2.4. Inquiry-based learning

2.4.1. Description of the type of method/strategy (300-400 words)
Inquiry is often defined as a seeking of truth, information or knowledge through questioning. As inquiry is a core skill to be developed in university students of any discipline, one could say that the inquiry-based learning (IBL) is a predominant method in HE. The method is principal in science faculties but is also popular in departments of education, social studies, etc. Before the tertiary level the method is widely applied in secondary and primary level, even for kindergarten, especially in science (e.g. Samarapungavan et al., 2008).

IBL engages students’ innate curiosity to spur their own learning. In this process students attempt to convert information into useful knowledge through formulating a question (usually open-ended); finding the resources to answer it; interpreting the collected data and reporting the findings. The method can be applied by individuals or groups. Inquiry can be a complex undertaking and it therefore requires dedicated instructional design and support to facilitate that students experience the excitement of reaching to conclusion on their own.

IBL evidently overlaps with Problem-Based Learning (PBL), in which the handling of a problem (rather than a question) defines and drives the whole learning experience of the students (Kahn & O’Rourke, 2005). IBL resembles also the scientific approach:
- It begins with deciding what is to be discovered (the question to be answered).
- The second part of the process is deciding what kind of data is to be collected and how.
- Thirdly the actual data collection follows.
- Fourthly the data analysis draws the appropriate conclusion of the inquiry.
- A reflection of the whole process as the last stage is vital, as it gives feedback about what went well or otherwise.
- Reflection may lead to another round of inquiry.

In IBL students actively engage in the learning process: The educator may establish the task and facilitate the process, but it is the students who pursue their own lines of inquiry, draw on their existing knowledge and identify their learning needs. They seek evidence to support their ideas and take responsibility for analysing and presenting them, individually or in groups. Their questions actually reveal the hidden obstacles, misconceptions and bias they might have as individuals. An important aspect is constant re-framing of knowledge through group work and discussion.

Alongside the other skills developed through IBL, IT literacy capabilities are internationally considered essential for people living and working in our network societies (e.g. McKinney & Levy, 2006). New digital technologies and resources that are affecting the creation, organisation and sharing of knowledge challenge academics to think afresh about disciplinary inquiry and the information-related capabilities that students need.

2.4.2. Its underpinning theory (150-200 words)
Inquiry-based learning (IBL) is often described as a cycle or a spiral, which implies formulation of a question investigation, response (or solution) and feedback. The
purpose is to engage the student in active learning, ideally based on their own questions. The exploration of the natural, constructed and the social world leads the learner to new questions and discoveries in the seeking of new understandings.

The method represents a shift away from the passive methods, which involve the transmission of knowledge to more facilitative teaching methods through which students are expected to construct their own understandings by engaging in supported processes of enquiry, often carried out in small groups. IBL is thus situated within the broader tradition of student-centered active learning of Dewey (Kahn & O’Rourke, 2005).

Overall, IBL is a project-oriented method that is based on the learning theory of constructivism which recognizes that knowledge is constructed by the individual based on mental activity (Eick & Reed, 2002).

2.4.3. Its strengths and weaknesses in the context of ESD (200-300 words)
The strengths (S) and weaknesses (W) of Inquiry-based learning (IBL) method are presented in the following table:

<table>
<thead>
<tr>
<th>Strengths (S)</th>
<th>Weaknesses (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBL is a student-centred and student-lead process. This way they share responsibility for their own learning</td>
<td>Some students may not perceive the inquiry as part of their learning process, so this needs to be clarified by the instructor.</td>
</tr>
<tr>
<td>IBL cultivates self-motivation and the natural curiosity and desire of individuals to learn</td>
<td>Students might tend to concentrate more on discussing and debating rather than on inquiring critically into concepts, ideas or models</td>
</tr>
<tr>
<td>IBL is appropriate for any age group and as students get older, more sophisticated questioning and research skills are developed</td>
<td>The educator needs to encourage debate and give input in times of fatigue (or dead-end). It is not enough to ask students to complete a survey; the process needs to be supportive</td>
</tr>
<tr>
<td>The method provides students with opportunities to learn with more freedom and utilize varied learning styles</td>
<td>If students work in groups it may prove difficult to test their level of individual participation</td>
</tr>
<tr>
<td>The method is ideal for exercising collaborative work in groups</td>
<td></td>
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<tr>
<td>The educator has the role of facilitator, rather than the transmitter of knowledge.</td>
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<tr>
<td>As students investigate authentic situations IBL offers the opportunity to develop a range of life skills and job-skills (e.g. knowledge creation; team-working; presentation; IT; problem-solving; creativity; project management)</td>
<td></td>
</tr>
</tbody>
</table>

2.4.4. How it can IBL be applied to advance ESD (300-500 words)
Inquiry-based learning, by nature, offers many opportunities to examine in depth the multi-dimensional concept of Sustainable Development and the complex factors affecting its implementation.

Through the application of the rather abstract concept of sustainability to the real and pressing problems of contemporary communities, the IBL allows students to
appreciate how SD can be an essential component of local social, economic and environmental issues, as well as the global challenges highlighted in literature.

Students could engage firstly in independent individual research, and later work in groups to address related sustainability challenges, allowing them on the one hand to develop in depth understanding of a specific policy area (e.g., renewable energy), but critically (through group discussions), to connect the various aspects. The whole experience becomes one of interchange where students share opinions, research and experience in order to achieve an end result. Through this process students get accustomed with of one of the key attributes of SD, its integrative nature and potential for solutions.

A categorization of IBL approaches proposed by Levy & Petrulis (2007) may prove useful to the educator wishing to plan IBL schemes for various ESD themes. In this context, some IBL approaches are designed to facilitate students’ exploration of the existing knowledge-base of their discipline (information-oriented), while others more explicitly invite students to build disciplinary knowledge (discovery-oriented). The authors identify two contrasting variants in each, according to the extent to which they are ‘teacher-lead’ or ‘student-lead’:

- ‘Information-responsive’ inquiry, framed by teachers: Students explore the knowledge-base of the discipline in response to inquiries formulated by university staff.
- ‘Information-active’ inquiry, framed by students: Students explore the knowledge-base of the discipline by pursuing inquiries that they themselves have formulated.
- ‘Discovery-responsive’ inquiry, framed by teachers: Students pursue new inquiries, as formulated by tutors, in interaction with the knowledge-base of the discipline.
- ‘Discovery-active’ inquiry, framed by students: Students pursue their own new inquiries, in interaction with the knowledge-base of the discipline.

To give an example from the business management sector, an IBL approach could have students explore how the principles of sustainability are perceived in the management plans of various companies e.g. of food retail. To the other end, following a theoretic study on SD in the food business sector, students may be asked to design and carry out an inquiry on their own, exploring some dimension of sustainability.

2. 4. 5. Provide cases/examples using IBL method with ESD themes (2-3 examples with different themes)

1. **Making Sustainability Real: Using a Group-Enquiry Approach in Masters Research**: This project evaluated the benefits of engaging Masters Students in research to address sustainable development in practice. The project further piloted the developed approach during one academic year, when thesis research of six students focused on identifying initiatives that would help deliver sustainable forms of regeneration for a failing Irish market Town, Clones. Read more at [http://www.heacademy.ac.uk/ourwork/teachingandlearning/alldisplay?type=projects&newid=esd/esd_group_enquiry_masters&site=york](http://www.heacademy.ac.uk/ourwork/teachingandlearning/alldisplay?type=projects&newid=esd/esd_group_enquiry_masters&site=york)
2. **CILASS: Centre for IBL University of Sheffield.** Through this initiative IBL is widely applied in many departments of the University itself such as the Faculty of Arts and Humanities; Engineering; Medicine and Science. Read more at [http://www.sheffield.ac.uk/ibl/home.html](http://www.sheffield.ac.uk/ibl/home.html)


**Bibliography**


