectives, i.e. the extent of the development of children's competences, opinions of the assistants (N=17) were collected. Below are presented two selected questions addressed to the assistants:

1. Is this type of teaching-learning activity an easy task? What did you find most difficult in this activity?
2. What do you think children have learned from our workshops?

About 90% of respondents pointed out that the major difficulty at the beginning of each class was the lack of effective communication with children. By contrast, about 50% of respondents said that they were not aware how much attention must be given to what you say to children and how you talk with them; they also emphasized the role of intonation, i.e. your voice can neither be too loud nor too quiet, neither too sharp nor too soft, etc. Selected interesting opinions are presented below:

- *Sometimes children's questions were "off the subject" and this could be a serious distraction in class.*
- *What I found most difficult was the work with the children who disturbed the class. At times I seemed to be running out of patience.*

About 80% of respondents ascertained that during the workshops the children learned the basic rules of the work in a laboratory. Additionally, they learned how to formulate hypotheses and draw conclusions. They also learned teamwork and the bases of preparing a research plan. Selected opinions in that respect are presented below:

- *I think that above all the children learned how to formulate questions on what they were interested.*
- *Certainly, the children learned how to approach problems in a self-reliant and logical manner, as well as how to be creative and original.*
- *The children understood that they should not be afraid of experiments in discovering new things.* ☺

The results of the workshops and the collected opinions and comments presented above, prove that the proposed workshops are a successful effort in teaching children soft competences, crucial for their future activities, as early as at the age of 6–7. Based on these results, the successful cooperation of the Faculty of Chemistry of the Jagiellonian University with Children University will certainly be continued.

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Non-formal education and soft competences – from personal experience

Abstract

It is generally recognized that to be fully successful, education has to be performed parallel in three formats: formal, non-formal, and informal. While formal education is principally about knowledge, the other two are largely about soft competences. Soft competences include personal abilities, behavioral traits and personal motivators and to achieve them young people have to perfect abilities such as problem-solving, decision-making, teamwork, and interpersonal skills necessary to both team and individual performance. It is in this context that the Faculty of Chemistry of the Jagiellonian University in cooperation with Children University offers children (age groups 6–7 and 8–9) chemical workshops, a teaching-learning activity typical of non-formal education. The objective of the workshops is to practice soft competences while performing chemical experiments. Herein we describe the workshops with successful experiments on effervescence.

Key words: non-formal education, soft competences, chemical workshops for Children University

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