IMPLEMENTING AN INNOVATIVE METHOD TO DEVELOP CRITICAL THINKING SKILLS IN STUDENT TEACHERS

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Abstract: In the contemporary international field of education and particularly in Science Education, there is a tendency of limiting the teacher to the role of a passive recipient of knowledge produced in research, followed by the transfer of that knowledge to the classroom. Meanwhile, the dominant tendencies on forming constructivist frameworks, where participatory procedures for discovering and constructing knowledge by the children are encouraged, are in contrast to the prevailing tendency mentioned above. This contradiction leads the teacher to failure, which we believe could be tackled with teacher training programs that promote critical thinking and reflective processes. The following text presents an attempt of a method application for educating adults (TLAE method) for teaching traditional university courses in Sciences Education. According to the findings of the research, the development of critical thinking skills in student teachers is evident. The example of the TLAE method application offers the possibility to enhance traditional teaching approaches with new innovative and experiential practices, while such a perspective could compensate for the inefficacies of teacher training..

Key words: Critical thinking, teacher training, Transformative Learning through Aesthetic Experience method (TLAE method)

1. The Theoretical Framework

In the last 30 years the development of Science Education, in terms of significant progress in research regarding learning and teaching natural sciences, has led to systematic revisions of science teacher training (Zeegers, 1994; Davis, 2004; Boilevin & Ravanis, 2007). Since dominant theoretical approaches in the broader context of Science Education are influenced by constructivism or/and socio-constructivism, the orientation of basic education as well as teacher training, has shifted from a traditional preoccupation of teaching subjects such as Physics, Chemistry or Biology, to cognitive processes and teaching practices that help children of all ages shape the way of perceiving phenomena and concepts of natural sciences.

This new orientation was formed gradually, facing great resistance from those who insisted on the value of teacher training programs aiming to a deeper understanding of natural sciences and laboratory teaching. This created a new awareness that moved the focus from the actual subject to the obstacles created by the children's thinking and often even by the teachers' thinking. This new concept was to reposition major issues for education in natural sciences such as the transformation of scientific knowledge into 'school knowledge', the curricula, the revision of teaching practices, the role of the laboratory, the solution of problems, evaluation etc. All these efforts that are recorded internationally over the last thirty years, certainly of different intensity and form in various educational systems, have created an environment in search of recognition and autonomy associated with significant currents of humanities and social sciences, such as the branch of Psychology that deals with learning and the classic educational theoretical aspects (Ravanis, 1998, 2010; Dumas Carré, Weil-Barais, Ravanis & Shourcheh, 2003). It goes without saying that this process was not linear, consensus and systematic. Weaknesses and contradictions for all research and development issues of Science Education, difficulties of adjusting to the framework of social sciences and divergent views, created degraded areas of theoretical reflection and research. The most important among them was the issue of the

teacher him/herself, who was usually treated either as a research subject or as a neutral factor whose role would be to "transfer" research results to the classroom.

However, such a concept is completely contrary to a constructivist framework that is based on the construction and reconstruction of knowledge by the same subjects of learning, thus also by teachers.

Combined with issues of professional identity, in the sense of feeling efficient, creative and accepted, giving a passive role to the teacher burdens the context of learning and teaching natural sciences with an innate weakness and contradiction: we expect from a passive teacher to play an important role in active processes for knowledge discovering and building by the children.

Teachers are exposed to practices throughout their school and student life, from which they draw patterns, attitudes and behaviours in order to form their own practices (Greene, 1991). However, very often these embraced attitudes, norms and values can lead to the formation of dysfunctional practices. Particularly in the Greek context, which has a long tradition in teacher-centered learning, this effect is essential in the reproduction of traditional practices and the emergence of obstacles in implementing innovative methods (Karalis, Ravanis & Komis, 2007). This trend is reinforced even more by the habit that feeds from the comfort of routine. Teachers develop routines that simplify their professional lives. This makes it harder to use new innovative practices, and in many cases the school environment acts as a privileged setting for reproducing established and often distorted practices (Karalis, Sotiropoulos & Kampeza, 2007).

2. The transformative learning approach

Transformative learning in recent years is the most investigated and questioned theory in the field of adult education. The scope of the theory is significant as the applications in the areas and methods vary (Mezirow, Taylor & Ass., 2009). Introduced by Jack Mezirow, this theory refers to how learning that involves critical reflection can cause transformations in adults' habits of mind (Mezirow & Ass., 2000).

The reasoning of Mezirow is based on the notion that the way in which we interpret reality is determined by the way we perceive it, our frame of reference. The main goal in adult learning is to help learners review the foundations of their erroneous perceptions and challenge the validity of those which have become dysfunctional, in order to build a more sustainable view of the world and of their place in it (Kokkos, 2011). Through transformative learning a rational metacognitive process occurs, revaluating arguments that support problematic meaning making perceptions or frames of reference, including those representing cultural or environmental factors. It is the process by which adults learn how to think critically for themselves rather than accept assumptions that support a view as given (Mezirow et al., 2009).

A frame of reference is "the structure of assumptions and expectations through which we filter sense impressions" (Mezirow & Ass., 2000, p. 16). Basically it provides the context for meaning making, by which we interpret and utilize the experiences derived from our sensory system, in order to understand the world. We may be aware of this process or we may not. Many of our beliefs of ourselves and the world are the conclusions that derive from experiences that affect us repeatedly without our realizing it. Many of these beliefs come from learning that is processed unintentional from the cultural reality or personal opinions of family, school and social environment, which the individual internalizes during the stages of development and socialization.

According to Mezirow (Lintzeris, 2007), there are two main pillars of the theoretical approach: critical reflection and rational discourse, essential presuppositions for any transformation to take place. Critical reflection is the means to achieve transformation. It is defined as the review process of perceptions and values on which we understand reality and act (Mezirow, 1998; Brookfield, 2005). The concept of critical reflection associated with our attempt to rationally search of the causes of an event or the justification of a statement. This approach, as a learning experience, doesn't mean simply adjusting or even exceeding the existing knowledge, but exceeding the basic assumptions on which the knowledge is based on. Thus, it refers to change in the basic understanding of the framework of

meanings that we have embodied during our configuration, changes that also often relate to action patterns.

The second cornerstone of transformative learning, as already mentioned, is *rational discourse*. In order to achieve reflection, feedback and thoughtful discussion are necessary, what Mezirow refers to as rational dialogue in terms of exchanging and sharing experiences of an individual in a group. This process leads to knowledge of ways to help people integrate into the social and intellectual life of their community. Without this exchange, people remain isolated from others and from themselves, as they don't have the means to present their experiences (Belenky, Clinchy, Goldberger & Tarule, 1986). Therefore, since a person alone cannot achieve this, the role of the educational process becomes critical, as it offers the appropriate framework for the encouragement and development of critical reflection.

3. Methodology

3.1. The «Transformative Learning through Aesthetic Experience» method

The qualitative research presented here was held in the Department of Educational Sciences and Early Childhood Education, of the University of Patras. It aimed to study the possible variations between two groups of students on the issue of critical reflection during their studies (Raikou, 2016). One group worked under the regular program of the Department, while students of the other group also participated in a series of workshops designed and applied on the basis of the method of «Transformative Learning through Aesthetic Experience» (TLAE), a method introduced and developed by A. Kokkos (2010, 2011). The themes of the workshops were related to the learning process (Raikou, 2013; Raikou & Karalis, 2011). The workshops were held over a period of three years (during the second, third and fourth year of studies) in order to investigate gradual variations in the levels of critical reflection.

The TLAE method is based on the use of art in order to enhance and promote the development of critical reflection. Its aim is, through a course of six stages to encourage the students to go deeper, analyze and reflect on a learning subject (Kokkos, 2010, 2011). The concept of the method is the observation and process of significant works of art that provide resources for the development of the addressed subject. In other words, it uses the aesthetic experience in order to promote critical reflection. The stages of TLAE method include (Kokkos, 2011, p. 97-100):

- Investigation of the need for critical reflection regarding the students' assumptions on a subject (1st stage).

- The participants express their views on the subject (2nd stage).

- After reviewing the proposals of the participants for elaboration and following a discussion, the trainer defines the opinions that should be examined and in which order (3rd stage).

- Selection of artworks (4th stage). The works of art are selected from all types of art, with the criterion that they can act as triggers for the elaboration of the subject.

- Critical reflection through aesthetic experience (5th stage). The teacher coordinates a systematic observation of the artworks selected in order to review the subject critically. The model by Perkins is used observe the work of art, with the aim to investigate the interrelation of meanings drawn from the art piece. Through the ideas that are expressed during the observation, the critical elaboration of various elements of the subject are developed.

- Reassessment of the assumptions related to the subject, after recording them in writing or orally. The assumptions, as they took shape during the observation process of the previous stage, are compared to those expressed before this process (6th stage).

3.2. The procedure

For the purposes of the research, two groups were formed: group A with 10 students who participated in the workshops where the TLAE method was applied and group B, with 9 students who did not

participate in the workshops. The students of both groups attended the lesson of the fourth year «Advanced Topics in Teaching Physics» which completes a cycle of four semesters, aiming to help the students develop activities from the world of physics for Kindergarten children. All 19 students had very high performances in the regular evaluation of the course. In the 2nd and 3rd year of their studies, i.e. the two years preceding the survey, group A students participated in a series of workshops carried out with the systematic application of TLAE method on the subject of learning (Raikou, 2016). Initially, an attempt was made to focus on the assumptions which the students had formed from their experiences in the formal educational frameworks so far (*1st stage*).The first distinction aims to locate the functional use of the projective activity of the child's thought process in regard to the formation of shadows, in order for us to draw conclusions regarding the integration and stability of the conception. The second distinction, i.e., the repetition of the questions about figures with two shadows, aims at the same purpose mentioned above. We can locate a factor which might lead to the revelation of difficulties of a functional nature, since our task does not allow any other possibility but the corresponding light sources and shadows, one-to-one; this factor is the number of shadows and consequently the number of light sources.

At the same time, the students' initial views on learning were expressed as well (*2nd stage*), which would form the basis for designing the following workshops, while during the last step of the process these initial views would be compared to the final views resulting from the process. Taking into account the students' views, the subjects of the learning process were identified, as well as the critical questions which would be the topics of the following workshops (*3rd stage*). During the first year, the subjects were related to concepts such as guidance, discipline and useful knowledge, and the development of attitudes and values. During the second year, the subjects concerned the relationship that develops between the trainer and the trainees, the role of the teacher and designing and evaluating the teaching process.

In the *4th stage* the artworks were determined that would be the trigger for the elaboration of the critical questions. The specific works of art were selected because they were significant works of art (by Kazantzakis, Brecht, Gansel, Proust, Raffaello, Wood, Barker, Vrettakos, Chagall, Rembrandt, Caravaggio, Picasso, Rodin, De Saint Exupery, Cantet) and they were easy to elaborate. Also, The second element crucial, since the target group -the students- was an inexperienced audience. Most importantly, the works of art served the teaching objectives, as they offered stimuli for reflection. The artworks used were from the fields of poetry, literature, painting, film and sculpture (Raikou, 2016).

During the following workshops, a systematic observation of the artworks was attempted in order to correlate the abstracted ideas to critical questions, in order to critically approach the students' views on the topics that were determined *(5th stage)*. Each workshop focused on some of the topics, addressing the issue through the artworks we had at our disposal. At first we posed the critical question we were to elaborate and, following the stages of the TLAE method, the initial opinions of the students were articulated. The presentation and analysis of the artworks followed, gradually linking them to the critical question. The workshops were completed with the re-evaluation of their initial views. In the last workshop of the year there was a reassessment of their views and their comparison to those that were expressed initially *(6th stage).*

During the fourth year of studies, all 19 students were given a variety of tasks of planning physics activities for Kindergarten, which required critical reflection on the subject. The aim of these tasks was to observe any impact of the TLAE method application and to investigate if there was a difference between the plans of the two groups. For this reason the opinions of the two groups were compared. The subjects of all tasks involved educational issues that were not discussed during the workshops.

In this paper we will focus on one of three control exercises, on the subject of diversity in education. The other two control exercises were on two other courses (course: Planning and Evaluation of Adult Education Programs and course: Distance Education), in an attempt to investigate whether identified differences in perceptions related to the development of training materials and the implementation of adult education principles in distance education (Karalis & Koutsonikos, 2003; Vorvilas, Karalis & Ravanis, 2011).

Both groups were given a case study, which involved designing a two-hour activity in Physical Sciences for Kindergarten students, in a class including children of immigrants. The exercise called for a) the content and objectives, b) the pedagogical principles underlying c) the phases of the activity, and d) the way of evaluation. Below is the text of the case study as given to the students of both groups.

Case Study
You are a kindergarten teacher in a class of twenty children, five of which are from migrant families.
You are given the opportunity to freely design and implement a two hour activity:

- *Describe the activity in general (objectives and contents).*
- *On which pedagogical principles would it be based on?*
- *What steps would the activity include?*
- *How would you rate the implementation? What actions would you take after the application? What would you consider?*

Based on Mezirows' concept of critical thinking, we attempt to examine the possible effect of the TLAE method on the students' perceptions of group A and if there are differences between the two groups. Considering the difficulty of developing critical reflection in the limited context of the workshops where the TLAE is applied, we are interested in finding points connected to this process as critical thinking in general or as defined by Mezirow, as critical reflection. The point we are examining is the reflective process in which the students engage when they organize an activity. Specifically, we are interested in studying a) the clarity of thought and objectives, b) the understanding of the subject, c) the ability to address the learners needs, both at a cognitive and emotional level, and d) the participatory dimension of the activity.

4. Results

Results showed that the students of the first group answered to all aspects of the exercise in depth and with strong arguments. At the same time, their activities include participatory processes, while focusing on the emotional and interpersonal relations in the educational context, emphasizing on the interaction between the members of the class.

On the contrary, the students of the second group have difficulties and limitations designing their activity. Some simply repeat the theory they were taught, failing to adapt it to their needs. Moreover, in some cases they do not understand the question and do not answer to what is asked, while some activities are incomplete, or lack the participatory element.

4.1. Activity description and objectives

More specifically, regarding the description of the objectives and the content of the activity, we see that two students of the second group describe activities where neither the objectives nor the content are relevant to the topic of diversity (S11, S15).

Here is an example clearly showing the differences between students of the first and second group:

> "*First we gather the children of the reading group and we read a story called 'Good morning buddy', a story of milk once found in the same bottle with cocoa, and even though their parents had told them not to hang out together because they were different, they did not listen to them and kept talking. At the end of the story the milk and the cocoa, although very different, made wonderful chocolate milk that children happily drank every day. Objective: to listen and understand a story. Then, after discussing the story and finding some elements, the children make arguments and say their opinion about the diversity in the world e.g. color, clothing and eating habits among people. At this point the children see that all people are different. Objectives: to engage in the process of making arguments and identify elements of diversity e.g. clothing, color and eating habits. At this point, the teacher shows the children a video with a child's journey, where he met different people with different habits in each country. This child had seen children from China, America, Africa and Europe and how different they were. Objectives: to find information from various sources, such as videos, and understand the*

concept of diversity. The teacher then shows the children a basket with pictures of different costumes and foods. Each child takes a picture and holds it in their hand, while the teacher shows the children a large board with people and indications of the countries they are from. Each child gets up and places the image under the person on the board they think corresponds to the image they have. For example, Chinese – rice, while explaining why they place it there. Objectives: to enable children to match meanings, understand the characteristics of each child and be able to make an argument in order to support their choice "(S7, group A).

To the same question about the content and objectives of the activity, a student of group B' states:

"The aim of the activity is for the children to learn about the shadowing effect, the various forms it can take (light source intensity, viewing angle), methods of use and utilization (games or other). To be familiarized with the use of equipment e.g. lenses. To describe the effect in different phases but to make assumptions and estimations about the number of shades (depending on the sources), their status (viewing angle) and size (light source distance from the illuminated object). The children will stand in front of a cross-shape wooden structure, where lenses are attached on the ends or in the center, with dimmers, in order to modulate the intensity of light emitted by each lens. This construction will not exceed the height of a child, so the students can handle the lenses. There will also be a base with wheels to increase or decrease the distance from the illuminated object. The illuminated object will be tied from the ceiling at a fixed point by line. Then it will be left to balance "(S11, group B).

4.2. Pedagogical principles

Regarding the pedagogical principles the activities were based on, we see that the answers of the first group are the most substantiated and clear, as opposed to the second group, where the answers are incomplete or not justified. Here are some indicative answers of the students, where the variation is evident:

"The activity is mainly based on the principles of communicative experiential teaching and cooperative learning. Specifically: the activity is initiated by the experiences of the children. It is necessary to investigate and record the previous experiences and knowledge of the children on the subject in order to use them later as a starting point of our activity. It is important to use the experiences and interests of the children in the educational process in order to proceed to activities that are meaningful for the children. It is important for children to make assumptions through communication procedures to increase their active participation. The use of appropriate learning questions facilitates the learning process. The children are divided into groups to facilitate the activity and reinforce cooperation, communication and joint decision making. It is very important to give to foreign language speaking children the opportunity for interaction and free expression, without correcting their mistakes, both in the context of intercultural education as well as when teaching the Greek language, but all these are grounds for further activities. It is important to make the foreign language speaking children feel accepted for their origin and language and appreciate it. Besides, intercultural education must be present in any activity we do "(S5, group A').

"Primarily on constructivism. Based on the fact that children may have some prior knowledge on the Olympics, they may have heard or have seen something from their families or their social environment, we consider this knowledge in order to build new knowledge on the topic we want to teach. I would also use behaviorism, mainly while playing games, in order to achieve the necessary and desired behavior of children by passing on information (e.g. game rules, etc.) (S10 group A ').

To the same question on pedagogical principles, we present some indicative answers of the second group:

"Of course we treat children with equality and respect regarding their culture and language. To help them participate and be proud of their origin, we can ask them to say in their native language the names of the objects in the images and listen to them with admiration "(S15, group B).

"I would base my activities on the pedagogical principles of constructivism. You start from the beginning by building relationships among the children, but also with the teacher "(S18, group B).

4.3. Activity evaluation

Regarding the evaluation of the activity, the students of the first group form clear and documented answers, which are linked to the theme and the objectives of the activity. Mentioned below are some answers of the first group:

"After the implementation of the activity, an evaluation activity would follow, where I would talk to them about an animal that lived in a distant country and had to leave with his parents for another country. In the country they went to, all the animals were different from them. I would encourage them to discuss how the animals in the neighborhood where they live now should behave, and observe their reactions. With reflective questions such as "how do you think the animals should treat their new neighbors?" I would try to understand if they accept diversity. I would use animals so the children of immigrants wouldn't be offended, as for sure they would have been through a lot in our country" (S1, group A)

"After the implementation of the activity, I would hold a discussion with the children to see their current views on diversity, as opposed to their initial views. At the end, we would make a large collage with images corresponding to each country, while we would generate a process to see that all people are the same, regardless of origin, clothing, habits and color between them. That a child from Africa is the same as a child from Europe" (S7, group A).

Conversely, the students of the second group show significant deficiencies. Two of the students who had described an activity that wasn't relevant to the subject, evaluate in the same matter, without making any association to the issue of diversity:

"The positive or negative evaluation of the implementation of the activity depends on the achievement of goals set by the mood and the interest of children. The discreet presence of a colleague-observer noting any oversights and omissions could possibly help. Also, the use of questions that require the knowledge gained through this activity in order to be answered. e.g. (In the playground) "At noon, when the sun is high, where do you think the shadow of the tree will be?" (In the game with the shadows) "Where should you put your hands so the mom elephant has a larger shadow than the baby elephant?"(S11, group B).

"Initially I would give a paper to each two children with various objects, to distinguish which could be found underground. I would make sure that any of five children would be with a Greek child to help, but also to work with other children, boosting their sociability. Finally, I would see whether they remember the words that we mentioned before, showing the images to all the children again and asking these 5 children to say the names of the images in their native languages as well "(S15, group B).

In addition, some students of the same group only evaluate at a cognitive level, without considering issues of interpersonal relations and interaction:

"To evaluate this activity the teacher could show a traditional outfit and ask each child where this outfit comes from. Finally, and after the activity is completed, the teacher could gather the children in the discussion corner for them to express what their findings were"(S14, group B).

"In order to ascertain that the children realize their rights, I would ask relevant questions to see if they have understood. If they have realized that all children are equal, this means that they actually understood this, otherwise I would ask more questions to make sure they do"(S16, group B).

Finally, there are some cases where the response is not well documented: *"We will evaluate it through the behavior of the children during the role play"* (S19, group B).

4. Discussion and conclusions

Over the last thirty years due to the influence of the theoretical framework of lifelong learning, an increasing tendency of diosmosis approaches between different contexts of formal and non-formal education. In the area of higher education there is a tendency to apply theoretical approaches and practices from the field of adult education. Although the context of higher education is not considered an adult learning context, and the students have not fully entered adulthood but are considered late teens, prolonged adolescence or more precisely as emerging adulthood (Arnett, 2000), in the international literature attempts to apply methods and techniques of adult education are recorded for teaching traditional university courses. The research intervention presented in this paper is in this direction. As mentioned, an innovative process was selected, based on the use of art to foster the development of critical thinking skills in student-teachers.

The results presented show that the students who participated in workshops with the TLAE method have a comprehensive understanding of the case study factors. They have the ability to organize the general activity groups for Kindergarten in the context of Science Education and also to analyze the content of the exercise and focus on all modules, while the students of the other group, even when they understand the questions, in most cases they fail to focus on them. We consider an important finding the fact that the students who participated in workshops with TLAE suggest experiential activities while investing on the emotional factor to a greater degree. The students who participated in TLAE workshops, emphasize more on group dynamics in educational settings, while students of the other group tend to consider educational settings as rather neutral environments, putting emphasis only on subject matter issues. Furthermore, the students of this group suggest evaluation approaches focused on their initial goal setting, while other students choose more vague approaches in evaluation. Finally, the options of the group that participated in workshops with TLAE are better documented, while the other group options are more vague, general and non-focused.

Based on the above, we conclude that the experimental application of the specific method in a university context, even though it was applied to a limited field such as Early Childhood Science Education, can encourage critical thinking and reflective processes in students of higher education institutions. Using art as a trigger, according to the TLAE method, offers the possibility to enhance traditional teaching approaches with new innovative and experiential practices. Therefore, such a perspective could compensate for the inefficiencies of teacher training in the field of Science Education to some extent. In our introduction we referred to these weaknesses, as they indeed tackle the issue of limiting the teacher to a passive receiver of knowledge that is produced in research. It is obvious that Science Education isn't but an example. The possibility of applying the method could be interesting from the perspective of research, for continuing education of in-service teachers, as it could promote the development of critical thinking skills and the revision of established opinions.

References

[1]   Arnett, J. J. (2000). Emerging adulthood: a theory of development from the late teens through the twenties. *American Psychologist*, *55*(5), 469-480.

[2]   Belenky, M. F., Clinchy, B. M., Goldberger, N., & Tarule, J. (1986). Women's ways of knowing: The development of self, voice and mind. New York: Basic Books.

[3]   Boilevin, J.-M., & Ravanis, K. (2007). L'éducation scientifique et technologique à l'école obligatoire face à la désaffection: recherches en didactique, dispositifs et références. *Skholê*, *HS*(1), 5-11.

[4]   Brookfield, S. D. (2005). The power of critical theory for adult learning and teaching. McGraw-Hill Education: Open University Press.

[5]   Davis, E. A. (2004). Knowledge integration in Science teaching: Analysing teachers' knowledge development. *Research in Science Education*, *34*(1), 21-53.

[6] Dumas Carré, A. Weil-Barais, A. Ravanis, K., & Shourcheh, F. (2003). Interactions maître-élèves en cours d'activités scientifiques à l'école maternelle: approche comparative. *Bulletin de Psychologie*, *56*(4), 493-508.

[7] Greene, M. (1991). Teaching: the question of personal reality. In A. Lieberman & I. Miller (Eds), *Staff Development for Education in the '90s: New Demands*. *New Realities, New Perspectives*. Columbia: Teachers College, Columbia University.

[8] Karalis, T., Ravanis, K., & Komis, V. (2007). La formation des enseignants du préscolaire et du primaire en Grèce entre 1984 et 2006: contradictions et défis. In T. Karsenti, R.-P. Garry, J. Bechoux & S. Tchaméni Ngamo (Éds), *La formation des enseignants dans la francophonie: diversités, défis et stratégies d'action* (pp. 344-356). Montréal: AUF.

[9] Karalis, T., & Koutsonikos, G. (2003). Issues and challenges in organizing web-based courses for adults. *Themes in Education*, *4*(2), 177-188.

[10] Karalis, T., Sotiropoulos, L., & Kampeza, M. (2007). La contribution de l'éducation tout au long de la vie et de l'anthropologie dans la préparation professionnelle des enseignants : réflexions théoriques. *Skholê, HS*(1), 149-155.

[11] Kokkos, A. (2010). Transformative Learning through Aesthetic Experience: towards a comprehensive method. *Journal of Transformative Education, 8*(3), 155-177.

[12] Kokkos, A. (2011). Transformative learning through aesthetic experience: The formulation of a method. In A. Kokkos & Associates (Eds.), *Education through the arts* (pp. 71-120). Athens, Greece: Metaihmio.

[13] Lintzeris, P. (2007). *The significance of critical reflection and discourse in Jack Mezirow's theory of transformative learning*. Athens: Hellenic Adult Education Association.

[14] Mezirow, J. (1998). On critical reflection. *Adult Education Quarterly*, *48*(3), 185-198.

[15] Mezirow, J., & Associates (2000). *Learning as transformation.* San Francisco, CA: Jossey Bass.

[16] Mezirow, J., Taylor, E., & Associates (2009). *Transformative learning in practice.* San Francisco, CA: Jossey-Bass.

[17] Raikou, A. (2013). *Adult and higher education: Exploring the potential for developing critical thinking through aesthetic experience to teacher students.* PhD Thesis, University of Patras, Greece.

[18] Raikou, N. (2016). Development of critical thinking through aesthetic experience: the case of students of an educational department. *Journal of Transformative Education*, *14*(1), 53-70.

[19] Raikou, N., & Karalis, T. (2011). Exploring the potential of Transformative Learning in Higher Education: the development of students' critical thinking through aesthetic experience. In M. Alhadeff-Jones & A. Kokkos (Eds.), *Transformative Learning in Time of Crisis: Individual and Collective Challenges* (pp. 261-267). Athens: Columbia University and Hellenic Open University.

[20] Ravanis, K. (1998). Procédures didactiques de déstabilisation des représentations spontanées des élèves de 5 et 10 ans. Le cas de la formation des ombres. In A. Dumas Carré & A. Weil-Barais (éds), *Tutelle et médiation dans l´éducation scientifique* (pp. 105-121). Berne: P. Lang.

[21] Ravanis, K. (2010). Représentations, Modèles Précurseurs, Objectifs-Obstacles et Médiation-Tutelle : concepts-clés pour la construction des connaissances du monde physique à l'âge de 5-7 ans. *Revista Electrónica de Investigación en Educación en Ciencias*, *5*(2), 1-11.

[22] Vorvilas, G., Karalis, T., & Ravanis, K. (2011). Designing Learning Objects: A genre-based approach. *Journal of Baltic Science Education*, *10*(2), 114-126.

[23] Zeegers, Y. (1994). Teacher professional development: Which aspects of inservice do teachers believe influence their classroom practice? *Research in Science Education, 24*(1), 358-365.

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