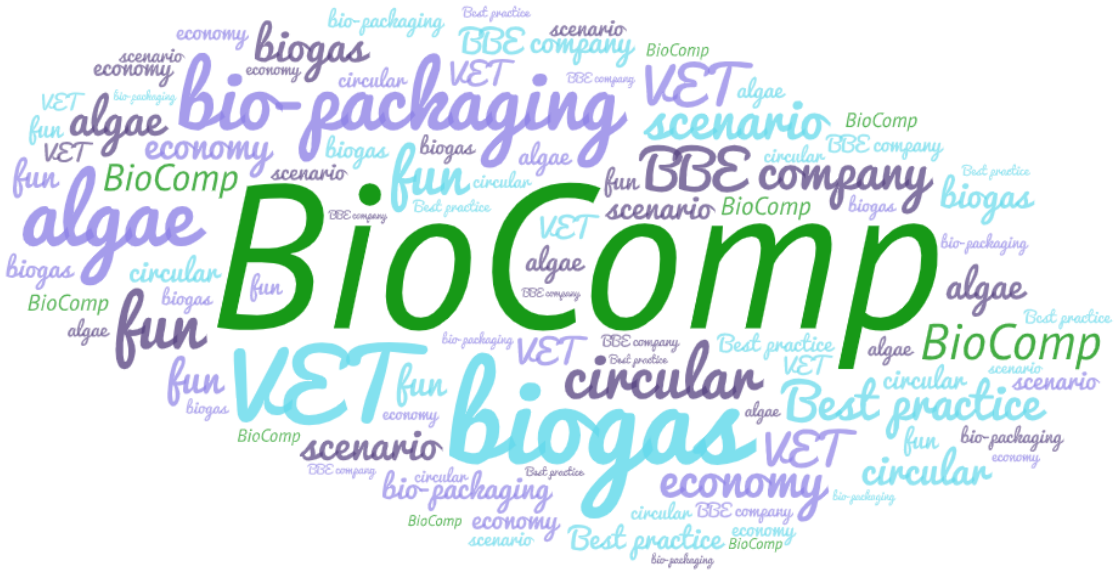
Co-funded by the
Erasmus+ Programme
of the European Union

Project-N° 2019-1-CZ01-KA202-061409

HANDBOOK OF BEST PRACTICE



Authors

This Handbook of Best Practice is a vademecum. It is developed in the frame of the European project “BioComp”.The authors are Michael Diaz, Marek Botek, Hans Blankenstijn, Frank Hiddink, Elke Halm, and Eliza Ninou.

TABLE OF CONTENTS

SUMMARY

PREFACE

The Handbook of Best Practice is part of the outputs of the BioComp project, co-financed by the Erasmus+ programme of the European Union: 2019-1-CZ 01-KA202-061409. It is primarily intended for trainers of practical education in relevant fields, but may also be useful for use in higher or secondary education. The handbook also points out how to use the teaching materials developed within the project for education and training purposes in institutions of these types.

The handbook contains a summary of basic information pertaining to the created teaching materials and their relevance for filling the missing competences in the field of bioeconomy. It is based on use in the five countries where the project partners operate. The document thus provides a basic insight into the reasoning behind why and how missing competences can best be filled as well as how to identify which competencies relevant employees may be lacking. More detailed information about the tutorials can be found on the BioComp website: http://www.navigator.biocompetences.eu.

The Handbook of Best Practice, as its title suggests, seeks to present practices that have proven successful in the use of the materials developed in practice. It provides access to concrete guidelines, examples, and tips that have led to a positive response from students. It summarises practical experiences directly from the lessons delivered and also incorporates feedback given from a series of field experts, teachers, and other participants who have studied and used the created materials during the course of their preparation and dissemination, including the Learning Teaching Training Activities (LTTA) session where the materials were presented to potential tutors.

The handbook also reports from the perspective of trainees, thus suggesting ways to motivate student engagement and attentiveness. However, this guide does not aspire to provide a one-size-fits-all guide on how to implement the developed learning materials in an individual tutor's own portfolio. It seeks primarily to highlight what, in our experience, has been found to be functional and beneficial when used and which may therefore be of interest, or at least inspirational, to lecturers. We are aware that each trainer has his/her own distinctive style and that the needs of different trainees also vary.

In compiling *The Handbook of Best Practice*, we have drawn on the testing of teaching materials in real teaching at the vocational high school in Veliko Tarnovo, Bulgaria and UNIWA (Athens, Greece) and UCT (Prague, the Czech Republic) universities. In total, the materials were used by 4 lecturers in the LTTA, in which there were 12 participants, and by 8 additional teachers at the above-mentioned schools, where the materials were used in teaching students.

The handbook is divided into three parts: A summary of the BioComp project, Feedback (Expert, Teacher, User, Participant), and Case Studies.

The summary provides a definition of the bio-based economy and its importance at the present time followed by a description of the BioComp project and its identification of key competences for bio-based employees. This is followed by a description of the philosophy and strategy regarding the creation of learning/training materials concluding with a synopsis of relevant pedagogical materials available for teachers and trainers and accompanying information on where such material can be found.

Feedback was given in several stages, the first of which was given by field experts and teachers who reviewed our created materials followed by feedback derived from educators, LTTA participants, and others who have used or studied the materials.

Several case studies are provided which give examples of how the created materials can be adapted and/or incorporated into classroom activities. Practical information for re-creation as well as information regarding organization and student reaction are provided as well.

The authors wish to extend thanks to all those who used our materials and provided feedback on them for their cooperation in informing the development of the handbook. Thanks to them, the knowledge, experiences, and insights from the lessons we have taught have become part of this handbook.

BIO-BASED ECONOMY

"The bio-based economy encompasses the production of renewable biological resources and the conversion of these resources and waste streams into value-added products such as food, feed, bioproducts and bioenergy" (European Commission (2012), *Innovation for Sustainable Growth: A Bioeconomy for Europe 2012-2020*). This is an area of great importance at the moment, given the pressure to make better use of natural resources and reduce the burden on the environment. Demands from a growing human population as well as legislative and societal pressures are leading more and more companies to take bio-based economy (BBE) rules into account. However, not all workers are competent enough to be able to respond adequately to the necessary changes in working habits and practices. Particularly at the lower levels of the hierarchy, there is a lack of the necessary competences, which needs to be supplemented by training or coaching.

It is for this purpose that the learning materials, the best use of which this publication represents, have been developed.

BIOCOMP PROJECT

The BioComp project is based on the cooperation of eight partners from eight European Union countries. It brings together both the consultancy institutions EUEI, OECF and the educational institutions Blankcon, Pro Time-R, SBGD, as well as the universities UCT, UNIWA and the vocational high school Dr. Vasil Beron. These bodies have jointly developed a project which has produced four sets of training materials.

The first phase of the project was to identify key competencies that are essential for workers in the bio-based economy. First, we identified the core areas in which we would pursue the key competencies: Personal, Transversal, and Technical. *Personal* are those competencies which are tied to people, often referred to as soft skills; *Transversal* are competencies transferable from one occupation to another - due to their heterogeneity, we have divided them into Digital competencies (working with information technology) and Entrepreneurial competencies; as for *Technical* competencies, we have identified those directly oriented to the activities that are performed at work.

We obtained a basic overview of Personal and Transversal competencies from the following European Union documents: McCallum E., Weicht R., McMullan L., Price A., *EntreComp into Action - Get inspired, make it happen: A user guide to the European Entrepreneurship Competence Framework*; Publications Office of the European Union, Luxembourg 2018.; Carretero G. S., Vuorikari R., Punie Y., *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*; Publications Office of the European Union, Luxembourg 2017.; Caena F., *Developing a European Framework for the Personal, Social and Learning to Learn Key Competence (LifEComp)*; Publications Office of the European Union, Luxembourg 2019. The main source for the relevant Technical Competencies was derived from interviews with senior and middle managers in companies and business.

From this data, we created a questionnaire to determine the importance of the competencies we identified. After its evaluation, we were able to create our first output, the Competence Navigator (http://www.navigator.biocompetences.eu). The online document presents the most important competencies in a clear way, while technical competencies are considered in the context of their application in selected areas of the bio-based economy.

LEARNING SCENARIO CREATION

After gaining an overview of which competencies were considered most important by representatives from the selected BBE areas, we started to create four learning scenarios: Algae Production, Biogas Production, Bio-packaging, and Setting up a BBE Company.

For each area, the most important competencies were selected and grouped into clusters. The number of modules in each scenario was then derived from the number of clusters thus formed. Therefore, one scenario has four modules, another has five, and two have six modules. The advantage of the modular structure is that the trainer can decide to choose only some modules - those that he/she considers important for the particular teaching group - and be given full material, including quizzes and relevant references to resources. Such an advantage soon became apparent when we decided to incorporate the introductory module *BBE - Circular Economy* into the other scenarios. It was sufficient only to adapt it and insert it into the scenarios.

For the convenience of lecturers who may use multiple scenarios, we decided to use a uniform layout throughout with only minor variations in referencing of sources.

Per design, multiple revisions were made during the creation process. Each partner carried out a series of tests throughout various stages of the learning scenario development. The Initial testing phase enabled partners to recruit field “experts” within our own networks who would read and test the developed material. This took place between December 2020 and January 2021 (during summer 2021 in the case of the Biogas modules). Experts reviewed and recommended areas of improvement and returned comments to partners via a completed survey. The second testing stage took place between March and April 2021 (in September 2021 for Biogas) when partners were tasked to recruit educators who would test the material in class with students. The final testing took place during the Learning, Training, and Teaching Activity (LTTA) in November 2021. Before final publication, any differences in format were unified and a language check by native speakers was carried out.

FINAL FORM OF TEACHING MATERIALS

During the preparation of the project, we discussed the ideal form of the scenarios and modules several times. According to the experience of the teachers involved in the project, we considered creating presentations, quizzes, practical exercises, and/or illustrative video files. In the end, we decided to create a text document that would include the specific exercises and subsequent quiz, as well as links to appropriate videos and other supplementary information. These documents can be given to students and then discussed, or a particular lecturer/teacher can use them to prepare a presentation in the style they prefer and with the design they need. Depending on the knowledge of the group to be

educated, the created material can be expanded using integrated references or, on the contrary, simplified.

Although we have decided that it is not possible to prepare a perfect, universally applicable "take and teach" document, we have decided to facilitate the use of our materials by writing the *Pedagogical Guidelines*.

PEDAGOGICAL GUIDELINES

In an effort to help trainers prepare for using the BioComp materials in the classroom or place of training, several documents were created to provide a pedagogical framework for using and/or adapting the modules for training purposes. The *Pedagogical Guidelines*, which can be found on the BioComp Navigator, provide summaries and information regarding the individual modules and learning scenarios as well as tips regarding classroom management and organization. Additional information regarding utilization of the created materials in a classroom/training environment, assessment, and practical logistical information regarding organization and management of the training is provided as well. This document is intended for trainers only.

The *Pedagogical Guidelines* are divided into four parts: **"How" Questions, Pedagogical Structure Guide, Personal and Transversal Competences, and Teacher Preparation Guides**.

The ***"How" Questions*** are intended for answering practical and logistical questions regarding organization, planning, and teaching. Relevant information regarding organization of field excursions, translation of documents, implementation of video, media, and AR technology, and navigation of the BioComp website is included with relevant links provided.

The **Pedagogical Structure Guideline** is intended to provide in-depth information regarding implementation of the modules in the classroom. It gives advice for classroom management, the structure of classroom training, as well as tips for engaging students and organizing classroom activities. Finally, criteria for and types of assessment is discussed.

The ***Personal and Transversal Competences*** provide a summary of how to activate these competencies in students through brief theoretical analyses followed by suggestions for relevant classroom activities.

The **Teacher Preparation Guides** are one-page summaries of each module from each Learning Scenario. They include the module's Aim, Learning Objectives, and relevant Keywords. In addition, a list of the module's videos and other resources/media with accompanying links are provided as well. In this way, the **Teacher Preparation Guide** is intended to provide trainers with a quick summary of each module as well as provide a succinct list of available additional resources that can be used.

FEEDBACK

1ST FEEDBACK – EXPERTS AND TEACHERS

[1]The information is comprehensive. The materials are fully applicable in the learning process.

[2]The module is recognized as a useful tool for quick teaching of newcomers, giving a concentrated and integrated view on the relevant topics.

[4]Very useful explanation of a business plan and its purpose. It is quite lengthy but nonetheless is good.

[4]The "Mission/Vision Statement" table and "Formulating Goals and Objectives" table are both great activities to include. More interactive and personal exercises such as these would prove useful for any aspiring entrepreneur taking the course.

[3]The practitioners of one type of biogas plant can get new info.

[3]It is useful to read about what is new in a field you consider well-known.

[4]Topic Legislation, the regulations on the different areas of BBE, is a great addition for aspiring BBE entrepreneurs to be made aware of.

[5]The structure of the course is very clear, the content is equally very concise, interesting and any individual new to the subject are signposted directly to key elements of the circular economy. There are some good explanatory images used.

[5]Coherent and well-structured module will be easily followed by both educators and students. Provides interesting links to further reading and videos explaining areas of circular economy.

[6]The illustration of the module is very good

[6]My students really enjoyed this module and I found it easy to prepare and deliver.

[7]I also tried out some of the material from this module with my learners, again the content was well structured for me as a teacher to turn it into a lesson.

Our learning scenarios were read by experts in the relevant fields of the topics covered. They were satisfied and gave us a first and exclusive view on the best practices. They considered the structure of the modules and scenarios logical, useful, and attractive for industry practitioners[1]. Most of the scenarios were recommended for use before commencement of work (not during work) and for training of newcomers[2] while others were seen as useful for the training of practitioners[3]. Several remarks were made regarding the relevance and usefulness of topic-specific information included in the modules[4].

Regarding module-specific feedback, it was recommended that the Biogas module should be more practical than general, with four of the six scenarios slated as important for use during work. We had initially assumed this ourselves, because topics such as *Health and Safety*, *Malfunctions*, and *Maintenance* contain information that should always be remembered and periodically refreshed. Additionally, the fourth Biogas scenario, *Composting and Disposal*, includes, among other things, the area of environmental legislation, which should be repeatedly discussed and updated with practitioners.

Additionally, after receiving feedback on the *Circular Economy* module, we decided to add it to all the other scenarios[5].

After embedding the feedback received from the experts, the BioComp partners sent the modules to relevant teachers, who focused on the pedagogical qualities of the materials. The general view from the teachers and educators was very positive[6]. Minor mistakes were found and corrected while some new ideas were also implemented.

It was discovered that the teachers appreciated the interconnection of different activities (text, videos, links to external sources followed by quiz, etc.) while being satisfied overall with the quality and quantity of information[7]. One comment suggested that the range difference among the different scenarios could be problematic, and many teachers wanted a guide for how to use the created materials. Luckily, the partners have since completed the detailed *Pedagogical Guidelines* which educators can use alongside the learning scenarios to help guide them in the usage and uptake of materials.

Overall, the partners received very valuable feedback on the created materials. The educators and experts who gave feedback over the last year provided great insights, recommendations, and ideas that enabled the BioComp partners to integrate across different modules and improve the learning offered by each learning scenario. The BioComp partners are very pleased with such positive feedback on the quality and value of the content. As a consortium, we are eager to engage in the dissemination process to ensure that the created materials are readily available to all who will find them relevant and useful.

2ND FEEDBACK – LTTA, PRAGUE

The participants of the Learning, Training, and Teaching Activity had their first experience with our materials in November 2021 in Prague, Czech Republic.

The activity was marked by anti-Covid regulations, two lecturers and several participants were only able to participate via MS Teams. Four lecturers and nine participants were able to be present in person. The participants were teachers who were lecturers in the following specializations - Economics, Chemistry, Environmental Informatics, Sustainability Management. Due to the diverse composition of participants as well as time restrictions, only the *Circular Economy* scenario (which is present in all of the modules) and the introductory scenario of each individual module was presented. Participants were then given time to look at other scenarios according to their interests. Additionally, as all of the participants were lecturers and teachers, they were also presented with the *Pedagogical Guidelines*. Afterwards, a detailed questionnaire was given to all participants which asked for relevant feedback on the content, organization, and structure of the materials as well as their thoughts concerning the overall learning experience and usefulness of the created materials. An analysis of the results is summarized below.

All participants considered the materials to be clear and well structured, containing a reasonable amount of information. The participants also considered the accompanying pictures and videos useful, but warned that "it is too difficult to watch some of the longer videos at once if you do not know what you should be focused on" (R1, *all feedback was anonymous*). One useful comment concerned the teaching of students in English – "The (English) subtitles in videos help you understand the speech much better" (R2). We were happy to hear that all the participants considered the English used in the materials to be understandable as well as finding the scenarios attractive to use, readable, and comprehensive, giving a good overview of the topic at hand.

As can be expected, sometimes opinions differed. For some, the bullet points in the trailers to the modules were too fast, for others, it was a good speed or, at least, manageable. However, the most important thing for us was to know the participants' opinions about the prepared content and format.

Overall, the participants stated their satisfaction with the prepared materials, with the worst reaction being "very good". Other reactions were more enthusiastic - "I am satisfied with the materials. Great Job!!" (R3). Additionally, the quizzes were evaluated very well and some important feedback was provided. While the created quizzes were primarily in the form of multiple-choice with one or more correct answers, some of the LTTA participants asked for revision-style, short-answer questions with no options provided as well as open-ended questions with the option to create your own detailed answer. These concerns were taken into account during final revision of the *Pedagogical Guidelines* and learning scenarios as information regarding assessment was updated.

One interesting feedback was the enthusiasm our participants expressed for Kahoot tests (https://kahoot.com/schools-u/). We were advised to prepare them for use in the scenarios. However, Kahoot restricts access to a test to its creator only. Therefore, we decided to

prepare quizzes in every scenario which the lecturer can then copy into his/her own Kahoot test for use during the lecture. Further information regarding the use of Kahoot is located in Case Study 3 as well as the *Pedagogical Guidelines*.

Participants were also asked for their professional opinion about using the materials for teaching.

Most of them agreed that individual sections of the modules (texts, pictures, videos, short practical examples, long practical activities, quizzes) work well and are perfectly assessible for lecturers to use. Furthermore, the *Pedagogical Guidelines* were found to be both practical and efficient in answering any possible questions trainers may have regarding use of the created materials. One comment, however, focused on adaptability issues regarding possible distance (remote) teaching while another pointed out their preference for short practical exercises as the best assessment option.

We were a bit worried about our participants' opinion concerning the different ranges (difficulty level, depth of content, etc.) within modules and the potential difficulties it may cause trainers, as this was an area of concern brought up by the selected teachers during the first feedback. Range differences among the material exists because not only were the scenarios created and prepared by a diverse group of people in 8 different countries, with each specific module having several working groups throughout the creation process, but the topics of the modules and the depth of knowledge necessary for instruction are different as well, accounting for the wide range in content and materials. However, the reaction was very positive, with comments ranging from "Not at all difficult" (R5) to "It won't be that difficult" (R6).

Although the LTTA participants considered the scenarios sufficient for teaching at EQF-level 3-4, they also wanted to use our WIKI sections for students with insufficient previous knowledge. The WIKI section on the Navigator website is full of links to other materials as well as videos explaining some of the content in a very illustrative way. Furthermore, some participants gratefully welcomed the use of another valuable tool at our disposal – an online web translator. In the General Tools section of each module on the Navigator website, the *DeepL Translator* is included. As the scenarios are prepared in English, and English language knowledge was not always uniform among participants, some will appreciate the availability and easy access to an online translator. *DeepL Translator* (https://www.deepl.com/translator) is designed for technical use and is possible to use for both short and longer pieces of text.

Finally, participants were asked what general success factors they felt were important for successful training of future participants. The following were mentioned:

Motivation (R6)
Teacher knowledge and practice (R3, R4)
Peer teaching, interactive learning, motivation, and connection with previous knowledge (R5, R7, R8)

Participants also told us the biggest potential constraints:

Low motivation of students (R2)
Lack of time (R6)
Poor previous knowledge (R1, R7)

We believe that the amount of information and the variability of its usage will help trainers minimize the weaknesses and optimize the strengths in their usage of the BioComp learning scenarios.

USERS´ FEEDBACK

The following feedback is derived from interviews given to teachers who used all or some of the materials in a classroom setting. Their interviews, along with a brief biographical background, are included in order to present a clearer picture of how the created materials have been used in a practical setting. Some responses have been edited/condensed for length and clarity.

Stanislava Grosová, Associate Professor at UCT Prague + photo

Stanislava is a graduate in Economics and Management from Management Akademie Munchen. She had a work placement at Nestlé Deutschland and currently works at the University of Chemical Technology, Prague.

Her professional focus is mainly on marketing, but she is also interested in management and management accounting. Her extensive publishing activity includes books, numerous articles, and conference papers. She is a member of the Czech Marketing Society, the Czech Logistics Association, and is a member of the editorial board of the journal Acta Logistica Moravica.

She has been interested in the circular economy for several years and has addressed the issue of end-of-life product use not only in logistics but also in marketing papers. Understandably, she follows other modern trends, and therefore is also interested in the gradual expansion of bio-packaging and considers its use in product marketing. However, she also looked forward to the sections on the establishment of BBE companies and Biogas production in the prepared materials.

What led you to the idea of using these training materials?

A great advantage for me was that my colleagues were also involved in the preparation of the materials. Thanks to this, I had more detailed information, and since I try to renew and update the teaching materials for my students every year, I knew where I could reach.

So, my need was to see what was new in the areas of focus and find inspiration for my management and marketing teaching. And also, to look at the module Algae Production, which I consider promising but still very little used in the Czech Republic.

Which elements of the program did you find most useful?

The short practical exercises. It has been my experience in recent years that students are less and less able to keep their attention. Especially with distance learning, it was impossible to talk to them coherently for a long time. That's why I try to "break up" my classes, talk for a while, then let the students do some exercises, look up the information and process it. That's why I also appreciate the links to additional and expanding information that is in some of the scenarios. And also, the wiki section. It's not always up to scratch professionally, but for a basic idea, it's enough.

How did you use it?

I have not yet had the opportunity to implement the whole scenario in my teaching. So, as I said, I used some short exercises, and designed the scenarios as supplementary material. They are written in such a way that an informed student, especially a practitioner who is professionally involved in the field, can get by without a lecture.

What is your advice to others?

The scenarios I was able to try out have the same difficulty. This is not a bad thing, but the lecturers who will be using them should be aware of this. Usually, it will probably be necessary to drop something in the teaching to fit it into the allotted time, but it may also be that sometimes one scenario is not enough.

I also recommend, but lecturers need to know their students and know a lot about the topic, to give students a final test right at the beginning of the lesson. It will show the level of knowledge among the students and the teaching can then be more tailored to their needs. Either more detailed or more discussion-based.

Any final thoughts?

I think prepared scripts are a great tool, but they also need competent trainers. And it's certainly advisable, if possible, to have a homogeneous group of listeners. If the information presented is trivial to some of them and

new to others, that would put a lot of pressure on the lecturer. Of course, even that could be used as an advantage. He/she could let the more experienced ones teach the newbies and just moderate it him/herself.

Dr Vassiliki Tsiachta, teacher in a public technical school, Thessaloniki, Greece + photo

Vassiliki graduated from the School of Agriculture, Aristotle University of Thessaloniki, and holds a PhD in Environmental Education. She has a long experience as a teacher in technical schools and has spent the last 2 years at the Aristotle University of Thessaloniki where she teaches undergraduate students. Her professional focus is mainly on food technology and agriculture. Her extensive publishing activity includes books, numerous articles, and conference papers. She is a member of the Geotechnical Chamber of Greece.

She is very interested in environmental protection and is very keen on the idea of teaching these principles to her students. She believes it is very important to introduce the thematic issues of Circular and Bio based economy and their potential role in providing a solution for a sustainable future into the educational procedure.

What are your general impressions/feelings about the BIOCOMP materials (What was your need when using the materials)?

I am a teacher in a technical school in the Agricultural/Food production sector. I had the opportunity to be familiar with the material in previous stages of the BIOCOMP project, so I had the chance to study carefully and review the material. The learning scenarios are coherent, with good structure, and include a lot of information. This provides a rich source that a teacher could select and build his/her lesson according to specific needs.

An important positive point was that all the learning scenarios and supporting materials are easily available on the website which is very well updated with all the activities, materials, and resources. The available quizzes and exercises are valuable. I tried some of the material to provide some new insight regarding the future trends in agriculture to my students. AR glasses are a very interesting application but this requires preparatory work for the adaptation of this tool.

Which elements of the program did you find most useful?

The BBE Competence Navigator is a central tool that includes all the necessary information, the wiki provides many resources that could be mainly used by students with a more advanced level. The quizzes and the practical exercises and experiments are ready to use. This will enable us to monitor if the students acquired the new knowledge and the answers are directly available. Finally, the HOW Guide, and Pedagogical Guidelines provide summarized guidance giving a short overview of the tools that can be used in the class.

What do teachers have to prepare in order to be able to realize a lecture?

The structure of the course should be built according to the level of the students and their previous educational background. These materials could be applied to many different courses addressing different specializations in which a teacher could build their course.

How did you use it?

I haven't had the opportunity to use all the materials but I tried to show some links and videos, especially the videos. I showed some of them in class to show to students the connectivity of our activities with environmental pollution and the circular and bio-based economy as a new way of thinking.

What is your advice to others?

The learning scenarios are addressed to students at EQF 3-4 level. The teacher should be aware of the previous background of their students. The basic principles of biology, chemistry and environmental sciences are provided in the material.

Any final thoughts?

The selected sectors are innovative. My students found learning materials around the Bio based and Circular economy to be very interesting and easily accessible.

Dr. Ilias Avdikos, a teacher in a Private VET School (IEK DELTA 360°) and external Associate Professor at the International Hellenic University + photo

Ilias graduated from the Department of Agriculture, Aristotle University of Thessaloniki, Greece and holds a PhD in the efficient use of plant genetic resources in tomato cultivation and breeding.

He focuses mainly on tomato cultivation and his research interest is in the efficient use of resources within the different tomato genotypes. As an agronomist he has a specific interest in the environment and the new trends that could be applied in agricultural production. Currently, he is a VET trainer at a private VET school and the responsible manager for the Educational Farm of the School. He is the author of 8 research papers in peer-reviewed journals of the Science Citation Index and numerous conference papers and publications. He is a member of the Geotechnical Chamber of Greece and the Greek Scientific Society of Plant Breeding.

Ilias believes that bio economy and circular economy is an emerging trend that is based on traditional practices with the investment of new knowledge. He thinks that the sector of bio-packaging and biogas has significant potential in Greece because the agricultural sector could be a resource of bio-based materials. The biogas sector is more developed while the bio-packaging concept is still an emerging one in Greece. Algae is very interesting but its wider use is probably connected with an investment in technological equipment.

What was your need when using the materials?

The materials of BioComp are not new to me because I was informed during the project and had the opportunity to see the available material. It is addressed to innovative sectors and the information is built to a practical level, the theory is balanced and the phenomena are explained simply. The BBE company is a horizontal scenario that could be applied to different sectors. The need was that I am teaching at a private VET school with students related to technical agricultural professions so any emerging trend possibly connected with future business activity would be valuable.

How easy is it to use the materials?

The website is very well structured and easy to navigate, so this facilitates the usability of the materials. The repetition of this structure in all four scenarios is very helpful to the reader. The practical exercises and the quizzes are handy and easy to use. The available answers facilitate the evaluation of the course. Also, the Teacher Guide [Pedagogical Guideline] is a practical tool to connect the selected competence and learning objective and how to teach it to the student.

How did you use it?

I showed some videos regarding the principles of the circular economy and the bio-based economy, the introductory video, and videos regarding the potential use of tomato residue use in the bio-based context. I showed the link to the students mainly connected with the circular economy to be able to have an idea about the policies connected to food production and environmental protection.

What is your advice to others?

To study first the teacher guide [Pedagogical Guidelines] and then go to the learning material and not the opposite.

Evaluate the background of the students and consider what the specific desirable competence/skills that should be covered are. At this point, we should start from the teacher guide [Pedagogical Guidelines] and then select the learning materials, resources from the wiki, videos, and practical exercises according to the needs.

Any final thoughts?

The sectors are innovative. Also, the leaning materials for the setting up of a BBE company could be used with other VET specializations (business oriented).

Marek Botek, Assistant Professor at UCT School of Business, Prague + photo

Marek graduated in Economics and Management and later also in Psychology. Early in his career, he became focused on Human Resources Management and currently leads introductory courses in Management of Enterprise processes.

His publishing activity includes books, numerous articles, and conference papers. He is a member of the Czech-Moravian Psychological Society. He also teaches concurrently at the University of Economics and Management, Prague.

In his focus on training employees, he is interested in new, innovative ways to achieve it. “Content is very important, but if the learner is not able or does not want to understand it, the effect of even perfect content is marginal”.

What led you to the idea of using these training materials?

I found them very interesting. I continually seek ways to improve and update my learning materials and want to give my students the best. Experts from several countries prepared these materials, I wanted to know what is new and important from their point of view.

In my Management course, I had not focused on topics related to the circular economy. However, this seems to be an emerging trend and people need to be informed about it. In addition, certain aspects of Biogas and Algae production can be beneficial in topics concerning Production management.

How did you use the materials?

I found that the scenarios contained too much information. I couldn't use a whole scenario, so I decided to use only some videos and partial information. In the circular economy, I used the video about the 17 goals of sustainable development as well as information about the five reasons for circular economy and its benefits. I was looking forward to using the activity with students offered in this scenario, but there was not enough time for it.

I asked another group of students to read the scenario by themselves and be prepared to discuss the benefits of circular economy in production management and the marketing activities of a company.

What is your advice to others?

Do not think that these are “take-and-learn” materials. They cannot be. It is important to know who the learners are, what their previous knowledge is, their motivation to study, and how much time you have. It is also important to know the language competencies of the participants. I consider it very useful to use English subtitles in videos if I present them to non-native speakers.

The second piece of advice is to be prepared. Always read all of the scenarios you want to use, check videos, and prepare materials for practical exercises, if any. The amount of information differs between the scenarios, preparing materials takes time. It is a good idea to create a detailed schedule of the whole course beforehand.

Any final thoughts?

I think that in the prepared scenarios there are often parts which are prepared in great detail. It is not necessary to explain the entire scenario in class. Ask participants to read something by themselves, best at home, and discuss it. Discuss the videos, use as many practical examples and exercises or tests as possible. Listening is not bad, but thinking makes learning much easier and deeper.

Anke Menning, department head at SBG Dresden + photo

Mrs. Anke Menning is the department head of Initial VET Training for Laboratory Professions at SBG Dresden, an inter-company training centre for training professionals in the fields of biology, chemistry, and pharmacy. Anke studied bioengineering and has been a VET trainer for biology lab technicians for 20 years.

Which elements of the program did you find most useful?

The combination of different media types like text, pictures, and quizzes does make the learning more interactive. The additional information helps the trainer to have access to further sources if needed. Learning videos activate learners during the introduction to a topic or to focus on the provision of detailed information.

What is your advice to others? How did you use it?

The developed materials provide additional information for trainers in VET. They are, on the one hand specific, but also general. They are best suited as additional learning materials for existing training courses in the field of biology, e. g., when working with the bioreactor in our labs.

Any final thoughts?

The modules on Algae can be used in practitioners' training in the field of biology. The other modules for Biogas, Bio-packaging and BBE Company also provide valuable information. The materials can be used before work (as training) but also during work. Some of them are more focused on newcomers than practitioners.

Dr. Stefanos Stefanou, Assistant Professor at the International Hellenic University (IHU) Greece + photo

Stefanos is an Assistant Professor of Soil Science and the Director of the Management and Environmental Protection for Sustainable Agricultural Development Laboratory, in the Department of Agriculture at International Hellenic University, Greece. His research interests focus on the subjects of management and protection of the environment in agriculture, emphasizing topics related to biotic and abiotic factors and their interactions with the agricultural environment. He also investigates the production, utilization, and management of biodegradable materials derived from agricultural products.

He has published 15 research papers in peer-reviewed journals indexed in the Web of Science databases and numerous conference papers and publications. He is the author of the practical handbook of the laboratory exercises for the undergraduate course "Soil Science" of the undergraduate course. He is a member of the Geotechnical Chamber of Greece, the Greek Society of Soil Scientists, and the Greek Society of Agricultural Engineers.

What was your need when using the materials?

The need is that I am dealing directly in my research with the transformation of biomass into different products so it is very useful to have a rich source of readily available learning resources, as well as a list of many other related links, and resources for further reading.

How easy is it to use the materials?

It is very easy to use the materials, there is readily available a rich source of video materials and links that are already selected for their connection with specific topics. The readily available quizzes are a good idea also. The organization and the design of the website are excellent, it is very pleasant to navigate.

How did you use it?

I shared in my class the link to the project and mainly the resources and the material related to Biogas. The videos about the Circular economy are very informative, our students have a strong Agricultural background so new things regarding Algae production or new trends on the use of Agricultural biomass they find interesting (e.g., the case with rice residues).

What is your advice to others?

They need to design the duration of the course, the specific themes that each course will cover, at this point the list of the competences is also useful. To make a mixture of materials (presentation based on the learning

scenarios, videos for better understanding, practical exercises for the improvement of knowledge acquisition, and quizzes for final knowledge embedding).

Any final thoughts?

It was a very good job; these sectors will attract the interest of the economy in the upcoming years.

Galina Yordanova, Algae and Bio-packaging modules + photo

Galina Yordanova graduated from Plovdiv University "Paisii Hilendarski" with a degree in Biology and Chemistry. She has a fifth professional qualification degree acquired at Sofia University "St. Kliment Ohridski "- DIIT, and a fourth at the University of Veliko Tarnovo "St. Cyril and Methodius". Her second qualification was entirely dedicated to Ecology.

She is currently a senior chemistry teacher at the Dr. Vassil Beron Vocational High School of Tourism, Bulgaria where she teaches Chemistry and Environmental Protection and Safety and Pre-medical Care in Tourism. Her interest in the bio-based economy is a logical consequence of her interest in protecting the environment. She has participated in a number of projects related to environmental protection and the contribution of new technologies. During the training activities, she held a series of classes to comment on organic packaging, the closed circle of resource absorption and the use of algae.

Galina decided to use our materials for students who are not competent enough in English. She used an automatic translator, an application of our recommended tools. Her first students were her colleagues at a professional high school

Which elements of the program did you find most useful?

My colleagues consider the modules *Algae* and *Bio-packaging* as clear and well structured. No further questions were required to clarify the material. Also, visualization is good. According to my colleagues, no additional illustrations are needed. The number of visuals and videos is sufficient, but not all of them have Bulgarian subtitles, which makes it difficult for good understanding.

The presentation of the material was interesting for our colleagues and created interest in algae. The topic turned out to be unfamiliar for most of the colleagues, especially when it comes to their future use. They were also interested in Bio-packaging. All of my colleagues agreed with how important this subject is nowadays.

How did you use it?

I used a demonstration of the materials, a presentation of them, and dialogue with my colleagues about the topics. I consider the information sufficient for these purposes.

I also used the WIKI section. It can be used both in introducing the topic and in consolidating the knowledge.

What is your advice to others?

If you want to use the automatic translator, not all modules can be translated automatically, this will limit the circle of teachers and students who can use the materials. Also, not all videos offer Bulgarian subtitles. It is necessary to be prepared and have, for example, a suitable translation for students.

Sometimes it is good to use the quiz at the beginning of the lecture. Depending on the type of lesson and the subject in which it is applied. It is new, the students' attention is then higher and you can discuss more than teach. In general, the application of the materials depends on whether the lesson is for new knowledge, exercise, or summarization and control.

Any final thoughts?

The assessed information is up-to-date and the modules are suitable for use in teaching in various disciplines. At first, some colleagues had doubts about the usefulness of the information provided, but after getting acquainted, they became convinced of its usefulness.

I think that the tests at the end of the scenarios will motivate students to be more interested in the problems of the bio economy. It is a bit strange that all the students prefer multiple choice tests.

Galina Atanasova, BBE company module + photo

Galina graduated with a degree in Accounting from the Academy of Economics in the town of Svishtov and worked as an accountant in the private sector for several years. She then graduated with a degree in Pedagogy from the Technical University of Gabrovo and completed a postgraduate course "Organization and Management of Education" at Sofia University. For the past 25 years she has been a teacher of Economics and is currently the head teacher of vocational training at the Vocational High School of Tourism in Veliko Tarnovo, Bulgaria. She currently teaches Accounting, Marketing, and Management and Entrepreneurship.

Her interest in the bio-based economy has emerged in recent years, with global advocacy for resource conservation and environmental protection. In this regard, she is interested in the BBE materials and in particular the management of the entrepreneurial activity dealing with a closed circle of resource utilization and use of eco-packaging. In some of the classes she leads there are topics related to eco-entrepreneurship.

Galina also used the translation of materials for her colleagues at the professional high school. As she says, “We used a fellow translator as well as Google translator and had no problems.”

What led you to the idea of using these training materials?

We always want to present our students with up-to-date and interesting, important information. Bio-economy is a current trend that they should be prepared for. I was curious to see and use this learning module.

Which elements of the program did you find most useful?

The materials are presented in an understandable and accessible way, so as to provide clarity on the problems.

The module is logically structured, scenarios are clear and also well structured; containing enough text and could be used in the classes and the work of colleagues. The materials are understandable, the pictures are appropriate and accessible to illustrate the text.

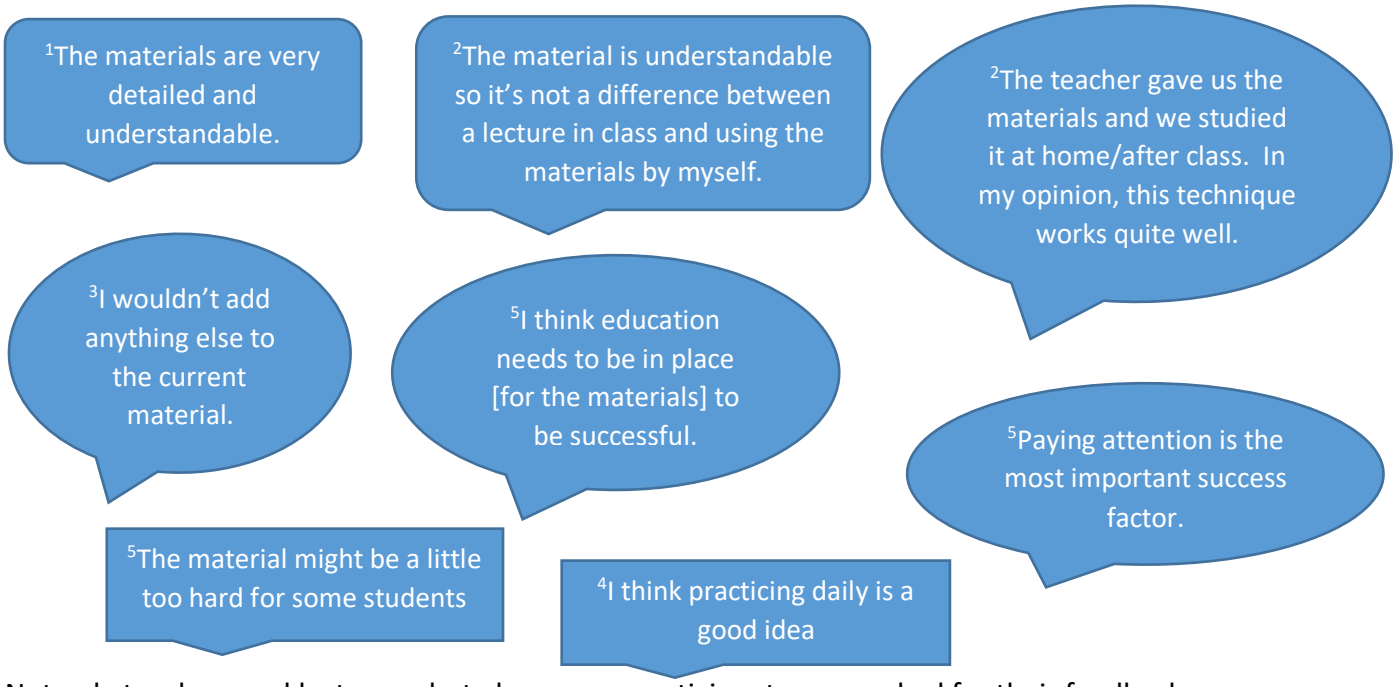
What is your advice to others?

The range of scenarios is different. There could be potential difficulties based on, e.g., different depths of content, but they are not great and can be overcome with desire and interest. In the process of teaching, I will decide whether to provide students with material that has additional relevant information. I will use it specifically in some entrepreneurship classes where we will discuss business ideas related to the bio-based economy. However, I think it is very important to have enough hours on the subject in which to discuss topics and issues related to the problems.

Any final thoughts?

Interesting material, properly presented, understandable and with practical application.

PARTICIPANTS´ FEEDBACK



Not only teachers and lecturers, but also course participants were asked for their feedback. Some of them were asked to read a scenario by themselves and afterwards, discuss it with the teacher. We were happy to hear that the majority considered the materials to be clear and well structured, with a reasonable amount of information and illustrative pictures[1].

Other positive feedback noted the ease of self-study[2]. While the created materials were certainly designed with the idea of potential self-study in mind, trainers are gently reminded to facilitate self-study by providing students with a list of important terms or principles to explain together with the materials. Trainers should also remember that, due to Covid and the ubiquity of distance-learning/remote-study, students are now quite competent in both the logistics and discipline of self-study. However, it is important to remember that self-study should ideally be augmented by a follow-up discussion and some form of assessment, such as a traditional quiz or preparation of a short presentation on a relevant topic.

We asked teachers if they considered the different ranges (difficulty level, depth of content, etc.) within scenarios problematic for successful use. The majority think that they will be able to work with the range differences without any problems. While students did not have an opportunity to read all of the scenarios, their opinion is the same.

However, it important to remember that, due to a variety of factors, course participants are usually similar in their attitude towards training and ultimately do not want to study too much or use too many different sources[3]. Except for some very motivated students,[4] most of them need to know what they should do and how to proceed with the training (i.e., which modules to read, what activities to do, what question to discuss, etc.). Ultimately, it is necessary for the trainer to recognize the differences among his/her students and do his/her best to accommodate as many potential learning styles/attitudes as possible[4].

Finally, while assessment materials are provided within the training materials, the majority of them are multiple-choice based. While it seems that most students prefer this style, please be aware that some participants preferred to be tested via open-ended questions with the option of creating their own answers (short answer, revision-style questions with no options provided). Therefore, trainers are encouraged to occasionally adapt the given multiple-choice quizzes or to find alternate means of assessment is possible.

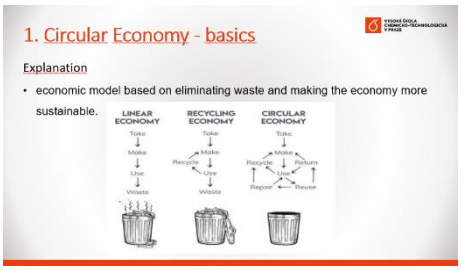
CASE STUDIES

CASE STUDY 1 - LECTURING

I needed to prepare my business university students about the Circular Economy. The prepared materials were too detailed for my purposes. As the students were used to using ppt presentations in class, I decided to use only a part of the content and modify it to my ppt design.

I made sure to include some of the videos. The first one was used as an Introduction. The students watched it carefully.

After briefly explaining the tenets of the circular economy (using data from the BioComp modules), the differences among different types of economy were explained.



The short video (Do you know all 17 SDGs? - YouTube) from the Circular economy module introduced them to the 17 goals of Agenda 2030. These were discussed using the link from “Activity in the classroom” included in the module.

At the end of this interesting half hour, we went through “the Five Reasons for the Circular Economy” and “the Nine Principles for Introducing it into Society”.

Next time, I will have to find more time for this topic in order to use more material from the prepared scenario.

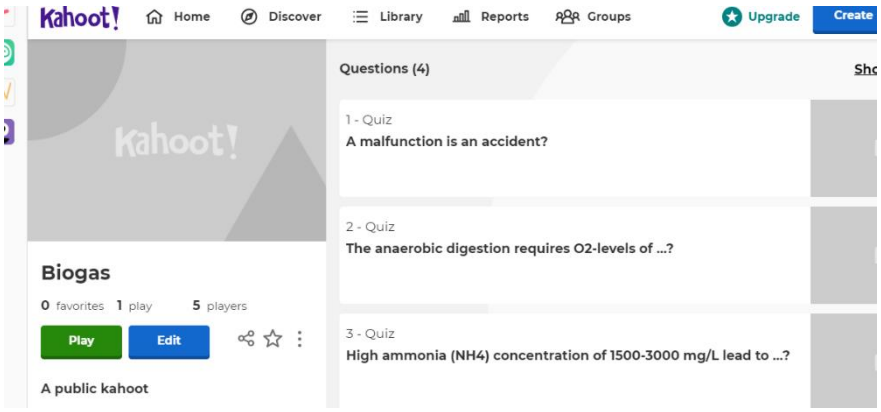
CASE STUDY 2 – ALGAE CULTIVATION

I introduced my agricultural university students to the "Production and Harvesting" module from the Algae scenario in the study of the plant kingdom. Provoked by what they had learned about microalgae, they set out to study their ability as producers of biomass and assimilation of CO_2 by modelling a bioreactor for spirulina cultivation. The resulting biomass was applied as a liquid fertilizer in the cultivation of houseplants by watering and aerosol as a foliar fertilizer.

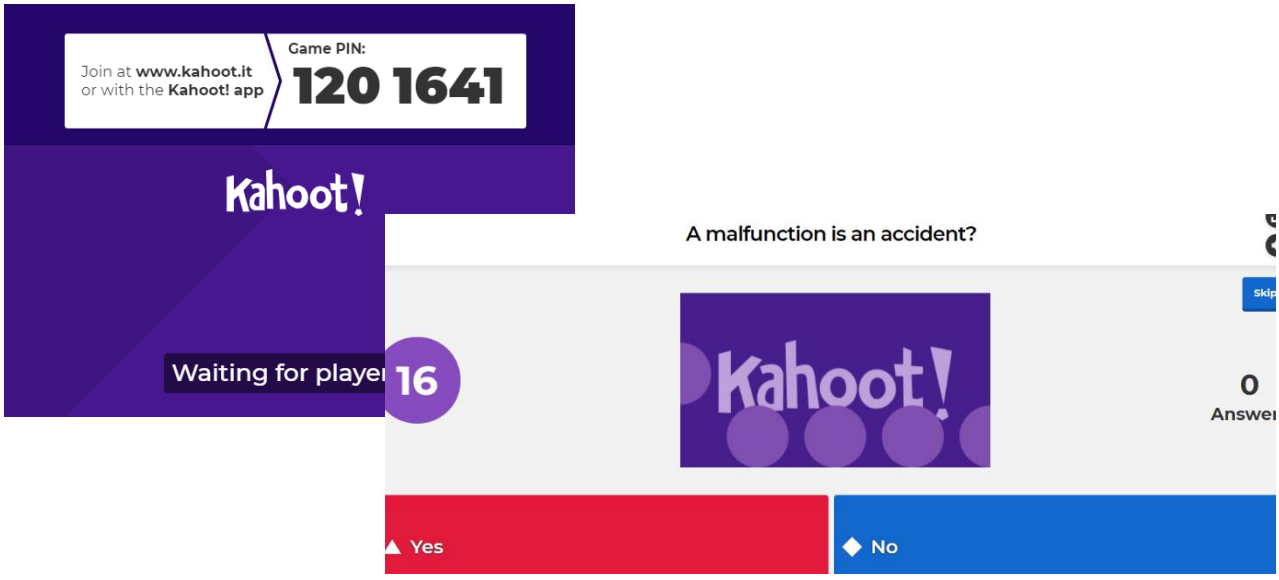
While studying the ecology section, the students suggested an idea for recycling old car tyres through a high-temperature process – up to 400 degrees – of deep thermal transformation - pyrolysis. Some of the raw materials obtained from pyrolysis are used to produce electricity on small farms. The released carbon dioxide is used for the cultivation of algae from which is obtained a bioprotein product /additional food to increase the yield of laying hen eggs and milk yield from dairy animals - sheep, goats, and cows as well as seaweed oil. This student project won first place in the National Competition in Ecology.

CASE STUDY 3 – KAHOOT IS PERFECT!

I often use Kahoot in my teaching but now I decided to ask students to prepare a test themselves. It was necessary for students to work in groups because not all of them had laptops. But later I considered this as an advantage as the students were active in their groups, communicating with one another and also finding some creative answers.



The students focused on the Biogas learning scenario (*Malfunctions*) and were tasked with creating a quiz from the created materials. Due to the clarity of the content and the large number of groups, many questions and answers were similar. However, this will allow us create a bank of test questions for future use.



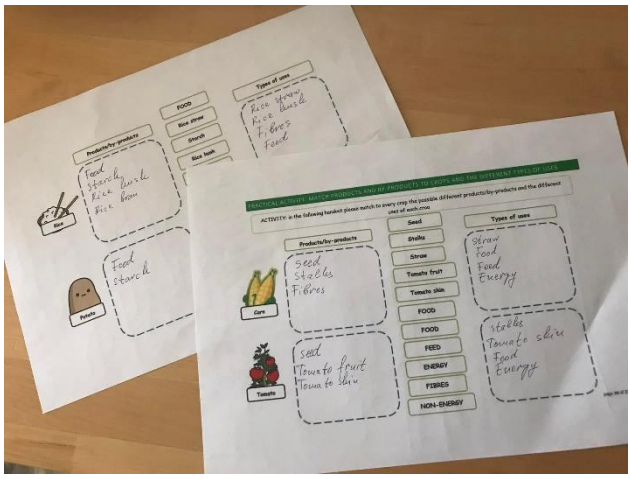
CASE STUDY 4 – PRACTICAL ACTIVITY

After explaining the Bio-packaging module Biomass Production in a BBE context, I decided to use the practical activity from pages 24 and 25.

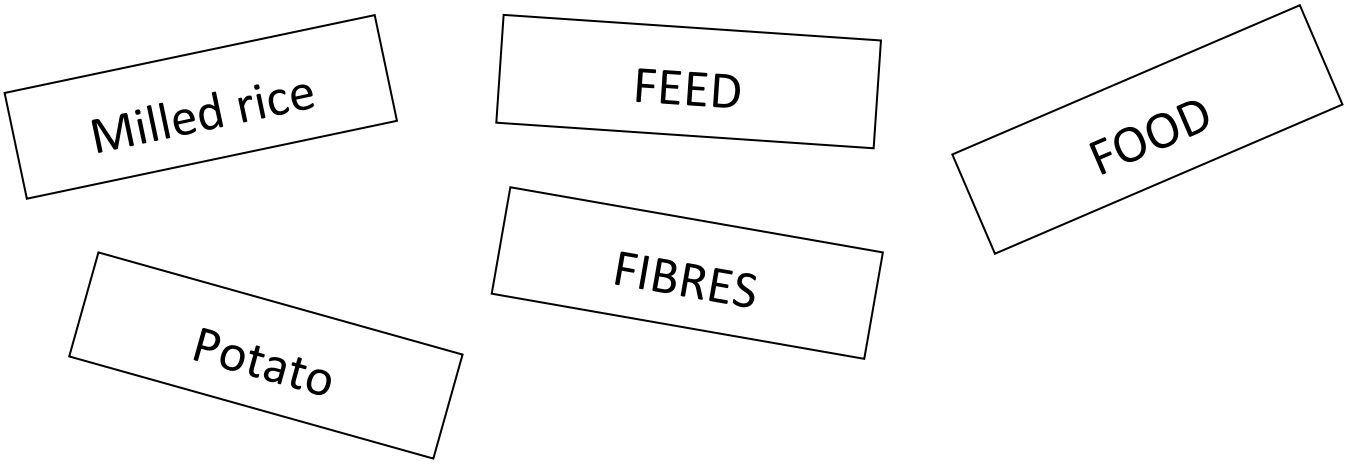
I divided the students into groups of four, gave each of them pre-printed forms and asked them to match the appropriate expressions to the plants.

They soon began to compete with each other.

In one group they wanted to see if the same expression could be used for two plants, but before I could answer, they noticed that the word FOOD appeared twice in the documents. As a result, they wanted to make sure they understood it correctly and that each term could be used only once.



The students finished much earlier than I had anticipated, so we also had time for a short discussion on the term "NON-ENERGY". A lively discussion soon emerged as one group argued that the term couldn't be used because everything has some energy, but in some cases the amount is much lower than the other. This discussion encouraged me to engage the students with the WIKI and online research necessary find the correct information regarding this term and its use in bio-economy.



And, for future reference, I will not only print out the two sheets, but also laminate them and make flashcards of the terms students are supposed to assign. This will make it easier for both trainees and trainers to work with the materials.

CASE STUDY 5 - VIDEO

I decided to use the advice from the *Pedagogical Guidelines* and use a video more effectively. Course attendees sometimes watch them closely, but often do not respond to questions. In the 2nd Algae scenario are some recommended videos. Before opening the video (https://www.youtube.com/watch?v=LNwUVET3CBQ), I tried to activate student knowledge and engagement by asking them the following questions:

1. How much CO_2 fixation on earth is carried out by Algae?
2. Which Algae can be used as a source of proteins, vitamins, and minerals?
3. Which Algae can be used as food or fertilizer?
4. What products are produced from Algae?
5. Which algae are used in sewage disposal?

I did not provide answers for the questions, I only checked to see if all students had written something. After that, I told them to watch the video and perform a new task to find the correct missing words in the following sentences:

a. Tolypothrix increases the fertility of …… fields.
b. …… is a modern tool for abortion.
c. Algae help in the bacterial decomposition of …….
d. Blue-green algae are used in studies on …… fixation.

This activity was quite successful as participants´ attention was focused on the video and the accompanying tasks. Furthermore, the ensuing discussion after watching the video had more active participation and more focus than usual.

Finally, here are the correct answers for the above-mentioned tasks.

1. 50 %
2. Chlorella, Laminaria, Porphyra, Sargassum
3. food: Gracilaria, Laminaria, Spirulina; fertilizers: Tolypothrix, Spirulina, (Cyanobacteria - Nostoc, Anabaena)
4. flame proof fabrics, plastics, paints, gauze materials, soups, sauces, ice creams, thickener in cosmetics, textiles, and pharmaceutical industry, agar – medium for growing algae, fungi, and bacteria, boiler insulation, antibiotics, and medicines
5. Euglena, Scenedesmus

a. rice;
b. Laminaria;
c. sewage;
d. nitrogen