The level of critical thinking in a process of evaluating the problem from multiple points of view, collecting information, shaping one’s own opinion and its subsequent argumentation is reflected in the daily activities of our professional and personal life and undoubtedly influences its quality. In Western countries, the development of critical thinking is a traditional part of educational objectives and teaching methods. In most Eastern European countries, the concept of critical thinking and its partial integration into teaching processes has been introduced in the mid-nineties. The recent researches in the Czech Republic show that despite the efforts to restructure and apply the activation methods of critical thinking in teaching, it has not been possible to revise the traditional concept of teacher as a mediator of information and the classical teaching methods continue to prevail. These findings lead us to analyse the critical thinking ability of students of the doctoral study program Education and its reflection in their teaching and learning process. The aim of this paper is to analyse how critical thinking as a formative factor influences the formation of the professional self-concept of students of the doctoral study program Education from Palacký University in Olomouc. What is the level of their critical thinking? Are these students future implementers of new approaches and methods in teaching? How do they develop their critical thinking skills? Critical thinking within the professional self-concept of students of the doctoral study program Education acts as one of the important formative factors affecting the self-concept, values and expectations on both the professional and personal levels.

Keywords: critical thinking, doctoral students, professional self-concept, Cornell Critical Thinking Test.

1 INTRODUCTION

According to Ennis, Millman and Tomko [1] the critical thinking is “reasonable and reflective thinking on deciding what to believe or what to do”. By this definition the authors attempt to capture the main thrust of the term critical thinking as it is used nowadays. Research findings on this topic demonstrate that it is a skill that can be developed based on personality qualities from a very early age, but can also be fostered in adults with stable values and attitudes [2]. In Western countries, the development of critical thinking is a traditional part of learning objectives and teaching methods, and in most Eastern European countries the concept and ideas of critical thinking and its partial integration into teaching processes in the mid-nineties, especially in the project Reading and Writing to Critical Thinking [3]. The program offers teachers a comprehensive didactic system that can be used in almost all subjects and at all school levels. Specific practical methods, techniques, and strategies are put together in an open, but coherent whole, in an effective learning system applicable at school. The main goal of the program is for pupils to become independent thinkers and readers who can look at things from different angles, pupils that are curious and passionate to learn and feel responsibility for the world they live in [4].

However, with the passage of time, it can be stated that, despite the efforts of the organizers of the project to restructure and apply the activation methods of critical thinking into teaching, it has not been possible to revise the traditional concept of teacher as a mediator of information and interpretation of terms and classical teaching methods continue to prevail [5].

The way we process and evaluate information acts as one of the important formative factors influencing our self-concept, values and expectations on a professional and personal level. Self-concept is formed in the process of socialization and can be defined as an image we have about ourselves [6]. Our definition of professional self-concept is based on the traditional concept of Marsh and Shavelson [7], which describes self-concept as a personal perception of ourselves based on experience and interpretation of our surroundings. Their model depicts self-concept as multifaceted and hierarchically structured. The positive relationship between self-concept and critical thinking among students is confirmed by Antler [8]: “The results of the research undoubtedly show that
educating students to work with self-concept can serve as an indirect method of strengthening the ability of critical thinking. Teaching methods, together with support for student self-concept, could be a whole new way to increase students’ critical thinking skills.”

The cornerstone of the concept of education, shared professional values, and the tool of self-realization is, according to Facione [9], critical thinking that leads to the liberation of the mind-developing critical thinking skills and cultivating the habit of positive critical thinking is a sign of education that liberates. By supporting critical thinking, we give individuals and groups the potential and opportunity to address their issues in the most responsible, effective, and self-corrective way. In the Czech education system, Klooster [10] defined critical thinking in five points:

1. Critical thinking is independent thinking. In a classroom where critical thinking is taught, each person creates their own opinions, values and beliefs.
2. Obtaining information is the starting point and not the goal of critical thinking.
3. Critical thinking begins with questions and problems to be addressed, as human beings have curiosity towards the outside world as their basic life orientation.
4. Critical thinking seeks reasonable arguments. Critical thinkers create their own problem solving and endure good arguments and compelling reasons for these solutions.
5. Critical thinking is thinking in society. Thoughts are validated and improved as we share them with others.

According to Scott and Awbrey [11], building an academic environment that promotes critical thinking and problem solving not only for students but also at faculty and institute level should be the main task of the next generation of educators: "Critical thinking will improve individuals’ lives not only by providing them with the skills of abstraction, systematic thinking, experimentation and collaboration that will make them competitive in the global economy… by developing critical thinking we ensure the future of our democracy."

It follows from the above definitions that, at the tertiary level of education, one of the key factors influencing the development of critical thinking ability integrated into the professional self-concept of novice university teachers and researchers is the open academic community as the basis for an educational and research environment that enables discussion and presentation of personal concepts.

2 METHODOLOGY

2.1 Specification of the research and methods

The research builds on the findings in the framework of project Professional Self-Concept of Beginning Academic Workers [12], which shows that the development of critical thinking is one of the most important values of education for respondents from the doctoral study program Education at Palacký University. Although critical thinking in higher education is generally considered an important component of students’ competence, comparable researches have not yet been carried out at faculty of Education, Palacký University. The research was realized in the period from February to April 2019. For data collection we used standardized Cornell Critical Thinking Test, Level Z and non-standardized questionnaire.

Research questions were set as follows:

- What is the concept of critical thinking of doctoral students of study program Education at Palacký University?
- What is the level of critical thinking of doctoral students of study program Education at Palacký University?
- What are the results of subtests focused on individual critical thinking aspects?
- What is the progress of critical thinking in relation to study years of group 1 (1st and 2nd year) and group 2 (3rd and 4th year)?

Research sample consists of doctoral students of study program Education at Palacký University in Olomouc (n=23) at the age ranking from 26 – 51 years. The sample was divided into two groups, the group 1 (n=12) included students from first and second year of study and group 2 (n=11) consisted of
third and fourth year students of Ph.D. in Education, who according to their individual study plan have passed most of the required doctoral exams.

**Cornell Critical Thinking Test, Level Z** is aimed at advanced and gifted high school students, college students, graduate students and other adults. In choosing the right level, we also had to take into account the amount of critical thinking instruction the respondents have had and their level of sophistication. The concept of level Z is based on following subcategories: induction, deduction, observation, credibility (of the statements made by others), assumptions and meaning (including definition, sensitivity to meaning). This 52 – item, multiple –choice test was translated into Czech language and it was intended to take within 60 minutes.

A questionnaire consisted of open questions and questions to be assessed by Likert type scale. The items were related to the personal concept of critical thinking ability and its reflection in the teaching style of the respondents. Respondents were asked to formulate their answers to the open questions freely, and their answering was not time-limited.

### 2.2 Data analysis of the questionnaire

In the framework of professional self-concept of the respondents, we have created a system of categories C1-C5 from their subjective opinions on the critical thinking as integrated part of the education in the Czech school system. In this article we present these following categories:

- **C1** - respondents’ view on the importance of critical thinking development of students at study program Education (Bc, MA).
- **C2** - the respondents’ evaluation of critical thinking ability of their students (Bc, MA).
- **C3** - respondents’ view on the importance of critical thinking education of pupils at primary and secondary schools in the Czech Republic.
- **C4** - the respondents’ evaluation of critical thinking ability of pupils at primary and secondary schools in the Czech Republic.
- **C5** – respondents’ conception of critical thinking ability in relation to their professional self-concept.

Categories C1-C4 were evaluated on Likert type scale from 1 – very low, 2 – rather low, 3 – no opinion, 4 – rather high, 5 – very high, see figure 1.

![Graph 1. Opinions on critical thinking level within Czech education.](image)

C5 consisted of open questions and the data were coded by open coding. The term “critical thinking” is mostly defined by the as respondents “the ability to evaluate information, to find false or truth information” (53%). Among most common codes also belongs “the ability to see things and problems from different angles” as pointed out by 38% of the respondents; 15% of the respondents have implemented “the ability to argue” into their definitions.
Almost 55% of the respondents perceive their doctoral study program as highly or rather supporting and developing their critical thinking ability, especially in the area of sorting and searching the information.

2.3 Data analysis of the critical thinking test

In the descriptive part of data analysis we aim to assess the level of critical thinking ability of doctoral students of study program Education at Palacký University and compare the total score with the results in the norms.

From the table of “User norms” [1] we have chosen two groups which offer us some basis for the comparison: group Z41 - graduate students in education at a large Southern California university (n=100) and group Z16 - graduate students in an educational psychology MA program at state university in the Far West, mostly part-time students (n=132). The table below shows the results and comparison of the two groups of doctoral students with the two user norms.

Table 1. Comparison of score (G1, G2) with user norms.

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Total</th>
<th>Group norm</th>
<th>Group norm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>25,5</td>
<td>24,7</td>
<td>25,1</td>
<td>31,8</td>
<td>29,1</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>4,6</td>
<td>6,4</td>
<td>5,5</td>
<td>6,2</td>
<td>6,1</td>
</tr>
</tbody>
</table>

Critical thinking is not unidimensional process and the items of the test take into consideration the individual aspect of critical thinking, such as:

- **induction** (test items 17, 26-42) - possible predictions are provided by a researcher to test the truth of a statement. The best prediction has to be picked from the possible predictions listed below the items;
- **deduction** (test items 1-10,39-52) - proposed conclusion follows from the given statements, contradicts the statements, or neither follows nor contradicts the statements;
- **observation/credibility** (test items 22-25) - in each of these items, either one statement is more believable than the other, or neither statement is more believable than the other;
- **assumption** (test items 43-52) - in each case, a situation is described and followed by three definitions from which the one that best gives the meaning should be picked;
- **meaning** (test items 11-21,43-46) - includes sensitivity to meaning and ability to handle equivocation.

The presented research used a descriptive method in order to define critical thinking levels of two different groups of students of doctoral study program Education. Critical thinking test does not take into consideration other aspects of critical thinker such as attitudes or other dispositions (open-mindedness, caution etc.).

Table 2. Score description of critical thinking aspects.

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Induction</strong></td>
<td>mean</td>
<td>SD</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>8,9</td>
<td>1,5</td>
<td>49,3</td>
</tr>
<tr>
<td><strong>Deduction</strong></td>
<td>13</td>
<td>2,8</td>
<td>52</td>
</tr>
<tr>
<td><strong>Observation/credibility</strong></td>
<td>1,3</td>
<td>0,7</td>
<td>34,4</td>
</tr>
<tr>
<td><strong>Assumption</strong></td>
<td>5,6</td>
<td>1,4</td>
<td>56,3</td>
</tr>
<tr>
<td><strong>Meaning</strong></td>
<td>6,9</td>
<td>1,3</td>
<td>45,9</td>
</tr>
</tbody>
</table>

The presented research used a descriptive method in order to define critical thinking levels of two different groups of students of doctoral program Education. As the variables of the research were
found to be non-normally distributed, the differences between variables were tested by using **Mann-Whitney U Test**, which is a nonparametric test that allows two groups or conditions or treatments to be compared without making the assumption that values are normally distributed. All statistical analyses were processed in STATISTICA 12 (StatSoft, Prague, Czech Republic). Significance was set at \( p < 0.05 \) level for the test.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean Rank</th>
<th>U value</th>
<th>( p ) value</th>
<th>( z ) score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>12</td>
<td>25.5</td>
<td>62.5</td>
<td>0.42858</td>
<td>0.18464</td>
</tr>
<tr>
<td>Group 2</td>
<td>11</td>
<td>24.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3 RESULTS

From the questionnaire data analysis comes out that 61% of the respondents perceive the critical thinking development of their students as highly important and 39% as rather important. According to the respondents, critical thinking education should be an integral part of education on tertiary level and critical thinking ability should be integrated into the professional self-concept of novice teachers. However, 35% of the respondents in their role of university teachers evaluate the current state of students of bachelor and master programme in Education as insufficient, 30% do not evaluate the critical thinking ability level of their students; only 30% of the respondents think that this level is rather high.

The analysis of critical thinking concept in category 5 shows that even respondents do not provide more complex definitions of critical thinking in its broad educational context, but they mostly reduce it to “the ability to evaluate information, to find false or truth information” (53%).

The university teachers at the faculty of Education should be not only able to educate but also support values and attitudes of their students - future teachers that reflect the current needs of the society. Critical thinking is one of the leading 21st century skills, however, 54% of the respondents do not know whether this ability is developed with pupils at the Czech primary and secondary schools or not, 46% perceive the level of critical thinking education at the Czech primary and secondary schools as rather low.

Regarding the total score of the critical thinking test compared to the norm Z41, doctoral students of study program Education in average gained 6.7 points less than the graduate students in education at a large Southern California university, which is the difference of 12.9%. When compared with norm Z14 (graduate students in an educational psychology MA program at state university in the Far West) the Czech doctoral students gained 4 points less (7.7%).

Although more than half of the respondents perceive the doctoral study program as a factor supporting their critical thinking development, a non-parametric Mann-Whitney U Test indicated that there is no significant difference between the score of the two study groups of doctoral students divided according to the years of study (G1, G2), the \( U \)-value is 62.5, the \( p \)-value is 0.428581. The result is not significant at \( p < .05 \).

Regarding the individual subtests evaluating the aspects of critical thinking, the highest score gained the doctoral students in assumption subtest (53.2% of the total score), followed by the deduction subtest (51.4% of the total score) and induction subtest (49.1% of the total score).

### 4 CONCLUSIONS

The importance of developing critical thinking ability is confirmed by Czech and foreign scientific societies, such as Partnership for 21st Century Learning [14] which has ranked critical thinking among the skills that separate students ready for the growing demands of today’s society in work and personal life from those who are not ready. According to a statement made by the Czech and Slovak Rectors issued on the 100th anniversary of the establishment of the First Czechoslovak Republic [15], critical thinking is associated with the values of a democratic society: “Therefore, universities will continue to educate students in the spirit of democracy, humanism and tolerance towards creative,
critical and independent thinking, healthy self-esteem, national pride and civil responsibility.”

Presented research is based on critical thinking as one of the main values of education and brings the findings on critical thinking ability in a professional self-concept of doctoral students of study program Education at Palacký University. These findings lead us to a conclusion that higher attention should be paid to the development of this ability with all students of Education, so that the novice teachers can better integrate critical thinking ability into their professional self-concept. Therefore a new course on critical thinking development is being designed and planned to be open in school year 2019/2020 at Faculty of Education under Institute of Education and Social Sciences.

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1. Professional self-concept of the beginning academic workers in relation to their critical thinking. IGA_PdF_2019_033,

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