Problem-centred learning for ESD: teaching resources

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Introduction

Resources to support the development of sustainability focused problem-centred (PCL) student group projects into your teaching.

If you have any resources that you use in your teaching that you think will be support this topic and will be accessible to other subject areas please contact cie@liverpool.ac.uk

Overview to problem-centred learning

- Authentic real-world problem-solving activities engaging students in groups to develop creative practical solutions to complex ill-defined problems similar to what they will encounter in the outside world.
- Can be integrated with other forms of learning and teaching and is designed to be efficient in terms of staff time and resource limitations compared to traditional problem-based learning.
- Staff act as group facilitators with students taking responsibility for elements of their learning.
- Enhancing student's abilities to apply theory to practice and transfer problem-solving competencies to novel contexts.

Problem-centred learning to support ESD

- Focuses on sustainable development challenges at a global or local level.
- Aims to develop student's sustainability competencies.
- Requires students to consider the interrelationship between social, economic, and environmental sustainability issues outside of their subject boundaries.
- Ideally involves student groups that are interdisciplinary, intercultural, and transdisciplinary working on real-world problems with external stakeholders. (This may not be appropriate early within a programme, or practical within your subject discipline.)

Overview to designing problem scenarios for sustainability

A problem design process typically will include the following steps:

1. Identifying a sustainability problem 'trigger.'
2. Analysing the trigger material and carry out further background research.
3. Framing the problem (set objectives and boundaries, bearing in mind constraints).
4. Defining the specific student task and its associated success criteria.

During the group work process students would be required to take responsibility for the following steps:

5. Identifying areas for investigation/research to seek data.
6. Finding, sorting and critically evaluating data to acquire relevant information.
7. Applying appropriate information.
8. Producing required deliverables.
9. Reflect on learning experience.

Identify a sustainability problem 'trigger'

A problem can be a scenario, a case, a challenge, a visual prompt, a dilemma, a design brief, a puzzling phenomenon, or some other trigger designed to mobilise learning. Most subject areas you will be able to create a problem 'trigger' issue to use as the basis for your problem scenario.

- Problems must represent one that the learners are likely to encounter in the real-world that are open-ended with a variety of possible solutions.
- Problems should be topical, unsolved projects rather than historic cases.

Frame the sustainability problem

Important to select real-world 'Ill-defined' or 'ill-structured' sustainability problem that does not have clearly defined solutions nor a clear process to arrive at a solution. Well-structured problems generally have clearly defined solutions.

The student group projects ideally must effectively lead to students learning about change processes and sustainability, working across disciplinary boundaries.

The following problem scenario is taken from: Problem-Based Learning: A Case Study of Sustainability Education ref page 23.

A framed problem scenario from a year 1 undergraduate business programme at the University of Keele:

"You are working for Uniformsdirect, a company which designs and supplies uniforms to a range of different sectors, including the hospitality and entertainment sector. The company is based in the centre of Stoke-on-Trent and has about 70 people directly employed in the main offices and distribution warehouse. The main offices are housed in a 1960s office building which has not had any major renovations since it was built. The majority of employees live in North Staffordshire; some live in Manchester and Birmingham. The clothing is manufactured in a factory on the rural outskirts of the busy city of Jakarta, Indonesia. Many factory workers in these areas are migrants from Indonesia's poorer eastern islands who have travelled to Jakarta for work.

The cotton used to produce uniforms is imported into Indonesia from the cotton growing regions of central Asia, mainly from Uzbekistan, and the clothes dyes are imported from India. Once clothes are manufactured they are shipped to Dover in England before being transported via lorry to the central distribution warehouse in Stoke. Recently the company has not been winning tenders from clients that they would have normally expected to win tenders from. The senior management have heard rumours from prospective clients that this is because Uniformsdirect are not seen as considering the sustainability agenda enough to satisfy their own stakeholders. However, not everyone on the senior management board at Uniformsdirect is convinced that it is worth investing in sustainability issues, particularly in current economically difficult times.

No-one in the company has any environmental management background but you have been asked as a team to take responsibility for environmental and sustainability issues within the company. Some prospective clients have asked whether your company has an Environmental Management System or a Sustainability Policy in place but no-one really

knows what this means. Your team have been asked to provide a five minute oral brief to the senior management of Uniformsdirect on what steps the company should be starting to take to address its environment and sustainability responsibilities."

In this example, you will note that the framing of the problem has deliberate 'trigger' sentences that should direct students towards specific areas of research and investigation. For example:

'the main offices are housed in a 1960s office building which has not had any major renovations since it was built.'

'many factory workers in these areas are migrants from Indonesia's poorer eastern islands who have travelled to Jakarta for work'

'However, not everyone on the senior management board at Uniformsdirect is convinced that it is worth investing in sustainability issues, particularly in current economically difficult times'

It's important to think through what you expect students to do in response to each trigger, if they are able to investigate each issue to an appropriate level, and how the combination of conflicting issues and challenges will enable to student to develop creative practical evidence-based solutions.

How do you expect students to identify and create solutions to the complexity in the scenario dealing with the interrelationships between social, economic and environmental factors, trade-offs, unknown impacts, values differences within the group and stakeholders, and other ambiguities etc.?

Define the student task and success criteria

In addition to providing students with information about group working etc. give students clear information about:

- Their role in the scenario – consultant, employee, agency etc.
- The extent and nature of any research you expect the groups to conduct.
- Any instructions, timescales, and outputs.
- Assessment criteria.

If working on a real project with external stakeholders:

- Information about and expectations for working with an external organisation etc.

Student task from the Keele University example:

"Your task as a group is to present a five-minute oral brief to senior management on what steps the company should be starting to take to address its environment and sustainability responsibilities.

To do this you need to have a greater understanding of the relevant issues and will need to carry out some more research before presenting the brief to the senior management in class on the 7th February. You will have a short amount of time in class next week to prepare how your group will present its ideas but most of your group work should be done before the session. You do not need to produce any PowerPoint slides or typed documents. This task is not assessed.

By the end of this week's session, you must have decided as a group four things that you need to do more research about before presenting the brief next week; these will be your 'Agreed Learning Objectives'. Be as specific as possible, and write these on your group's 'Agreed Learning Objectives' form (attached). It might be a good idea to assign one learning objective/research area to each person.

The brief must be a short summary of the issues that you decide (as a group) are most important to get across to the senior management to help them to decide how (and whether) to start to address sustainability considerations within the company."

Ensure the student task is align to sustainability competencies

Think though how you will design your problem scenario and student tasks to develop all or a selection of the eight UNESCO student's sustainability competencies.

A problem-centred learning project within a single discipline, not involving wider stakeholders for example, will probably not fully develop student's collaboration, integrated-problem solving, and normative competencies. A few example tasks aligned to each of the eight sustainability competencies:

Sustainability competencies	**Example Tasks**
Systems thinking - approaching problems that analyse how all the elements within a system influence one another.	"Utilise systems thinking to assess the interconnected challenges facing the/ involved in (scenario context)."
Anticipatory/ futures thinking - understanding and meaningfully contributing towards current and future	"Apply futures thinking to envisage various potential futures for the region, factoring in global trends, technological advancements, and environmental changes."

challenges, whether in a local or global context.	
Critical thinking - conceptualising, applying, analysing, synthesising and evaluating information.	"Critically evaluate potential solutions for their practicality, sustainability, and impact on different community groups."
Strategic competence - transitioning to sustainable alternatives or developing sustainable solutions to current problems or issues requiring strategy.	"Project deliverables to include: A detailed report outlining the proposed sustainability strategy. A presentation showcasing your vision, including visual aids and models. A financial plan, including potential sources of funding and investment."
Collaborative competency - communicating effectively with colleagues, clients and stakeholders, ethically and professionally across platforms, disciplines, cultures, national boundaries and cyber-physical interfaces.	"Develop community engagement strategies to ensure local voices are heard and incorporated." "Conduct a series of stakeholder meetings, where students engage with various groups to gather input and negotiate solutions."
Integrated problem-solving competency - responding to complex, ill-defined problems that can include missing, contradictory, or contested information.	"Develop a comprehensive plan addressing economic development, social welfare, and environmental protection. This could include strategies for green infrastructure, initiatives to foster inclusive economic growth, and programs to enhance social welfare."
Self-awareness competency - recognising how students' emotions, motivations and personality impact on their actions and behaviours.	"Individually embark on a 'Personal Sustainability Journey', where you record, reflect on, and critically assess your daily routines, consumption patterns, and overall lifestyle in terms of sustainability."
Normative competency - understanding and reflecting on the norms and values that underpin students' own actions and those of other stakeholders.	"Understand the values, beliefs, and motivations that drive each stakeholder group."

	"Conduct simulated interviews, surveys, or focus groups with representatives from each stakeholder group." "Actively listen to and document the concerns, aspirations, and suggestions of each stakeholder group."

Give student groups clear instructions

For example, from the University of Keele example:

"Read through your chosen project. Following the 6 steps below will help you to successfully complete your group projects:

"Highlight and clarify unfamiliar terms and concepts - make sure you know what everything means and make sure you are clear about what your group task is asking of you."

"Formulate group learning objectives for further research. Learning objectives are a list of things that your group needs to find out and research to be able to complete the task. You may want to split your research into 4/5 areas so each team member takes responsibility for one part of the research."

"In-between class sessions you should research the topic/area/issue that was assigned to you, through the internet, books, articles, etc. and be ready to share this research with your group the next time you meet."

"Remember to keep in regular contact with your group and discuss ideas and progress via your Facebook or Blackboard discussion groups. You should also meet up as a group in person in-between class sessions."

"Module staff will be monitoring online group interaction. Please feel free to ask the module facilitator any questions related to your project via email, Blackboard or Facebook. The facilitator is there to provide guidance and support through the group projects."

Set the ground rules and context for the student groups

- **Introduce to students** - explicitly communicate to students why PCL is being introduced – aligned to programme/ module learning outcomes aiming to develop

their sustainability, group work, employability, and problem-solving skills. Aligned to programme/ module learning outcomes.

- **Your role** - clearly explain the role of the facilitator(s) as this may be a change of expectation for students. For example: facilitators role is to assist each group to formulate learning objectives, monitor progress, drip-feed information as appropriate to support the learning process (without revealing possible solutions etc.), and to intervene in if the groups are not working well.
- **Your expectations** - provide students with clear information about timetabling, meeting expectations, and any engagement with external stakeholders etc.
- **Tools and methods** – if appropriate, introduce to student's appropriate tools or methods that you expect them to utilise within the project e.g. systems thinking methodologies.

Tips for facilitating problem-centred learning student groups

- **Group formation** - if using interdisciplinary or intercultural groups where students are less familiar, use social and fun group forming activities to enable students to get to know each other before they engage fully with the problem task.
- **Help students to get started** - tutors can initiate the group process by making explicit connections between the problem, theory and practice (help them see the 'bigger picture' context) as these may not be apparent to the learner at their current level of abilities and knowledge. Provide more than simply information about the problem – learners may struggle if left only with the problem and not support about how to start approaching the problem.
- **Engage prior learning** - help learners, recall, explain or discuss what they already know about the problem as a foundation for building new knowledge.
- **Model expert behavior** - learners can gain from hearing how an expert would approach and solve the problem through demonstration of procedures, visualisations of process, modelling behaviours etc.

Assessing problem-centred learning

- Typical assessments include weekly reflective diaries, self and peer-assessment tasks, and real-world products (could be presented to stakeholder) such as a report, policy, plan, design, or poster, for example.

Develop students experience of problem-centred learning progressively across a programme

- **Appropriate level** - Important to choose problems at the appropriate level of students learning abilities to promote active learning and develop problem solving skills.
- **Develop progressively** - early in a programme when students are new to a subject area PCL could focus more on developing students problem-solving skills through engaging with simpler closed defined problems. As the programme progresses students can be exposed to a variety of ill-defined and complex real-world issues that can be solved with a variety of open-ended solutions with risks and costs etc. to progressively develop their problem-solving skills and ability to engage with novel contexts.
- **Assessment of process Vs product** - It may be appropriate for early programme problem-centred learning activities to explicitly focus on process and skill development and less weighted project products.
- **Transferable skills** - the context for the problem that students are presented with will affect the development of transferable skills. A student' s ability to transfer knowledge gained in one problem situation to another will be affected by whether the student expects the principles used in solving the two problems to be related.
- **Coherent** - the series of projects across a programme must form a coherent learning experience.

Supporting resources

Interdisciplinary learning for ESD teaching resources in this ESD toolkit.

References

Problem-Based Learning: A Case Study of Sustainability Education

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