Constructing and implementing an OER regarding sustainability issues in vocational education

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ABSTRACT

In this work the construction of a learning unit in the form of Open Educational Resource (OER) is described. The unit concerns sustainability issues of medicament administration and refers to the curricula of vocational education and training. The OER has been implemented in an institute of vocational training. This implementation as well as evaluation of the OER by various agents (trainees, trainers, prospective and in-service vocational school teachers) is also presented in this work. Results indicate that OER can be an excellent learning tool for education for sustainable development.

KEYWORDS

Open Educational Resources (OER), Webquest, Sustainable Development

RÉSUMÉ

Dans ce travail, la construction d'une unité d'apprentissage sous forme de ressource éducative ouverte (REL) est décrite. L'unité concerne les questions de développement durable liées à l'administration de médicaments et fait référence aux programmes d'enseignement et de formation professionnels. Cette REL a été mise en œuvre dans un institut de formation professionnelle. Cette mise en œuvre ainsi que l'évaluation de la REL par divers agents (étudiants, formateurs, futurs enseignants et enseignants des écoles professionnelles en activité) sont également présentées dans ce travail. Les résultats montrent que les REL peuvent être un outil d'apprentissage excellent pour l'enseignement sur le développement durable.

MOTS-CLÉS

Ressources éducatives Libres (REL), Webquest, Développement durable

THEORETICAL FRAMEWORK

Defining OER
The term Open Educational Resources (OER), refers to digital educational material that is openly and freely available to the educational community (teachers and students) for use and reuse in teaching, learning and research (Armakolas, Panagiotakopoulos, Karatrantou & Viris, 2018; Ischinger, 2007). They include full courses, course modules, curriculum, lectures, assignments, quizzes, laboratory and classroom activities, pedagogical material, games, simulations, streaming videos, tests, software and any other tools, materials or techniques used to enhance access to knowledge (Armakolas, Panagiotakopoulos & Magaki, 2017; Misra, 2013; Smith & Lee, 2017). According to Jung et al. (2016, p. 1) "It is generally held that making openly licensed educational resources freely available online under an intellectual property license that permits their free use and repurposing offers opportunities for people everywhere to share, use and reuse quality materials and tools". The OER can be reused, revised, redistributed and remixed (four Rs) with other resources or shared with students or other teachers. A key tool for creators of OER to legally permit these four Rs is open licensing (Hilton, Wiley, Stein & Johnson, 2010). The OER accords with open content licenses (e.g., Creative Commons) that have been properly referenced and applied to the resources. These licenses are necessary because many countries have laws that restrict people's ability to reuse creative works. The Creative Commons licenses are among the most common open licenses for OER (Armakolas, Magkaki & Panagiotakopoulos, 2017; D'Antoni, 2007).

The Web Quest platform 'Open Web Quest'
The Greek Web Site 'Open Web Quest' presents great educational and research interest as open source software. Its evaluation has shown that the tool meets many requirements, but it can accept improvements and extensions. This edition is available under the Commons license 4.0 (Tsiotakis & Tzimogiannis, 2011) license. The main pedagogical features of this web-based platform are as follows (Tsiotakis & Tzimogiannis, 2011, 2014):

- It supports student activation and learner-centered learning. The role of the teacher is to coordinate and to support.
- It focuses on the use and application of information to solve a problem rather than simply searching for information on the Web.
- It supports critical thinking and the development of high-level skills (such as analysis, synthesis, transformation, organization and evaluation of information, deepening and application of knowledge, drawing conclusions, etc.).
- It promotes knowledge building, conceptual learning, through cross-thematic approaches to the content under study.
- It supports students' creativity.
- It supports cooperative and interactive learning, through sharing ideas, exchanging views and arguments, interacting with peers, and presenting their work to the classroom.
- It develops pupils' digital competence and skills through the use of ICT tools and environments (general purpose or conceptual mapping software, Web 2.0 applications, educational software, etc.).

Sustainable Development (SD) and Education for Sustainable Development (ESD)
The need for a sustainable development as a common global challenge was highlighted by the UN World Summit of Rio de Janeiro (1992) and Johannesburg (2002). SD is understood by the

international community as a social design process. There is no universal definition of SD and ESD. The most common definition of SD is the one formulated by the World Commission on Environment and Development (WCED) "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 37).

According to UNESCO (2014) ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a fair society, for present and future generations, while respecting cultural diversity. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purposes by transforming society. ESD is viewed by different authors and in different countries as an evolution of environmental education (Flogaiti & Liarakou, 2008; Overwien, 2016). There are some characteristic stages which describe and explain this evolution. Two paths, following this evolution are described by Overwien (2016):

- The first path: Critics, regarding the first environmental movements, complained that the environmental education solely served the legitimating of the state's environmental policies and that it did not pose decisive questions for the constitution of society (Becker, 2001). The concept of ecological learning was developed which emphasized the interconnection between nature and social environment and was followed later by the more "biocentric" approach of eco-pedagogy.
- The second path describes an evolution from environmental education (conceived as environmental protection) to environmental education conceived as precautionary environmental planning and later on to ESD which incorporated the idea of shaping the future in a self-determined way and has overlaps with political science: the well-known triangle environment-economy-society depicts ESD.

The use of OER by teachers and trainers

It goes without saying that a teacher must have a good knowledge of the content of a learning unit. This is called the 'Content Knowledge' (CK). The perspective of teaching implies an additional knowledge. This is the knowledge on how the teacher makes a subject understandable by students. This is best described by the term 'Pedagogical Content Knowledge' (PCK) (Gomatos, 2010; Shulman, 1986). It describes the result of the effective combination of pedagogy and content (Figure 1).

FIGURE 1
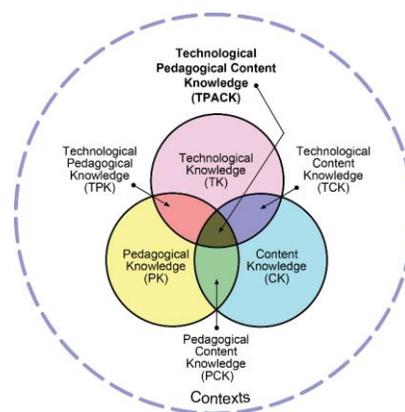
Technological Pedagogical Content Knowledge (Koehler & Mishra, 2009, p. 63)

When using technology in the process of teaching, the teacher must have technological skills concerning the specific tools that she/he utilizes. But this is not enough. There is a difference between using technology as a performance tool and using technology as part of a teaching strategy as a teaching tool. The later is usually called 'Technological Pedagogical Content Knowledge' (TPACK). According to Schmidt et al. (2009), it refers to the knowledge and understanding of the interaction between Content Knowledge, Pedagogical Knowledge and Technological Knowledge when using technology for teaching and learning. These considerations make figure 1 better understood. In this figure are depicted Content Knowledge, Pedagogical Knowledge and Technological Knowledge as initial circles. The interest is chiefly in their combinations. These are represented by the cross-sections of the circles.

In our task regarding the construction of an OER for the teaching unit that is described in the following paragraphs, two points have been taken into consideration:

1. Good use of OER demands on behalf of the teachers not only Technological Knowledge but what is described above as TPACK
2. Content Knowledge which in general is considered as granted for certified teachers cannot be consider as granted for a subject as SD. The teacher may be competent regarding the vocational aspects of the subject but not regarding SD. Besides, in traditional curricula the SD objectives are not always proposed along with the vocational competences.

The purpose of this work

In this work the construction, implementation and evaluation of a learning unit in the form of Open Educational Resource (OER) is described. The unit concerns sustainability issues of medicament administration and refers to the curricula of vocational education and training. This OER was part of the ASPETE (School of Pedagogical and Technological Education) intellectual outputs in the framework of a European Erasmus+ KA2 project called GreenSkills4VET (link of the project: https://www.greenskills4vet.eu/). The purpose of the GreenSkills4VET project was the production of OER learning material regarding SD issues in Vocational Education.

METHODOLOGICAL FRAMEWORK

Presentation of the OER

The module "medicament administration" is taught in the Health sector in Vocational Education and Training (VET). This learning unit was considered appropriate for the development of objectives regarding ESD. The excessive use of medicaments, non-correct storage, their release in the environment which may entail groundwater contamination are some important SD themes. Drug delivery is one of the most basic, responsible and complex nursing activities. The knowledge of the nursing staff regarding the proper administration and management of the drug, as well as safe and effective release and care to promote recycling are key axes and responsibility for health professionals. In this sense, there are multiple benefits for the patient, the environment and the broader society. The aim of this OER is the development of knowledge of trainees on the concept of medicament as well as their awareness regarding SD issues in this area. Expected skills are the correct administration and the overall sound management of medicaments both by the professional and, later on, by their patients. The objectives are compatible with EQF level 5.

EQF (European Qualifications Framework) spans the whole system of qualifications – formal and informal learning as well as various educational types and levels (Elken, 2015).

Webquest is the type of OER that was chosen. This type of activity belongs to the family of Inquiry Based Learning. Web quest activities are often developed on special platforms designed for this purpose. We decided to use the platform OpenWebQuest described above. The English version of the OER can be visited in the following link: http://eprl.korinthos.uop.gr/openwebquest/view/teachers.php?wq=1839 and the Greek version in http://eprl.korinthos.uop.gr/openwebquest/view/teachers.php?wq=1841.

For the complete Learning Unit with all its components and without any adjustments, at least 3 Sessions of 45 minutes each are considered necessary.

The 1st session comprises an introduction to the subject from the teacher followed by group work. Two specific sources are proposed to the groups. The video (which appears in the Sources section of both the English and Greek versions https://youtu.be/P99pDxvUV0s) and source No6 of the Greek version (or source No14 of the English version) of the webquest. The learners have to follow them and then transfer their impressions to a whole class discussion which concludes the 1st session. In this 1st session the basic objective is sensitization on the subject but also acquiring essential knowledge on the SD issues of medicament administration.

In the 2rd session the teacher presents a synthesis of what has emerged in the first session and then groups go back to work. This time their task is to search in a number of sources additional stimuli and information on SD issues of medicament administration. Almost 20 different sources appear at the "Sources" Section of the web quest but they are not all meant to be visited by all groups. At first, two of them have been utilized by all groups in the 1st Session; in the "Sources" Section of the webquest all the sources appear no matter the Session in which they will be used. At second, it is advisable to propose a restricted number of sources to each group (3 to 5) so that they can be utilized by the groups in the time proposed. The set of sources for each group in this 2nd Session differs which is not the case in the 1st Session: during the first session the groups deal with common sources because we want them to share ideas on this common material during the discussion in plenary session. In Session 2 the purpose is different: we want the groups to present their own findings and to assure that each group has its proper ideas, proposals and contributions for the poster. After all, the poster has to be a collective work of the whole class.

The 3rd session starts with a collective construction of a poster. A retrospection of the whole activity and an evaluation of the learning unit and the OER complete the 3rd Session (cf. Evaluation Section of the OER).

The video (see: Sources section of the OER https://youtu.be/P99pDxvUV0s) was produced with interviews of actors of a social pharmacy and also of a pharmacist who speaks about medicine recycling. This video was designed and produced in Greece by the ASPETE team of the project. It has been subtitled for the English version of the OER and has been uploaded to a separate link in YouTube.

All sessions can be developed in class environment. However, computers are necessary in order to go through the web searching and the web quest evaluation. Internet access is necessary. A colour printer is also necessary in order to print selected material in the beginning of session 3 as well as cardboards and all the necessary material to create the poster. Basic digital literacy is required by the teachers and students.

Implementation of the OER

The OER has been implemented in a class of 18 trainees of an Institute of Vocational Training in Greece in mid-February 2018. The implementation followed the three sessions described above. It is to be mentioned that in this implementation the third session was separated by two days from the two first sessions for practical reasons.

Evaluation

The present study aims to investigate how different agents (trainees, teachers and trainers) evaluate this OER. Apart from the trainer who implemented the OER and his trainees (evaluations a1 and a2 respectively) the OER has also been the object of evaluation by ASPETE students who were prospective or in-service VET health care teachers (evaluation b). The 68 respondents had followed lessons of webquest creating and of OER use. They replied to a questionnaire of 19 closed-ended questions (Appendix 1). The questionnaire comprised items and criteria from Roblyer (2006) and Jung, Sasaki and Latchem, (2016). Finally the OER has been evaluated by perspective and in-service teachers in a multiplier event which took place in the Conference and Cultural Center of the University of Patras (evaluation c). This event was scheduled to be a Daily Training Conference for the participants. The latter worked in groups, each group accompanied by a member of the ASPETE GreenSkills4VET team who had the role of facilitator. During the first session the teams have dealt with basic concepts of SD and Education for SD and studied specific examples in which they were invited to locate the sustainability dimensions of the cases proposed. The groups have subsequently presented their work in plenary session. The second session comprised three presentations from academic teachers regarding the themes involved in the daily conference. During the third session the focus was the OER produced by ASPETE. The participants studied it in small groups following the OER on a laptop and exchanging ideas. They presented their answers to the questionnaire (Appendix 1) and their comments later on in the plenary session. The multiplier event was completed by retrospection on the daily conference and a discussion on the perspectives. All in all the evaluation comprises a) Items from the implementation of the OER (from the trainer and the trainees) , b) items from the evaluation by ASPETE students and c) Items from the OER evaluation during the multiplier event. Table 1 recapitulates all forms of evaluation.

TABLE 1

Evaluation scheme

	WHO	**HOW**	**HOW MANY**
a1	Trainer who implemented	Interview	1
a2	Trainees	Rubric, test	20
b	ASPETE students	Questionnaire	68
c	Multiplier participants	Questionnaire	23

Triangulation is a method of research that involves the use of two or more data collection techniques for the multidimensional study of human behavior (Cohen, Manion & Morrison, 2007). This technique was chosen as appropriate for research purposes, resulting in more valid results. In this study, triangulation has been chosen in terms of the methodology axis, or methodological triangulation, which aims, through the use of multiple methods, to study the use of OER (Cohen, Manion & Morrison, 2007; Panagiotakopoulos & Sarris, 2015). The semi-structured individual interview (with the trainer), the rubric and test (evaluation a2) and the

questionnaire in b and c evaluations were selected as the main data collection tools for this research. Three different agents (trainer, trainees and perspective and in-service teachers) contributed to the evaluation of the OER. However, it has to be mentioned that in evaluations b and c the agents did not evaluate the implementation of the OER: they studied the OER directly from the Openwebquest and presented their comments and answers in the questionnaire.

The interview and questionnaire items were based on the literature research (Jung, Sasaki & Latchem, 2016; Roblyer, 2006):

- Purposes: Determine which, or which mix, of the possible purposes matched user needs.
- Ease of use by teachers and students.
- Content (correctness, significance, update).
- Pedagogy (teaching/learning effectiveness).

We have omitted the first of the above categories as none of the agents had the possibility to mix or to use the OER for different purposes. This was out of the evaluation design.

RESULTS

Hereafter are presented the results from the different sources of evaluation in a combined form. The text is redacted to correspond one to one to the criteria of the categories Ease of Use, Content and Pedagogy of table 5 of Jung et al. (2016, p. 9), (The names of the criteria are presented in italics).

Ease of Use (4 criteria)
1. The OER accords with open content licenses (e.g., Creative Commons) that have been properly referenced and applied to the resources.
OER could be remixed and shared to support interdisciplinary and intercultural teachings. The license used in the present OER production is the 4.0 International (CC BY NC SA 4.0).

2. The OER can be reused, revised and remixed with other resources or shared with students or other teachers.
The OER is free to: 1) Share - copy and redistribute the material in any medium or format 2) Adapt - remix, transform, and build upon the material (Creative commons, 2018). It can be remixed and shared to support interdisciplinary and intercultural teachings. This is expressed by the majority of teachers in evaluation b (in question 18, "agree" and "partly agree" is chosen by 75% and 14.7% responders respectively). It seems that the responders recognize the virtues of the OER and they are able to distinguish the license that the OER has.

3. The screen design and navigation systems are clear and consistent.
According to trainees' answers (cf. second diagram) simplicity, accuracy and clarity of web material are declared very high. According to b and c evaluations the navigation system is clear. Screen design is also considered as appropriate.

FIGURE 2

Ease of navigation
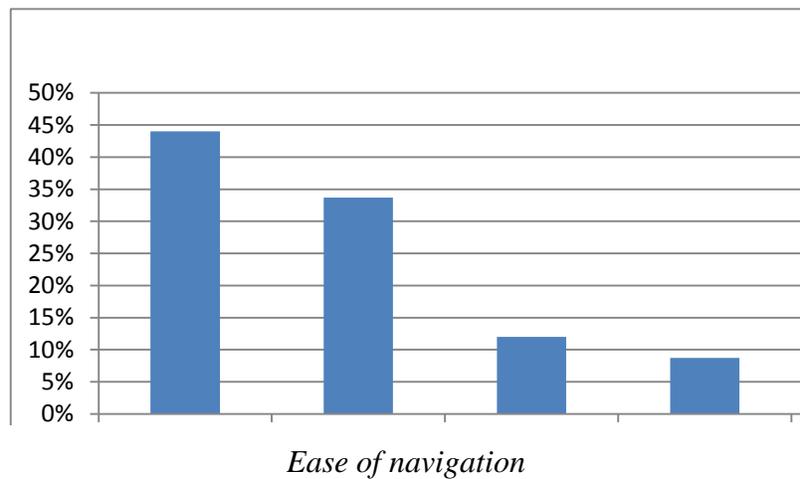
*4. The presentation methods accord with the learner's knowledge and abilities.*
According to ASPETE students and to the Multiplier participants' answers the navigation system is clear. Some users (evaluations b and c) suggested more accompanying images. According to the trainer: "...the content of the teaching is largely matched to the learner's knowledge and abilities". According to trainees' answers simplicity, accuracy and clarity of web material are declared very high (see Conclusion section of the OER, Results, 2ⁿᵈ diagramme: https://drive.google.com/file/d/1IvuSlwItjMEOY-BOLmqUfnDqN9rcKB34/view).

Content (5 criteria)
1. The goals and content are easily understood
Trainees' performance in solving the proposed crossword puzzle shows that the content has been understood to a large extent. Some incorrect answers were detected as incorrect interpretation of a word. According to the trainer the teaching content is being developed from simple to complex. Finally, trainees declare Content appropriateness for expected goals, 5ᵗʰ diagram of Results in the Conclusion section of the OER).

FIGURE 3
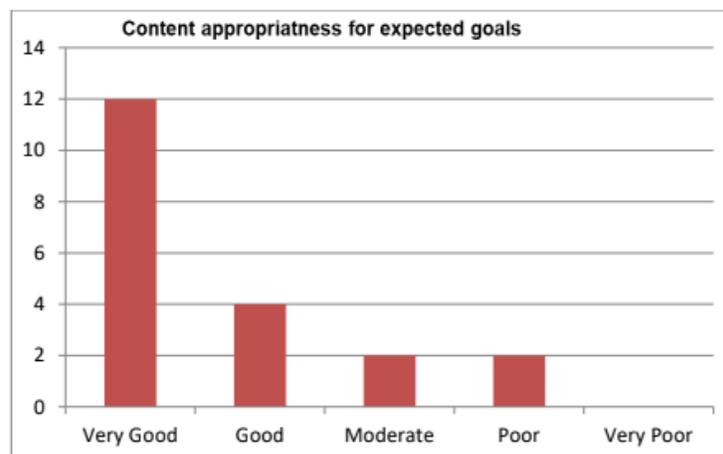
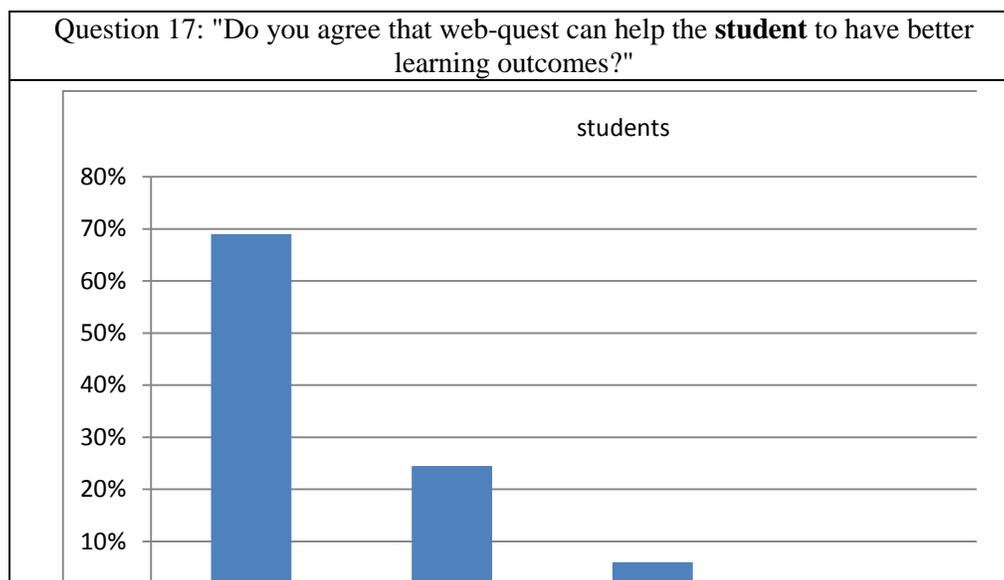*Content appropriateness for expected goal (evaluation a2)*

2. The content is accurate and up to date.

SD is a subject that concerns modern societies and educational systems. The content relates to current problems. The video production is very recent (it is produced within the project). There are positive answers of the trainees regarding completeness and sufficiency of content (1st and 3rd diagrams of Results in the Conclusion section of the OER).

3. The content covers educationally significant concepts and enables deep understanding.

Medicament administration and related SD issues is a significant educational subject. The content supports student activation and learner-centred learning (See also Figure 4)

FIGURE 4

Question 17: "Do you agree that web-quest can help the **student** to have better learning outcomes?"

Answers to question 17 (evaluation b)

4. The content progresses from simple to complex.

The trainer has replied to it: "Clearly the teaching content is being developed from simple to complex. Initially, they were given through the sources and the experts' interviews (*video*), the appropriate stimuli for reflection and critical view of the pre-existing relevant knowledge and experiences".

5. The content is appropriate to the students' knowledge, experience, language, ethnicity, race, culture, religion age, gender or other circumstances.

The content of the teaching is largely matched to all the facts mentioned above. Regarding the criteria of nationality, race, culture and religion, as the trainer described, a negative reaction of a foreign student has been noticed. However, this reaction was blunted thanks to the help of the group and of the trainer.

Pedagogy (9 criteria)

1. The OER gains and maintains students' attention and interest.

Here is the trainers' answer regarding this criterion: "It clearly attracts and maintains the interest and attention of students, since we are talking about something new for students and extremely

tempting. It is explained to you vividly. The approach is different. It's more emotional". See also the answers to a relevant question (evaluation b) in figure 5.

FIGURE 5

Overall view and attractiveness
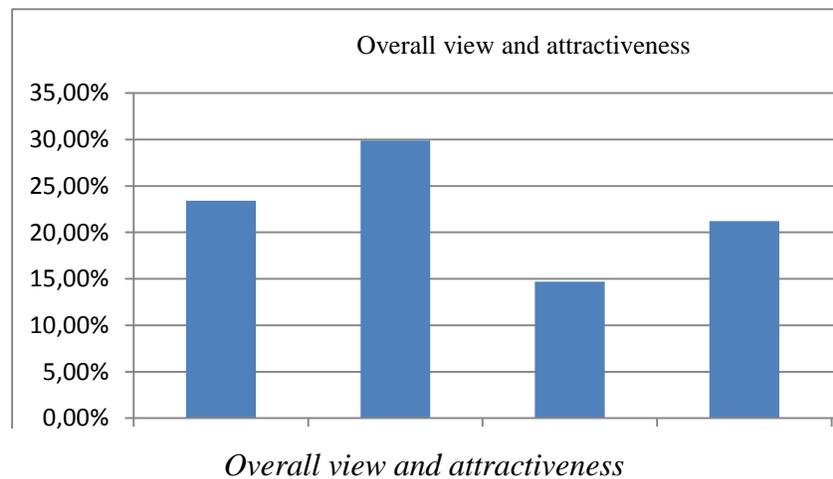
2. The OER helps the students recall, relate or apply prior knowledge, skills, experience, etc.
According to the trainer: "prior knowledge, skills and experiences of apprentices varied according to their individual characteristics (gender, age, origin, cultural background)". The display of video and the web-browsing played a helpful role during the educational procedure, in order to associate prior with new knowledge. It promoted in parallel the critical reflexion of their relative personal experiences".

3. The OER provides a sound structure for knowledge and skills development.
It supports critical thinking and the development of high-level skills. See also the answers to a relevant question (evaluation b) in figure 6.

4. The OER provides opportunities for task analysis and solving hands-on, real-world problems.
Additional evidence is necessary to answer this.

5. The OER's text, images, audio and video elements and hyperlinks provide diversity in learning.
The OER's text, images, audio and video elements and hyperlinks provided diversity in learning. It was quite stimulating for the trainees and it gave valuable feedback. It deals with a subject of general interest. Additionally the students who have evaluated the web-quest declared that it provides mediating learning and awareness on the SD problem. The trainer mentioned that maybe a smaller number of proposed sites (four sources have been proposed to each group during implementation) would have been enough to consolidate knowledge and to provide stimuli and material for the poster.

6. The instructional design focuses on the key aspects of the learning and lacks distracting features.

The OER was evaluated as accurate and sufficient regarding content and goals and it lacks distracting features but maybe to the extreme (some teachers in the evaluations b and c would prefer it more attractive, for instance more images).

FIGURE 6

Question 16: "Do you agree that web-quest can help **teacher** to have better learning outcomes?"
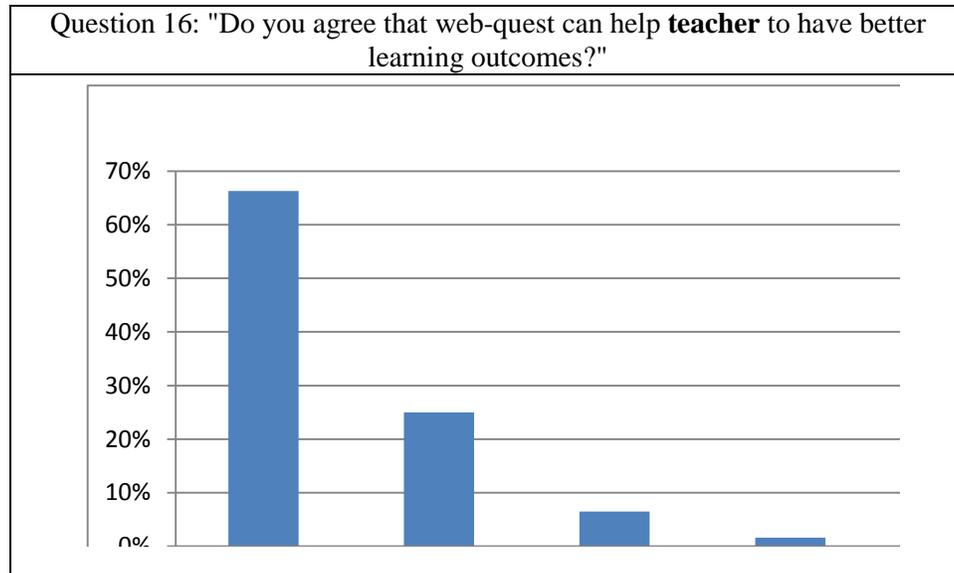
Answers to question 16 (evaluation b)

7. The OER contains in-built feedback, support and assessment.
According to the trainer "The use of OER with the distinctive sections provides additional educational value combined with cooperative-learning aiming to remove differences between the apprentices. Feedback, support and evaluation of students can also be achieved…. This procedure promoted feedback through fruitful discussion since both each member by itself and the group as a whole did their part in the educational procedure towards this direction". In evaluation b, question 15: "Do you agree that the students' assessment was adequate?" 34.8% replied that they agree, while 30.4% replied that they partly agree. On the other hand the trainer claimed that the rubric should comprise more questions.

8. The OER enables the transfer of the new knowledge and skills to different tasks, problems or contexts.
The OER clearly provides important knowledge corresponding to the different types of knowledge we used in figure 1. We don't have enough evidence regarding knowledge transfer.

9. The OER enables the students to consolidate their learning or construct personal meaning through reflection, discussion, demonstration of new knowledge or skills, etc.
The OER supports cooperative and interactive learning, through sharing ideas, exchanging views and arguments, interacting with peers, and presenting their work to the classroom. Additionally, according to the trainer: "through this procedure some apprentices contested their prior stereotypic perceptions".

DISCUSSION

We collected several indications that the described OER can support the learning procedure and that trainees are led to a creative work. It is rather easy to use and provides up to date content regarding S.D. These points emerged from all three agents of the evaluation. It seems that there are some points to modify as the number of proposed sites as well as the alternation of the proposed sites in view of the optimization of the sequence. The rubric of the evaluation phase (a2) could possibly host some more questions. Finally simpler terminology has to be used in the evaluation questions.

It would certainly be interesting to implement this OER to a larger population of students and to evaluate it on a larger scale, especially after the incorporation of some improvements suggested in the present evaluation.

The webquest provided completeness in the provision of knowledge and the ability to acquire new learning outcomes. It is well arranged and stimulated creatively the students' interest for gaining new knowledge. It is a teaching-learning tool closer to the interests of today's kids, than a traditional teaching (Tsiotakis & Tzimogiannis, 2011). However, there are opportunities for improvement. The use of more images for instance would make the webquest more attractive than the mere listing of information and of activities.

The good management and the rational use of pharmaceuticals is one of the nurse assistants' responsibilities, as far as they are involved in the administration. Since it is a matter of patient's safety and a public health issue we have to sensitize pupils on the procedures of administration, storage and disposal of pharmaceuticals. This particular webquest provides full information for the issue and evaluation shows that it meets its objectives. It achieves it in a simple, interactive, descriptive and understandable way. By the results, it seems that the usage of the webquest as an OER tool is comprehensible. This OER can help the teacher and the student in gaining new skills in sustainability issues which agrees with results of other authors (Bertschy, Künzli & Lehmann, 2013; Bürgener & Barth, 2018). The support through its use and its implementation offers better learning outcomes. The participants realized that the Webquest has license 4.0. and supports the process "use-elaborate- modify-share" which is the main axis of the definition of OER (Armakolas, Magkaki & Panagiotakopoulos, 2017; D´Antoni, 2007).

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APPENDIX

Questionnaire (Evaluations b and c)

(Agree, partly agree, neither agree nor disagree, partly disagree, disagree)
1. Do you agree that the overall view is attractive?
2. Do you agree that the texts, pictures and hyperlinks of the application provide diversity in learning?
3. Do you agree that the application facilitates the flexibility in learning allowing users to control the rhythm and the sequence (succession) of learning?
4. Do you agree that the navigation and the flow of the information are easy and clear?
5. Do you agree that the introduction "pulls" the reader into the lesson?
6. Do you agree that the introduction describes the objectives in an analytical way?
7. Do you agree that the introduction prepares the student for the content of the course?
8. Do you agree that the task is linked to the goals?
9. Do you agree that the task is achievable and attractive?
10. Do you agree that the procedure is clearly formulated?
11. Do you agree that the procedure incorporates pupil's assessment tests?
12. Do you agree that different roles are recommended to students?
13. Do you agree that the sources are linked to the goals and the contents?
14. Do you agree that the sources provide as much information as possible to students?
15. Do you agree that the students' assessment was adequate?
16. Do you agree that the webquest can help the teacher to have better learning outcomes?
17. Do you agree that the webquest can help the student to have better learning outcomes?
18. Do you agree that the paternity of the material the webquest uses can be a quality criterion?

19. The webquest has license 4.0. Do you agree that it helps the process "use-elaborate- modify-share"?