BEST PRACTICE IN INNOVATIVE TEACHING METHODS

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Author(s)	BOKU (Michael Tritthart), MUHEC (Sally Priest, Simon McCarthy), UNIME (Giuseppe Aronica), OE (Agota Dregelyi-Kiss), TUC (Georgios Stavroulakis), UNI (Milan Gocić)
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1 Introduction

When disseminating knowledge to students or other stakeholders regarding natural disaster risk management, as in other fields of science, innovative teaching methods should be employed. This report summarizes the corresponding outcomes from the training of teaching staff conducted in Budapest, London, Chania, Messina and Vienna.
In general, before considering the teaching methods themselves, a paradigm shift towards a view that is centred on learning should be adopted. As a consequence, first principles of learning have to be understood, then learning outcomes can be formulated, and based on this the most appropriate teaching methods can be selected. These topics therefore form the structure of this document.

2 Principles of learning

2.1 Consolidation

Learning means the establishment of neuronal pathways. Like a hiking trail leading uphill to a mountain top, the neuronal pathways require frequent repetition in order to allow the newly acquired knowledge to settle. Taking notes or asking questions in class are similarly effective techniques to consolidate knowledge as the repetitive learning process itself.

2.2 Distributed practice

The neuronal connections are strengthened by the number of times they are used. Therefore several shorter study sessions are preferred over fewer and longer study sessions. This is comparable to a mountaineer who needs to break his climb into shorter legs in order to avoid losing momentum and consequentially becoming discouraged. For beginners' simpler and shorter paths to knowledge acquisition are required than for experts.

2.3 Determinedness

Learning requires a certain level of determinedness to achieve the aim of remembering the knowledge. It is more helpful to keep a constant level of learning challenge rather than only doing it once in a while. Moreover, every learning session benefits from a "warm up" phase for the brain as well as a "cool down" phase, similar to physical exercise in fitness training. These phases should therefore be accounted for when teaching in a classroom.

2.4 Meaningful organization

When learning, the human brain requires change and a variation of stimuli. This works best when putting order and structure into the learning matter. Hence, the already existing knowledge frequently requires re-arrangement in order to optimize the mental capacity available. This can be compared to achieving an organized structure on a writing desk. Re-organisation and structuration essentially require time and the capability to group items into meaningful subunits.

2.5 Interest

In order to learn something, interest in the subject must be present. Only relevant, interesting and essentially important information will be retained. Like a writer presenting an entertaining detective story to the reader, the teacher needs to put structure into the matter, avoid confusing details and provide connections to the bigger picture related to the knowledge gained.

2.6 Selectivity

Our brain's capacity for learning is limited. Thus it is not helpful to try to keep insignificant knowledge. Learning therefore should aim at quality rather than quantity. Similar to a bathtub which is overflowing once too much water is filled in, additional knowledge has the tendency to overflow unless a certain level of selectivity is applied to the knowledge, focusing only on the essential aspects.

2.7 Realistic aims

Learning large amounts of knowledge within short time is nearly impossible. Knowledge needs to be divided into manageable pieces in order to always have an end in sight. Realistic learning goals need to be set and appropriate rest phases in between are required. A picture applying to this concept is a traveller in the desert who needs to schedule the legs of his trip according to the oases along the way.

2.8 Packaging and presentation

For learning success it is important how the learning content is presented. The human brain has a tendency for becoming bored easily, hence diversity and change as well as attractive content and animation are needed to keep a constant level of activation. A teacher thus needs to use various different methods of knowledge presentation, e.g. different ways of presenting learning materials and different teaching methods, to disseminate the knowledge to the students, similar to a shopkeeper decorating the shop window in a diverse way. Having a variety of teaching methods recognises that learners each have different preferences for how they learn best and, as such, it is appropriate to vary activities to cater most effectively to these different styles and preferences.

2.9 Comprehensibility

Subject matters which are devoid of meaning or use, are much harder, if not outright impossible to learn. Comprehensible and clear content, with examples drawn from life and practical applications, is easy to understand and leads to a better understanding of the learning subject. The teacher needs to provide those examples to his students, similar to a driving school where the student is accompanied by a driving instructor who can interact in case of complex and unfamiliar situations coming up.

2.10 Creativity

Learning ultimately is not just about gathering knowledge. Building on the work and the person centred approach of Knowles (1984) and Rogers (1945) rather it should be seen as a

personal development process. In that view, learning is a creative process that allows influences and inspiration by environment to take place. The teacher needs to understand and acknowledge this, and consequentially recognise students as different and unique personalities who might take different paths to achieving the knowledgeable aims of class. It focuses on the student rather than purely the transmission of knowledge and acknowldges the requirements of the student who may have differing abilities and interests within a subject. It requires the student to explore and make mistakes reflecting and learning from them. The goal of the approach is to shift some (if not all) responsibility for learning towards the student rather than complete dependance on the teacher. Hence the recognition of the learning outcomes is important for the teaching institutuion but also that skills as well as knowldge is built within the student cohort. Hands-on training, if possible, and homework, gives the students the required freedom to gain experience and to experiment what they are learning.

3 Learning outcomes

After understanding the principles of learning and drawing conclusions for the teacher's task of knowledge dissemination, the next step towards setting up a course is the definition of learning outcomes. Learning outcomes assist the teacher in selecting course content, design appropriate exams or other assessment techniques and also devise teaching and/or learning strategies appropriate for the course. On the other hand, the learning outcomes assist the students in identifying what the requirements for success in the course are, and consequentially understand what and for which purpose they are learning.

3.1 Function of learning outcomes

According to Weber (2017) learning outcomes have four important functions:

- They serve as guideline for teaching.
- They help the teacher in justifying the content he selected for his course.
- They help the teacher select the right teaching methods.
- They serve as evaluation tool for the teacher and his students.

A concept for cognitive learning outcomes was provided by Bloom (1956) and revised by Anderson and Krathwohl in 2001. According to this concept, a pyramid of six categories of thinking skills can be defined from lower to higher order:

1. Remember: Recognizing and recalling facts.
2. Understand: Understanding what the facts mean.
3. Apply: Applying the facts, rules, concepts and ideas.
4. Analyse: Breaking down information into component parts.
5. Evaluate: Judging the value of information or ideas.
6. Create: Combining parts to make a new whole.

When defining learning outcomes, it needs to be specified at which level the students are required to reach, this may typically not be the highest level, but an intermediate level. Learning outcomes (Biggs, 2003) should then be tailored to the desired level and set at programme, module and teaching session levels for a particular course.

3.2 Formulation of learning outcomes

In general, learning outcomes must describe observable behaviour and be action-oriented. Therefore vague formulations, such as "know" or "understand", "believe", etc. are improved upon set against clear, unambiguous formulations, such as "describe", "calculate", "compare", etc.
Bloom's taxonomy provides not only a framework for defining the learning objectives, but also a list of action verbs that can be used for writing down the learning outcomes (Table 1).

Table 1. Action verbs based on Bloom's taxonomy (Weber, 2017)

lower order thinking skills → higher order thinking skills					
remember	**understand**	**apply**	**analyze**	**evaluate**	**create**
arrange	abstract	appraise	attribute	appraise	arrange
copy	categorize	calculate	change	argue	assemble
define	clarify	carry out	combine	assess	compose
describe	classify	classify	compare	check	construct
identify	compare	construct	deconstruct	coordinate	develop
label	conclude	contrast	diagram	critique	create
list	contrast	criticize	differentiate	defend	design
locate	defend	demonstrate	discriminate	detect	devise
name	describe	diagnose	distinguish	estimate	formulate
quote	discuss	estimate	examine	judge	generate
recall	exemplify	execute	figure	monitor	hypothesize
recite	explain	identify	find	predict	invent
recognize	extrapolate	illustrate	coherence	qualify	manage
repeat	generalize	implement	focus	rate	modify
retrieve	identify	interpret	integrate	recommend	organize
select	illustrate	use	modify	support	plan
state	infer		organize	test	prepare
	interpolate		outline		produce
	interpret		predict		propose
	map		select		setup
	match		sketch		verify
	organize		solve		
	paraphrase		structure		
	predict		survey		
	reorganize		test		
	report				
	represent				
	restate				
	review				
	rewrite				
	subsume				
	summarize				
	transform				
	translate				

4 Teaching methods

After setting forth the learning outcomes of a course, the appropriate teaching methods can be selected. While the typical setup of a course normally involves only PowerPoint presentations, there exists a large number of techniques that consider the principles of learning as stated in chapter 2 and which can be used for specific purposes. It is strongly recommended to augment courses with innovative teaching methods and thereby avoid a tiresome experience for the students and reduced opportunities to learn.

Several innovative teaching methods are listed and briefly explained in the following section:

- **Covered Card:** Allows the students some time at the beginning of a class to summarize on their own the contents of the last unit. This provides a "warm-up" for the brain and additionally gives the opportunity for repetition of the course contents.
- **Conclusion Card:** At the end of a class, the students get some time to note what they learned on that specific day. This provides a repetition mechanism and also makes it easier for the students to start the following unit next time.
- **Muddiest Point:** The students are requested to write down (in 2 minutes) what they didn't understand near the end of a particular unit. In reality the students receive more time to think about this. Afterwards the students are asked whether they have questions. This way, there is enough time to formulate a question precisely.
- **Minute Paper:** Students are invited to take down notes in one minute on what was covered so far in the current unit. This method also works with large groups, invoking a repetition mechanism. In fact, no feedback is required, as this method just provides time to the students for knowledge consolidation.
- **3S's Questions:** The three "S" stand for: (i) stress-free question, (ii) so-so question, (iii) stinker question. These questions are asked for students to answer on their own on a sheet of paper. While the stress-free question relates to the minimum requirement to pass the course, the so-so question is of medium difficulty and the stinker question is a hard question for experts among the students. The participants are free to answer which question they would like; however, due to the three levels of difficulty, it is easy for all students to participate and even those with a deep understanding of the subject, who otherwise could be bored, are challenged.
- **A, B, C or D:** Students receive a card with the letters printed on paper in appropriate colours. This card can be re-used throughout the semester. The teacher then asks questions about the course contents and gives four possibilities as answers. Students are then requested to hold up their cards according to which answer they consider correct. By employing this technique, the teacher receives feedback on how well the course contents were received by the students, and at the same time only the teacher can see the result, which spares students from the potential embarrassment of providing wrong answers.
- **Mood Barometer:** At the beginning of a course, students can be requested to draw a cross on a barometer stretching along the blackboard, indicating their estimate regarding the knowledge about the course contents. This allows the students to give quick, anonymous feedback to the teacher and thereby take ownership of their learning

process.

- **Jigsaw Teaching:** Students are divided into groups which correspond to the number of topics that should be taught in a specific unit. Then an expert phase commences, during which each student tries to learn a specific subject in such a way that he can present it to his fellow students. After this, the exchange part takes place, during which the "experts" in a rotating principle disseminate the knowledge to their peers. The teacher accompanies the whole process and listens in to the progress of the groups.
- **Knowledge Card:** Students are encouraged to write down which new knowledge was gained near the end of a course.
- **Buzz Group:** This method creates a way for students to talk among themselves (in small groups) about a topic for a minute. Thereby, the natural need for human beings towards verbal exchange is satisfied and in addition knowledge is consolidated.
- **World Café:** For this method, a large room or several smaller rooms are required. The participants of a class hold discussions or presentations at several places at the same time. Students obtain experience by giving the same presentation several times in a row. Time management is paramount for this technique to work well.
- **Take Home Message:** Shortly before the end of a class, students are requested to write down what they would like to take home from the class. This again provides a refresher for the next class unit.
- **Learning Stations:** Various learning materials are distributed at different tables throughout the classroom, students are asked to proceed from station to station. Thereby physical motion is paired with the mental learning process.
- **Placemat:** A large sheet of paper (format A3 or larger) with a line in the middle and a square in the centre is distributed each among two or three students. The students are requested to write down certain findings (cf. Conclusion Card, Muddiest Point, etc.) and together summarize the most important common findings in the square in the middle.
- **Think Pair Share:** This important teaching method consists of three steps: (i) Students are requested to silently take notes on a specific subject or question, (ii) they talk to their neighbour about it, (iii) finally sharing among all participants in form of a discussion.
- **Fishbowl:** This method is limited to 20 to 30 participants. A circle of (e.g. six) chairs is set up in the middle of the classroom. Four students sit down on the chairs, the rest stands outside. The people seated in the inner circle are allowed to talk about a subject, others listen. Outsiders can sit in on one of the two empty chairs and join the discussion. This way, an organized discussion can be led with many people sharing in. The method can also be conducted by bringing people to the front of the classroom if the auditorium equipment is fixed.
- **Story Cubes:** Students are requested to tell a story based on what they see (printed on a cube or dice). The story cubes can be bought in shops catering to teachers. This method serves as an icebreaker.
- **Cards:** Cards with a tick-mark (for yes), a cross (for no) and a question mark can be distributed among students. Depending on the situation, they can be asked to answer a question anonymously by holding up the cards. In principle this method shares similarities with the "A, B, C or D" technique.
- **Smileys:** This method is a gamification strategy in teaching. Cards with smileys (or the teacher with a smiling face) are produced and students are allowed, within each class, to take up to three cards. The cards entitle the students for interaction (e.g. questions, answers to other students, discussion statements). At the beginning of class, the cards

are turned upside-down on the desks. Once a student is interacting, he is allowed to turn over a card. There is a natural desire of human beings to achieve the task that is self-assigned in such a case, i.e. turning over all cards. Thereby a much higher involvement of students during the progress of the course can be achieved.

- **Online awards:** Online systems such as the Moodle system, which is in use at many universities, allow the award of badges to students. For particular achievements, such as statements in discussions, or excellent homework, students can receive badges as awarded by the teacher. This method activates the natural human desire for reward and acknowledgment and therefore has the potential to highly improve student interaction.
- **LSP Serious Play:** A teaching technique that can be used to initiate students in group working, building student teams for a future group task and in itself for students to explore their perspectives on problems (Peabody and Noyles, 2017) Based on using Lego building blocks students are challenged to build a specific structure first individually and then as a group. For each task the students are encouraged to share their interpretation of the task and resultant structure and to reflect on differences in their individual interpretation and when working as a group their ability to assign tasks and communicate goals among themselves.

It is however, acknowledged that in some cases part of a course of teaching and engaging students may involve the conventional lecture style but here also good practices can be adopted. A clear focus on the learning objectives for the session aligned with the course learning outcomes is advised. For the lecture session preparing well, considering the teaching environment, the teachers' presence and clarity of delivery, enhancing interactivity with and between students (questioning slides, mini activities, personal response systems) and gaining continual feedback during the session to assess understanding can all improve learning engagement (Race, 1999, 2007).

4.1 Problem-Based Learning

Problem-based learning (PBL) approach exposes students to a problem they need to investigate in order to design and discuss solutions (Boud & Grahame 1997). This problem should be real world and ill-structured. It has unclear goals, has incomplete information, includes a high level of complexity, may not have a clear solution and requires an interdisciplinary approach (Savery 2006; Jonassen & Hung 2008; Moore 2011). Therefore, they have to involve collaboration and decision-making process (Savery 2006). PBL can be classified into different types such as diagnosis-solution problems, decision-making problems, policy problems, design problems (Jonassen & Hung 2008). On an environmental issue the students may adopt a diagnosis-solution and decision making problem approach. For instance, the students may be asked to consider the problem of Amazonian deforestation. They will have to analyse its causes and its consequences and to define the responses to mitigate intensive deforestation. However, they will not be asked to implement and evaluate these responses.

Adopting a problem-based learning approach is not as simple as adding a new activity into a traditional curriculum. Indeed it is "Not just a method but a way of learning" (Charles E. Engel in Boud & Grahame 1997). PBL approach implicates that the learning process is pre-dominantly active. Inquiry-based and self-regulated learning (SRL) are key processes (English & Kitsabtas 2013) but not only. Another important process is the collaborative learning resulting from the

group activities (Almajed & Skinner 2016). These three processes should occur successfully in order to facilitate the knowledge acquisition, clarification and retention, the development of critical thinking and analysing. Working within a group has also additional advantages. It provides opportunity for conflicting knowledge to be revealed and discussed and for the new knowledge to be co-created. Or, developing such skills is essential in environmental studies and in our educational system where students from different university background and cultures have to interact on a specific problem.

It must be highlighted here that the way a group will understand and solve the problem will vary according to the initial group composition and the group dynamic. This aspect is not without consequences for the teaching team as sufficient flexibility must exist in order to respond to the group learning needs. Indeed PBL is often a challenge for a teacher as his role change from a specific knowledge provider to a facilitator of learning. Poikela & Poikela (2012) indicate, for instance, that the tutor should support the group in setting and structuring the problem, selecting and supporting and formulating the tasks, acquiring and integrating knowledge and clarifying the issues expressed by the group. The degree of the teacher's intervention in the group and in the individual learning can have a significant impact of their learning and their engagement.

Savin-baden (2016) discusses the opposition between scaffolding and liminality. In a problem-based learning approach the individual and the group are confronted to an ill-problem and, as such, have to experience to be stuck in the solving process and to overcome the difficult on their own. This experience is part of the learning process. But there is always a risk of disengagement and a failure of the learning. One critical issue with student-centred learning is that students have to learn to learn (Barrows and Tamblyn, 1980) and they are not used to it. Teacher can avoid this situation by scaffolding technique when necessary. Yet intervening in interdisciplinary study may be counterproductive as the teacher will naturally impose his disciplinary and thinking approach. Similarly Savin-baden (2016) discusses the issues of pedagogical knowledge and stance. The degree of intervention may vary depending of the module aims and learning outcomes, the problem to solve, the groups and the individual. Certain flexibility is thus required to adapt to specific situations occurring during the semester but the degree of intervention can also be planned in the curriculum. For instance, English & Kitsabtas (2013) propose an increase in self-regulation learning as the student progress in the activities (Figure 1). It permits for the teacher to initially frame the problem and the tasks and to guide the students in their enquiry with sufficient flexibility for creating solutions at the end of the process.

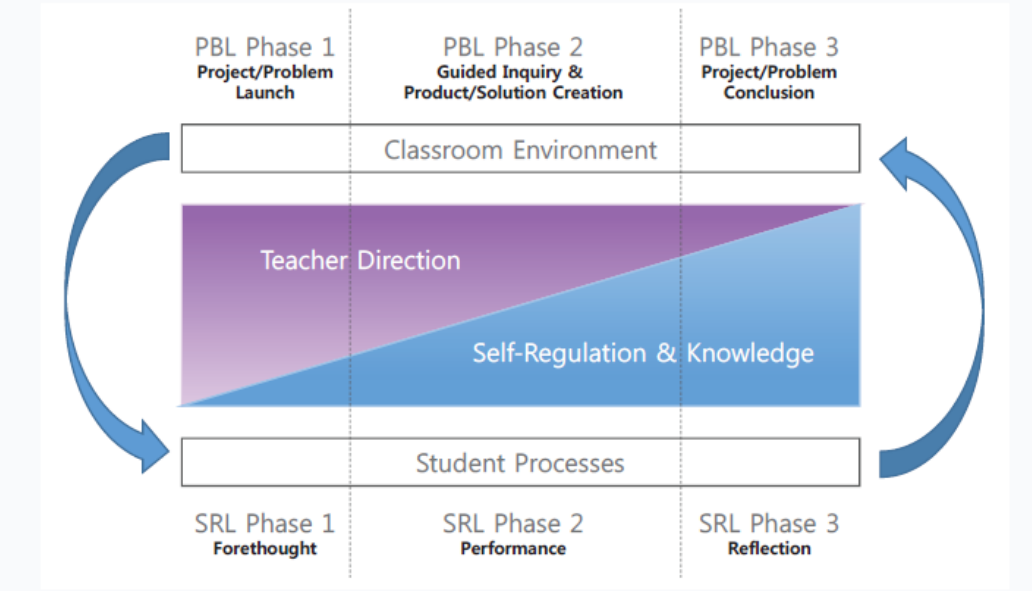

Figure 1. Progression in self-regulated learning (SRL) along Problem-based Learning (PBL) phases (in English & Kitsabtas (2013))

Practical challenges in PBL are related to the resources allocation required to support the students in their inquiries (access to data and tools) and group interaction (infrastructure outside the "learning" hours). PBL also requires more teaching hours to support the students despite a reduced lecturing time and this may not be recognized by the institution. Finally it is important for the assessment to be PBL compatible; i.e. to evaluate high solving skills, individual and group interaction, self and peer assessment (Poikela & Moore 2011). Other criteria relative to interdisciplinary studies can also be added to this list such as the integration of different disciplines knowledge in approaching the problem (Harvard University 2006).

4.2 Benefits of computer-based learning

Laurillard (2002, p126) is explicit about the importance of feedback "For the learning process to be fully supported students should receive meaningful intrinsic feedback on their actions" and elearning is a powerful mechanism for achieving this. It has also enabled skills to be introduced to the students, something that is impractical to do in a lecture or non-computer environment. The introduction of electronic elearning practicals has allowed greater flexibility in the types of data, technology and resources presented to the students. These sessions have permitted the use of maps, imagery, numerical and textual data that otherwise the student would have little or no access to. Elearning sessions have the potential to broaden the range of geographical experiences of the students, better embedding issues into a global context, as well as permitting local field-based learning.

Elearning sessions can take greater account of individual learning (Laurillard, 2002). Students work their way through the practicals at their own pace and have access to numerous resources in order to help their increase their knowledge. It can be argued that the process of learning in these practicals is much more visible. The students are able to work through a series of tasks and the consolidation and extension of their knowledge is much more transparent. Perkin (1999) argues that this is a recognised advantage of computer-based learning as opposed to more traditional teaching activities. Elearning can be designed to have elements that tailor the

experience even more to the individual student. These aspects could be as straightforward as including preferences for coloured backgrounds and text, through related style-sheets, to more involved aspects that would take account of preferential learning styles and subsequently tailor resources to reflect this. As Perkin (1999, p61) states a "good package will be able to accommodate a wider range of aptitudes and prior knowledge among the students and target the assessment processes accordingly."

4.3 Peer-led learning

As Biggs (2003) highlights that peer-group activities allow the students to discuss issues uninhibitedly with each other and follow through the processes of learning. It is important also to consider the size of group as Biggs (2003) suggests that this determines if each of the students can feel commitment and responsibility for the work.

4.4 Field-based learning (fieldwork)

Field-based learning can add some positive benefits to many disaster-related teaching and learning experiences. Fuller *et al.* (2000, p201) argue that there are two difference approaches to the teaching and practice of field-based geography 'descriptive-explanatory' and 'analytical-predictive'. The first involves a more traditional approach whereby knowledge is merely transferred to students from the teacher. Students may still be asked to collect data and information; however they will be informed about the implication of these data for the field environment. The latter involves asking the students to carry out a "directed, semi-independent investigation…[through which] to encourage students to *see for themselves and deduce for themselves*" ideas about the environment in which they are working. Fuller *et al.* (2000) argue that the value of each approach depends upon the level and experience of the students.

Pearce (1987, p36) argues that "in the best forms of fieldwork, the task does the teaching, not the teacher, based on "direct engagement" of students (cited in Pawson and Teather, 2002). Designing exercises which enable the teacher to be flexible and respond directly and appropriately to the needs of the students often have the more positive outcomes. Allowing the students more freedom and encouraging them to engage in an activity that was more 'student-led' hopes that students would be encouraged to take greater responsibility for their own learning. Fuller *et al.* (2000) recognise this as a 'key educational objective' that is satisfied through fieldwork, particularly that which is project-based. It is hoped that by setting the students a problem/goal to achieve and by arranging them into groups, they will take on this challenge and engage with the task at hand. Through field-based project activities it is hoped that students would develop a number of personal, educational (e.g. data collection, critical analysis, reflection) and transferable skills. The activity-based nature of the project fostered deeper and more independent thinking (Ramsden, 1991).

Fieldwork is also regonised as challenging the relationship between the 'teacher' and the 'learner' and being a good way in which the normal barriers between the teacher and student can be broken down enabling the students to more readily take part in exercises and learn more effectively (Dando and Weidel, 1971; as cited in Fuller *et al.*, 2000).

During fieldwork splitting students into groups can have additional advantages. If handled well, students often comment that they enjoy the element of competition involved and this can foster friendships within groups and also motivate them to work hard, be organised and do well. This notion is supported by McEwen (1996) who argues that "Competition between groups may be a useful spur to achievement and may foster enterprise skills" (cited in Kent *et al.,* 1997, p318). By adopting an approach that is closer to a real life situation reinforces the importance and relevance of the activity to the students (Livingstone *et al.,* 1998). As Livingstone (1999, p72) argues this type of project and particularly public inquiry role-playing "helps students engage with the planning process and begin to grasp that decisions are made by individuals and groups of individuals with whom they can emphasise". By providing the students with a project brief and allowing them to follow through the processes of designing and justifying a project enables students to experience many aspects of the 'experimental learning cycle' (Kolb, 1984; as cited in Race, 2007, p7). Although their activities may not fit all the cycle exactly, many of the principles are often present. It can be possible to design a project which encourages students to; gather information (*experiencing*), try out ideas (*experiencing*) and then went through the processes of reflection (*reflecting*) and refinement (*thinking and planning*). In sum, both Ramsden (1991) and Livingstone *et al.* (1998) argue that fieldwork and its active learning style promotes deeper learning experiences and increases the motivation of the students.

4.5 Negative points about lectures and large group teaching

Lectures are a very passive means of teaching and therefore student interest and attention are likely to fluctuate throughout the session (Gold et al., 1991). It is also well documented that lectures are not the most effective means of enthusing the students about the topic and encouraging them to interact with the material, a feature that is essential in order to promote deeper learning (Habeshaw, 1995; Agnew and Elton, 1998; Gibbs and Habeshaw, 2001). Students also feel quite anonymous with these large group situations (Habeshaw, Gibbs and Habeshaw, 1992) and whilst some may appreciate the ability to 'hide' within the group, others may feel lost and detached from the learning situation.

5 References

Agnew, C. and Elton, L. (1998), Lecturing in geography, Geography Discipline Network (GDN), Cheltenham, pp64.

Almajed, A. , Skinner, V. , Peterson, R. , & Winning, T. (2016) Collaborative Learning: Students' Perspectives on How Learning Happens. *Interdisciplinary Journal of Problem-Based Learning, 10*(2). Available at: https://doi.org/10.7771/1541-5015.1601

Anderson, L W., Krathwohl, D R., Eds (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman

Barrows, S.H. & Tamblyn R.M. (1980) *Problem-based learning: an approach to medical education*. Springers Series on Medical education – Vol. 1.

Biggs, J. (2003), Teaching for Quality Learning at University, The Society for Research into Higher Education and the Open University Press, Second Edition, pp309.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., Krathwohl, D. R. (1956). Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York: David McKay Company

Boud, D. & Grahame, F. (1997) *The Challenge of problem-based learning*. 2nd Edition. Routledge.
English, M. C. , & Kitsantas, A. (2013) Supporting Student Self-Regulated Learning in Problem- and

Project-Based Learning. *Interdisciplinary Journal of Problem-Based Learning, 7*(2). Available at: https://doi.org/10.7771/1541-5015.1339

Fuller, I., Rawlinson, S. and Bevan, R. (2000), Evaluation of student learning experiences in physical geography fieldwork: paddling or pedagogy, Journal of Geography in Higher Education, Vol. 24, No. 2, p199-215.

Gibbs, G. and Habeshaw, T. (2001), Preparing to Teach, Technical and Educational Services, Bristol, pp255.

Gold, J.R., Jenkins, A., Lee, R., Monk, J., Riley, J., Shepherd, I. and Unwin, D. (1991), Teaching Geography in Higher Education, Blackwell, Oxford, pp256.Habeshaw, 1995

Habeshaw, S., Gibbs, G. and Habeshaw, T. (1992), Problems with large classes: making the best of a bad job, BPCC Wheatons Ltd, Exeter, UK, pp162.

Harvard University (2006) Teaching for interdisciplinary understanding: a framework for design internal memo draft.
https://oercommons.s3.amazonaws.com/media/editor/120463/Article%20Three.pdf
(accessed 14.09.2017)

Jonassen, D. H. , & Hung, W. (2008) All Problems are Not Equal: Implications for Problem-Based Learning. *Interdisciplinary Journal of Problem-Based Learning, 2*(2). Available at: https://doi.org/10.7771/1541-5015.1080

Kent, M., Gilbertson, D.D. and Hunt, C.O. (1997), Fieldwork in Geography teaching: a critical review of the literature and approaches, in Journal of Geography in Higher Education, Vol. 21, p313-332.

Knowles, M. (1984). *Andragogy in Action*. San Francisco: Jossey-Bass

Laurillard, D. (2002) Rethinking University Teaching: a framework for the effective use of educational technology (2nd edition), RoutledgeFalmer London.

Peabody, M. A., & Noyes, S. (2017). Reflective boot camp: adapting LEGO®SERIOUS PLAY® in higher education. Reflective Practice, 18(2), 232-243.

Livingstone, I. (1999), Role playing public planning enquiries, in Journal of Geography in Higher Education, Vol. 23, No. 1, p63-76.

Livingstone, I., Matthews, H. and Castley, A. (1998), Fieldwork and dissertations in Geography, Geography Discipline Network (GDN), Cheltenham, pp50.

McEwen, L. (1996), Fieldwork in the undergraduate geography programme: challenges and changes, in Journal of Geography in Higher Education, Vol. 20, p379-384.

Pawson, E. and Teather, E.K. (2002), Geographical expeditions': assessing the benefits of a student-driven fieldwork method, in Journal of Geography in Higher Education, Vol. 20, p275-289.

Pearce, T. (1987), Teaching and learning through direct experience, in Bailey, P. and Binns, T. (eds.) A case for geography: a response to the Secretary of State for Education from members of the Geographical Association, Geographical Association, Sheffield, p34-37.

Perkin, M. (1999), Validating formative and summative assessment, in Brown, S., Bull, J. and Race, P. (eds.), Computer-assisted assessment in Higher Education, Staff and Educational Development Series, Kogan Page, London, p29-37.

Poikela, S. & Moore, I. (2011) PBL Challenges both curriculum and teaching. Chapt. 17 in Barrett & Moore (2011) *New approaches to Problem-based learning*. Routledge edition.

Poikela, E. & Poikela, S. (2012) *Competence and problem-based learning: experience, learning and future*. Rovaniemi University of Applied Sciences.

Race, P. (1999) 2000 Tips for Lecturers. London: Kogan Page

Race. P. (2007) The Lecturer's Toolkit. (3rd edn), Chapter 3: Refreshing your lecturing. London and New York: Routledge.

Ramsden, P. (1991), Learning to teach in Higher Education, Routledge, London.

Rogers, C. R. (1945). "Counseling", *Review of Educational Research*. 15: pp. 135-163

Savery, J. R. (2006) Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning, 1*(1). Available at: https://doi.org/10.7771/1541-5015.1002

Savin-Baden, M. (2016) The Impact of Transdisciplinary Threshold Concepts on Student Engagement in Problem-Based Learning: A Conceptual Synthesis. *Interdisciplinary Journal of Problem-Based Learning, 10*(2). Available at: https://doi.org/10.7771/1541-5015.1588

Weber, E. (2017). Basics in University Didactics and Academic Instruction: Teacher Training and Education. BOKU – University of Natural Resources and Life Sciences, Vienna.