***“****Across all development sectors there are tremendous and*

*dynamic skills needs. Each country will need to set context specific*

*approaches and priorities to ensure a sustainable*

*national development path. However, for all countries,*

*climate change represents an urgent and potentially*

*irreversible threat. All Member States have priorities for*

*the transition to green economies and climate resilient societies.*

*UNESCO will support Member States in achieving a smooth transition to*

*green economies and increase their capacities to meet their commitments*

*to the Paris Agreement on Climate Change, adopted in December 2015.”*

*UNESCO: STRATEGY FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) (2016-2021)*

**A new paradigm of learning and teaching – The GreenSkills4VET concept of Sustainable Development and ESD**

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This article examines key aspects of sustainability and Education for Sustainable Development (ESD). The article also describes our own process of development regarding this topic. In the first phase of the project, (see Report IO1), data collection was carried out by way of Desk Research in the partner countries to develop the OER teaching materials. Existing curricula, lesson plans, and selected textbooks were reviewed with regard in light of how the concept of sustainability was understood (AESD, ESD). In addition, research also included examining the scope of the implementation of Open Educational Materials (OER) in training for apprenticeships.

The Greenskills4VET project has developed prototypes of innovative educational materials as for the implementation of sustainability skills for apprenticeships in the sectors of logistics (for future specialists in the areas of shipping and logistics) as well as in health care (for nursing and care work). These materials are available as Open Educational Materials (OER) for free terms of use.

**The Concept of Sustainable Development**

The basic idea of ​​understanding sustainability is that each generation is responsible for solving their own problems and the next generation should have to not be burdened by such problems. Moreover, industrialized countries have a special responsibility. This definition of sustainability is based on resolutions from the 1992 UNCED Earth Summit in Rio de Janeiro, Brazil, as **a three-dimensional concept that encompasses nature, the economy, and society as interdependent spheres of an interlocking system within an overall holistic perspective.** The ecological viability and carrying capacity of the biosphere (resource use and emissions) serve as limits to the growth and development of the social and economic aspects. As a global development concept, sustainability incorporates two key goals for all societies: the growth of economic development with the aim of better living conditions and the protection of natural resources and the environment.

The working definition of Education for Sustainable Development (ESD) in the context of the project partnership thus is as follows:

“Sustainability is based on a simple principle: Everything that we need for our survival and well-being either directly or indirectly depends on our natural environment. Achieving sustainability means creating maintaining the conditions under which humankind and nature can exist in productive harmony, to support present as well as future generations.”

**Education in the Context of Sustainable Development – “Bridging the Human Gap”**

In the discourse on sustainability, the importance of education and the need for an organizational and pedagogical reorientation of the education system plays a valuable role. Education is a necessary but not sufficient condition for the necessary support of sustainable development.

*The Limits to Growth*, published in early 1972 by the Club of Rome and written by a group of authors led by Donella H. and Dennis Meadows was the first comprehensive and methodically grounded study on the dangers of exponential growth in light of finite resources (Meadows et al. 1972). Later that same year, from the 5th to the 16th of June, the first UN environmental conference, the “UN Conference on the Human Environment,” took place in Stockholm. It was during this time that the UN set up the “System-wide Earthwatch” under the UN Environmental Programme (UNEP) with its secretariat in Nairobi, Kenya.

Over 1,200 representatives from 112 countries (the Eastern Bloc did not attend) drafted a total 26 principles in the Stockholm Declaration. Principle 19 recognizes the importance of education as well as the responsibility of the mass media for sustainable development.

*“Principle 19: Education in environmental matters, for the younger generation as well as adults, giving due consideration to the underprivileged, is essential in order to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension. It is also essential that mass media of communications avoid contributing to the deterioration of the environment, but, on the contrary, disseminates information of an educational nature on the need to project and improve the environment in order to enable man to develop in every respect” (UN 1972).*

In 1979, an international working group presented a report entitled “No Limits to Learning – Bridging the Human Gap” to the Club of Rome. In this report, the authors referred to the “human gap,” dealing with humankind’s insufficient skills in light of increasing complexity – a complexity that is the result of human activities and serves as another barrier to the resolution of humankind’s problems.

*“The human gap is the distance between growing complexity and our capacity to cope with it. Clearly, one eternal human endeavor has been to develop additions to knowledge and improvements in action to deal with a complexity, which, for most of history, derived primarily from natural phenomena. An essential difference today is that contemporary complexity is caused predominantly by human activities. We call it a human gap, because it is a dichotomy between a growing complexity of our own making and a lagging development of our own capacities” (Botkin et al. 1980, p. 7).*

In the view of Botkin et al., this “human gap” can only be overcome by education and learning. Humankind’s unlimited capability to learn is the only resource that can help overcome this dilemma. The urgently needed reorientation to the world as a whole must be achieved through education. Only in this way will people be able to intellectually and morally understand the new confusing reality of their globally reaching commitments. Learning and transferring the skills required will allow people to take a responsible role in shaping the globalization process (Botkin et al. 1980, p. 17 et seq.).

In the declaration at the close of the Earth Summit in Rio de Janeiro in 1992 (Agenda 21), education was declared to be “indispensable to changing people's attitudes” (Chapter 35.4) and the sciences were “increasingly… understood as an essential component in the search for feasible pathways towards sustainable development” (Agenda 21, Chapter 35.2).

Later, UNESCO declared 2005-2014 to be the Decade for Education for Sustainable Development” (ESD). ESD was not to be a new subject, but an approach to content that was to guide all disciplines as an orientation (Fischer 2016, p. 42).

In a UN Resolution from 25 September 2015, a high value was once again placed on education for the achievement of sustainable development:

*“4.7. By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development” (UN 2015, p. 17).*

UNESCO has defined ESD as follows:

*“ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society (UNESCO n. d.).*

**Education for Sustainable Development (ESD)** – **a Paradigm Shift in Pedagogy**

Education for sustainable development is an integrative didactic approach, and establishes a new paradigm. ESD should not be reduced to an isolated educational concept (“adjectival education”) (Barth 2015, p. 25). Nevertheless, education as a whole is an essential prerequisite for the necessary transformation of operational processes in companies as well as in society at large.

According to de Haan, in the vision of

*“sustainable development, a challenge to environmental education has emerged, with the latter challenged to a paradigm shift.... The traditional paradigm of environmental education had a destroyed, damaged, or threatened environment as a basis for all understanding and courses of action…. For the new paradigm, the destroyed, damaged, or threatened environment is only one – albeit crucial – area of the entire project that is sustainable development” (de Haan 1998, p. 38).*

What is needed is a new, *innovative* form of learning – the activation of the total learning potential of individuals as well as of society (Behne / Peitsch 2012, p. 94). This means incorporating all areas of education, training, and upbringing, and aligning them with the goals of sustainability, and in doing so identifying the problems of unsustainable development (de Haan 2008, p. 28).

The reorientation of education processes in the sense of education for sustainable development (ESD) means a departure from a pedagogy of instruction and instead a shift to open educational concepts that overcome outdated mental models and attention-based rules, and that also facilitate the acquisition of interdisciplinary and transdisciplinary strategies of solutions among all social actors (Behne / Peitsch 2012, p. 94 and the sources cited therein).

This meaning of “education” encompasses learning both in school as well as outside of it, incorporating the entire school as an institution – from the mission statement to the classroom (curricula, lesson planning, and teaching approaches). It requires a new conceptualization of learning as a whole – formal, non-formal, and informal learning – and does not emerge from individual activities and occasional discussions of ecological topics and environmental catastrophes, as prevailing approaches commonly do today. Didactic concepts that are primarily geared towards individual scientific-technical phenomena and solutions also prevent a comprehensive view of environmental problems.

Germany’s National Action Plan for Education for Sustainable Development (“Nationale Aktionsplan zur Bildung für nachhaltige Entwicklung”) from 2002 defines the following principles (BMBF 2002, p. 6):

* Education for Sustainable Development affects **everybody**
* Education for Sustainable Development is an **ongoing**, continuous process and contributes to the acceptance of transformation processes in society
* Education for Sustainable Development is a **task that crosses traditional divisions** and has an **integrative** function
* Education for Sustainable Development intends to improve the human **living environment**
* Education for Sustainable Development promotes individual, societal and economic **opportunities for the future**
* Education for Sustainable Development demands **global responsibility**

**ESD in vocational education**

*“As a result of its setting in companies,”* Vocational education *“plays a transformative role to a special degree for an economy geared to sustainable development with a view to Agenda 2030 and Sustainable Development Goals (SDGs) laid down therein” (BMBF 2017, p. 41).*

# The *UNESCO Strategy for Technical and Vocational Education and Training (2016-2021*), also emphasized the key role of vocational education in light of achieving the goals of Agenda 2030. On-the-job training creates the prerequisites for “*sustainable economic growth, and supporting transitions to green economies and environmental sustainability” (UNESCO 2017, p. 4).*

A flood of publications on the topic of sustainable development have emerged, particularly in the last 10 years, and both international (UN, UNESCO) as well as national governmental institutions (in Germany, for example, by the BMBF, and the BiBB) have published a wealth of documents on the subject (manuals facilitating practices, academic reports, etc.) and have supported various pilot projects. However, research from this project that examined such documents (curricula, training and exam regulations, module descriptions) revealed a limited degree of permanence and a largely negative result with respect to the use of OER educational materials during the performance of apprenticeships (for the case of Germany, see Brock 2018, p. 312). If anything, this confirms the hypothesis in our application. This was followed by an adaptation of the ESD concept to traditional topics of environmental protection topics in vocational education, which was studied across all partner countries.

Nevertheless, the findings also made clear that there were important approaches in the documents under review to introducing aspects of sustainable development that could be used during the apprenticeship process. “Niches” emerged both in the European Qualifications Framework (EQF) and in curricula that could be creatively tailored to learning processes for the relevant topics surrounding sustainability (for an international context, comp. UNESCO-UNEVOC 2013, p. 11). This in turn puts a major responsibility on the shoulders of apprenticeship supervisors to take advantage of these niches. However, this assumes that they themselves have the corresponding sustainability skills – in theory and in practice – to employ them.

According to the project partners, the successful implementation of ESD in vocational education requires successful pedagogical practices that make the development of existing skills and the acquisition of new skills the subjects of learning processes. Such an approach builds on the fostering of independent thinking and reflection – i.e. the fostering of *inquiry learning*. Inquiry learning means learning from one’s own questions and investigation and research (comp. Lange / Grabber / Heldt 2012) instead of the mere reproduction of knowledge; the approach also tries to establish incentives to motivate and empower students to take responsibility for their learning process and their lives.

This approach also calls into question traditional learning and teaching paradigms. Transformation thus can only occur if people – including in their working life – raise their awareness/consciousness to identify and define their occupational fields of action, and take responsibility for their own work practices, which they can also apply to their private and social lives.

Changes never come from outside alone. Changes begin within the agent herself or himself. This means that multiple steps are necessary during the (school-based) learning process.

1. Comprehension: First, learning material must be preparing in such a way that is resonates with students, so that it can be connected with their existing level of experience.
2. Curiosity/Relevance: Students must recognize that the material is something that affects them or that arouses their curiosity.
3. Pressure to change: Change comes from outside only so far as people see a necessity to address a situation. This external pressure or incentive to deal with change can arise from either fear of negative developments or anticipation of positive developments. The pressure to change can be anchored in and reinforced by the environment (friends, peer pressure), or may arise from learners’ own ethical commitments (to better understand the path from initial comprehension to sustainable action, we rely on Hamann / Baumann / Löschinger 2016).

The purpose of ESD is thus to create awareness of the need to take action, and give students the skills they need to take responsibility and act with respect to sustainability. The project partners believe in a bottom-up approach insofar as education for sustainable development should motivate learners to question, reflect on and put into practice new conclusions and measures on the basis of their own thought process (recognize – evaluate – act/create).

Nevertheless, the instructor/supervisor must serve as a person who provides incentives and establishes the context of the teaching-learning process. He or she initiates the process, monitors it according to the learning styles, prior knowledge, and motivation of the students/apprentices, and develops it in cooperation with the learners. In this respect, we consider the process to be a combination of top-down and bottom-up elements. The educational setting must conceptualize the learning process as an open and collaborative learning opportunity. Collaborative knowledge generation, problem-solving strategies, and collective action stand at the forefront. Learners must define the problem and decision-making situation, manage and evaluate the necessary information, and think outside the box. The individual acquisition processes of the *learners* belong at the forefront of the learning process, and not the instructional procedures of the teacher. Teachers can find materials for this sort of active learning in our teaching units as well as supplementary materials, so that other change agents can be trained in ESD as well.

**The World Needs New Competences**

There are many definitions of “competence.” According to the psychological understanding of competence by Erpenbeck / v. Rosenstiel (2007, p. XII), competences include skills, knowledge, and qualifications, but cannot be limited to these. There are other facets that create capabilities to decide and act in open-ended, insecure, and complex situations. These may include, e.g. self-imposed rules, values, and norms that have a systemizing function during self-directed action. This means that “competence” in the psychological sense is concerned with qualifications and knowledge that create the potential for action, the disposition to organize one’s own affairs, which manifests itself in action as performance. Competence as the capability to make decisions in new, non-routine situations is particularly important in the context of sustainable development. This understanding of competence surpasses that of the understanding of competence formulated in the German Qualifications Framework and the EQF, because such competences are not quantifiable (in the context of IO4, see the text “Recommendations for Verifying Learning Outcomes,” available in in the LearnBox under Section 4 of “Teaching Units”).

The topic of sustainability is particularly difficult for people to manage cognitively, because many processes in nature stand in opposition to human learning processes: people learn on the basis of experience, and particularly from their mistakes (comp. Whener 1992). Long-term, complex developments rule out the idea of learning from experience after a generation. Human beings have developed heuristics for decision-making and routines for action that are not appropriate for complex situations (see Kahnemann 2011). Decision-making processes that should serve in situations concerning sustainable development are considered complex. The cognitive psychologist Dietrich Dörner (1989) identified some general traits of complex decision-making situations: these deal with tackling problems in complex, interlinked, non-transparent, and dynamic situations.

**Complexity / Interlinkage:** Complex, interlinked situations are that are not independent from one another, but instead bound up with each other. This means an impact on one part of the system always has an impact on the system as a whole via feedback mechanisms (among others). This results in side effects and remote effects, which cannot be anticipated (see also Perrow 1987).

**Non-transparency:** Not everything that a person wants to see can actually be seen. Many characteristics of a situation are inaccessible to the person who must make the decision.

**Dynamic:** Complex systems are not passive. They evolve on their own; they reveal their own dynamics (Dörner 1989, p. 58 et seq.). This can be seen in the example of time pressure – you don’t always have all the time in the world to collect all relevant information. Therefore, it is necessary to make a decision in spite of a lack of certainty. Moreover, an analysis of the current situation is not sufficient – it is also necessary to find out what future developments are to be expected.

These challenges do not stand in isolation, and cannot be solved with the cognitive capabilities currently disseminated in vocational training institutions. A recent report from the Club of Rome therefore stated that education to address the challenges of sustainable development must depart “from the mere imparting of knowledge gained from the past” and instead must focus “far more on the abilities of human beings, broaden their knowledge, their skills, and their personal capacities, so that they can creatively adapt in a future that no one can yet predict” (Weizsäcker / Wijkman et al. 2017, p. 369). The World Social Science Report described the necessity of “futures literacy” in a similar sense (ISSC / UNESCO 2013).

A “futures literacy” as the authors of the Club of Rome report put it as well (Weizsäcker / Wijkman et al. 2017, pp. 369-377), would call first and foremost for the imparting of more **sustainability content** in teaching. However, the very idea it is possible to impart objective, sustainability-related factual content and that this would be sufficient is a fallacy. Instead, according the authors, it is also necessary to include the values of sustainability alongside the content as a compass for thought and action **(sustainability-focused value orientation)**. Additionally, there must be more pluralism in the character of orthodoxy/schools of thought and a corresponding reduction in “intellectual sectarianism” so that apprentices can look beyond their noses in terms of content and philosophy, thereby taking in more perspectives and weaving them together **(Multiperspectivity)**. It is only in this way that the complexity and dynamism of future developments can be understood and solutions generated. A perspective on the challenges of sustainability formed from only a single school of thought or discipline entails the danger of intractable contradiction that can only be cognitively and practically be solved by expunging and erasing other views. However, future generations will have to find more constructive solutions for such contradictions, particularly those among social, economic, and ecological tensions (one such contradiction, for example, would be the decision between expensive occupational safety measures and the maintenance of the workforce) **(constructive management of contradictions)**. This example also points to the need to foster an integrated mindset, as the current dominance of analytic thinking disguises the capacity for systemic, complex thinking. The goal is therefore to bring **organic conceptions of reality** to the fore, instead of mechanistic ones.

Finally, a new attitude to the work of teaching must also be demanded, in which the challenges of sustainability can only be solved through combined strength (including that of ideas). The necessary innovations can only arise out of **cooperative, outside-of-the-box thought and action**, which rules out the currently prevailing teaching and occupational forms based on competition.

**OER und Education for Sustainable Development**

UNESCO’s Second World OER Congress took place on 20 September 2017 in Ljubljana, Slovenia. The OER Action Plan discussed the “pivotal role OER can play toward achieving the 2030 Agenda for Sustainable Development, and above all Sustainable Development Goal 4 on Quality Education” (UNESCO 2017a, p. 1). Among other topics, the Action Plan discussed the need for “the capacity of users to find, re-use, create, and share OER” (UNESCO 2017a, p. 3) as well as “collaborative development of OER, reuse and continuous improvement of OER by educators and learners, and open pedagogy approaches where learners engage in learning practices generating OER that provide a public good” (UNESCO 2017a, p. 6).

The educational materials developed in our project bring together the didactic Approach to Education for Sustainable Development (AESD) with existing curricular requirements and the use and/or design of Open Educational Resources – AESD and OER (EDS and ICT/OER). The integration of the two pedagogical approaches – new forms of learning and teaching as well as ESD competences (active, exploratory, *digital* learning) is an initial attempt by the partners of the project to develop prototype OER materials for vocational education. They allow instructors and other change agents to improve learners’ competences in self-reflection, thereby helping them to identify traces of unsustainable development in their own occupational and personal life, and develop and actively take advantage of their potential to create solutions.

**ESD und OER: How do they benefit students from the point of view of educational and cognitive psychology?**

This section is only intended to make a few important points about this topic. These relate largely to the implementation and design of learning and teaching processes in the practice of vocational education and the essential aspects to be taken into account by teachers and trainers in the planning of lessons (Wilbers 2014, p. 205 et seq.).

The OER materials, characterized by interactivity and integration with digitally accessible knowledge, allow learners to obtain material that fits according to their own questions, based on their own life experience and professional interests. Collaborative modifications of such material also generate the motivation to ask new questions and discover new learning situations. The material can be evaluated based on learners’ own reflections on their learning processes. This means every learning situation can become a paradigmatic unit of analysis that can and should be utilized. Learning thus always consists of two goals: first, more *World* than before to connect with; second how the process of *Connecting the Self with the World* can be optimized.

Such an approach does not replace the instructor, but it simply gives him or her a different role, specifically as a guide with a head start on knowledge, and who takes on responsibility for the educational process of the learner as a moderator.

**The Outcomes of the Project – OER Materials in the Context of AESD**

By creating learning opportunities (learning assignments) that initiate learning processes in topics dealing with sustainability, learners prepare themselves to make informed decisions and to learn how to act responsibly with respect to sustainable development. However, it is important to emphasize that the cooperative learning process should not be replaced by an individualized learning environment, which would defeat the purpose of the cooperative process. Our teaching units are explicitly based on cooperation, such as in the development of case studies that due to their complexity make mutual communication and cooperation indispensable, or worksheets that initially call for individual, experience-based solutions, but which must subsequently be tested and revised in group discussions.

In addition to aspects of content related to sustainability education, the new didactic-methodical implications (a pedagogical paradigm shift), closely linked with both concepts, have been taken into account insofar as they can arise from such educational materials. The insufficient grounding of AESD in the curricula of the partner countries during the first phase of the project points to the gap that still exists between the needs in education policy with respect to the challenge of unsustainable development on the one hand and realities on the ground on the other (Botkin et al. 1980). With this project, the partners wish to “bridge this gap,” particularly through the linking of the two innovative pedagogical approaches – AESD and OER. With the GreenSkills4VET LearnBox, potential change agents now have a tool to generate the learners’ initial experiences for their development of the corresponding competences for their occupational and private spheres, and motivate them toward further development.

The materials are designed in such a way that apprentices can incorporate their own professional routines in their work and reflectively apply it (work-based learning).

Due to the limited establishment of AESD in the curricula in all partner countries as well as the still insufficient use of OER materials, the project had to forge new trails. This situation had to be taken into account during the development of these materials. A Middle Way had to be found between the preservation of the core elements and therefore the coherence of AESD and OER on the one hand, and the avoidance of an overly high barrier to implementation by instructors and learners on the other (didactic reduction).

Our trials of the teaching units demonstrated that there was a very positive response from both supervisors and apprentices. The in-depth engagement with sustainability in work life as well as in the orientation of values were particularly appreciated. However, the learning style itself still must be self-driven (including in small groups), and thus individual interests must be allowed – and indeed facilitated. Participants also to have to come up with solutions without clearly knowing the correct solution from the lesson input (because they are not always there – for example, when dealing with stress); this led to some frustration. This style of acquisition from the learning materials was seen as unfamiliar. As such, it provides a reason to start off with our materials.

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Greening technical and vocational education and training. A practical guide for institutions: <https://unevoc.unesco.org/up/Greening%20technical%20and%20vocational%20education%20and%20training_online.pdf>

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# Greening TVET: Qualifications and implementation strategies: The report of the online conference on “Greening TVET: Qualifications and implementation strategies” <https://unevoc.unesco.org/go.php?q=Just%20published%20Greening%20TVET%20Qualifications%20and%20implementation%20strategies>.

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1. *Проект Оупън Майнд развива и пилотира иновативен геймифициран отворен онлайн курс по социално предприемачество за жени и студенти в не-икономически специалности.*

[*http://platform.open-mind-project.eu*](http://platform.open-mind-project.eu)[*http://open-mind-project.eu/bg/*](http://open-mind-project.eu/bg/)

1. *Проект CULTOUR има за цел да допринесе за подобряване на уменията и стимулиране на мобилността в туризма чрез признаване, валидиране и обучение в междукултурни компетентности на работещите в сектора. Проектът ще интегрира междукултурното измерение в нови обучителни програми, специално адресиращи работните места в туризма и ще създаде иновативни инструменти за признаване и валидиране на тези компетентности.*

[*http://www.cultourproject.eu/bg/*](http://www.cultourproject.eu/bg/)

1. *Проект „Integrating E-Learning and Open Educational Resources into Classroom - iOERc”*

*Целта на проект „Интегриране на електронно обучение и отворени образователни ресурси в класната стая ” е да се повиши квалификацията на учителите и техните компетенции за интегриране на ИКТ в обучението, чрез прилагане на технологии за електронно обучение и чрез създаване на електронно образователно съдържание под формата на он-лайн ресурси OERs (Online Educational Resources).*

[*http://www.2els.com/%D0%BF%D1%80%D0%BE%D0%B5%D0%BA%D1%82-%E2%80%9Eintegrating-e-learning-and-open-educational-resources-classroom-ioerc%E2%80%9D*](http://www.2els.com/%D0%BF%D1%80%D0%BE%D0%B5%D0%BA%D1%82-%E2%80%9Eintegrating-e-learning-and-open-educational-resources-classroom-ioerc%E2%80%9D)

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2. Les ressources éducatives en libre accès : de nouvelles possibilités, de nouveaux défis: <http://www.oecd.org/fr/education/lesressourceseducativesenlibreaccesdenouvellespossibilitesdenouveauxdefis.htm>
3. Promouvoir l´apprentissage pour le monde du travail. “l’EFTP écologique. Vue d’ensemble“ [https://unevoc.unesco.org/go.php?q=UUIC+-+l’EFTP+écologique&lang=fr](https://unevoc.unesco.org/go.php?q=UUIC+-+l'EFTP+écologique&lang=fr)