HOW TO APPLY ACTIVE LEARNING TECHNIQUES

Learning through meaning

MACQUARIE UNIVERSITY

FACULTY OF BUSINESS AND ECONOMICS

FACULTY OF HUMAN SCIENCES

Contents

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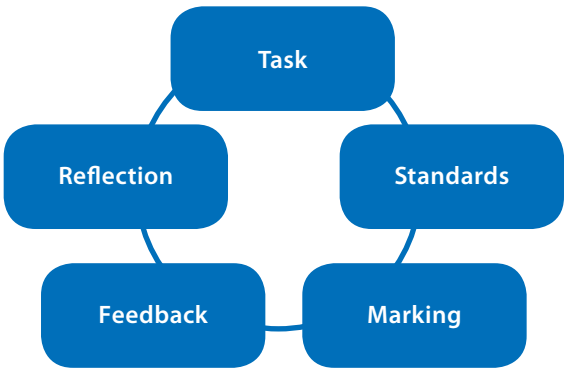
Foreword

Active learning techniques encourage – and even demand – that students become co-creators of their learning. The design of the teaching and learning activities and the assessment tasks requires students to participate in their learning.

The participatory nature of active learning may be a challenge to students (and teaching staff) who may be used to more passive forms of direct instruction. Active learning techniques can be far-reaching and may oblige students to design their own activities and assessments, or use group design.

For example, if we consider the assessment cycle below, there is opportunity to provide active learning opportunities at each stage. Students can choose or modify a task; they can set standards for the outcomes of the task; they can mark each other's work; give feedback; and reflect on the learning that was developed in the learning activity.



This guide will help you move to a more active approach to learning. There are case studies and some excellent reading materials to guide and inspire you. All of the case studies have been trialled with students, and have been successful in achieving high student evaluation and good student outcomes.

So have a look at the samples in this guide and experiment with your learning design. There are also examples of enhancing student engagement in associated guides in this series on *How to lead discussions* and *Research enhanced learning and teaching*, available at http://staff.mq.edu.au/teaching/teaching_development/resources/

Congratulations to the writers of these cases studies for their stimulating approach to student engagement and active learning.

Leigh Wood, Associate Dean, Learning & Teaching, Faculty of Business and Economics

Introduction

Active learning is … any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think about what they are doing.[1]

Active learning techniques are wide and varying; they are limited only by your imagination. The case studies in this volume provide concrete examples and practical guidelines that you can adapt to your own classroom needs. In addition, we hope you will be stimulated to develop new ideas of your own. We also hope that once you have implemented these ideas, new and old, you will share your experiences with us so that we can continue in an ever-improving cycle of effective education.

This guide is aimed at practitioners in higher education: at lecturers, tutors and educational designers. Our intention is to give you examples that you can adapt to your context immediately. You do not need to spend vast amounts of time integrating the literature, meeting with experts or planning strategic goals. We share five case studies from five educators across diverse disciplines. The case studies are all transportable to other domains and adaptable to other student cohorts. Our aim is to present simple and effective principles, techniques and protocols that you can use to actively engage students in their own learning.

The value of active engagement is well known and has been clearly established by research[2]. For example, in a study of 6,000 physics students, the conceptual understanding of students enrolled in courses using interactive engagement methods was measured at roughly double that for students in 'traditional' courses[3]. Other studies have shown even more remarkable improvements: conceptual understanding of basic physics concepts such as *force* and *acceleration* were 2–3 times better when taught using active engagement rather than traditional methods[4].

The main principle behind active learning is to directly engage student in *activities*, both mental and physical. Challenge your students to work things out for themselves and have them physically active rather than sedentary. Make them look up information in libraries; have them discuss ideas with peers; ask them to develop new approaches to problem solving; and have them constantly question their own level of understanding. In the following section we have summarised the techniques you will read about in the case studies.

Case studies: summary

Peter Keegan asks his students to choose one slide from the PowerPoint presentation of any lecture during the semester and then to expand on the content by providing up to five more slides. In this way the student is actively engaged in research and gets practical experience in delivering material.

Group work provides an enormous range of opportunities and engages students in a wide variety of skills and challenges such as communication, leadership, negotiation, conflict management and many more. Josie Lategan develops these capacities in her students using group work in which the group is responsible for delivery of a project outcome or analysis of real-world case studies. In Sham Nair's version of group work, the students' learning is greatly enhanced through *group examination*. After answering exam questions individually, students are required to really think about and defend their reasoning in a small group setting. The ensuing lively discussions certainly sharpen students' conceptual understanding!

Spence and Armand's students are required to critically appraise science-based newspaper articles. The students gain experience in 'active' (rather than passive) reading and the critical evaluation of scientific material presented to the general public. Naturally there is the added benefit that their own communication skills are enhanced in the process.

Sunny Wang's technique is to directly engage students in the design and execution of original research, in this case both as researchers and subjects. This innovative scheme allows the educators to work alongside the students as peers rather than sitting above them as judges.

We design active learning programs so that students engage in activities that require them to reflect upon ideas and knowledge claims, and regularly assess their own degree of understanding. Various techniques are presented in this guide, some of which you might wish to try out for yourself:

- discovery-based and challenge-based learning
- peer instruction
- problem-based or inquiry-based learning
- work-integrated learning.

Many references have been cited through the text that you could follow up; these are listed in the *Endnotes* section. We have also presented some extra resources on active learning techniques more generally in the section *If you want to know more*.

We wish you great success and enjoyment as you apply active learning in your own contexts and we look forward to your feedback.

Stef Savanah and Mitch Parsell
Faculty of Human Sciences

Enriching content with online **BLENDED MEDIA**

We applied active learning techniques to a third year unit in the Department of Ancient History, titled "Rome and the Caesars: From the murder of Julius Caesar to the death of Hadrian – 44BC–AD138".

We designed the unit to engage students in tasks that expose them to the cultural aspects of imperial Rome so they could learn how to understand and express themselves in relation to an unfamiliar historical context, through engaging gradually with what men and women in the ancient Mediterranean tell us about their ideas and feelings. In the case of the external student cohort, this also means learning within a new teaching environment. We wanted to give students the opportunity to channel their enthusiasm for ancient history into an understanding of the different ways in which the ancients recorded what their lives were like.

Each tutorial – campus and online – is devoted to the synchronised study of an ancient artefact, inscription, and literary text to stimulate students to share a variety of possible viewpoints. As well as weighing up a wide range of genuine ancient data in tutorial posts, students are encouraged to reflect on each activity in personal learning blogs, tutorial post and general group discussion, which combine to generate both formative and summative assessment and feedback.

There are two lectures each week live on campus that are recorded as Mp3 files. Each lecture is accompanied by a PowerPoint presentation of 15-30 slides with text, images, hyperlinks, and (on occasion) embedded video files. So far this looks like a traditional format, but the active learning comes into play when we ask students to contribute their own material to the slide presentation.

Students select one slide from any lecture as the inspiration for a lecture slide enhancement (LSE), where they provide amplification on their selected slide. Of course, we want them to emphasise political history, but we also want them to pay attention to social, cultural and economic developments by drawing on evidence from documents, monuments and the literature of the period.

We encourage students to base their selection on items included in the lecture slide presentations which are only touched on or incorporated in passing in the course of each lecture, but which piqued their interest. Then we ask them to provide (no more than) five additional slides. As you will see in the example below, assignment markers give their feedback directly onto the students' submitted slides (see Figure 2) and they also add an additional 'assessment slide' with comments and a grade (see Figure 3).

Although we require that students' additional slides conform to the format of the lecture presentation, we give our students free rein to express their own creativity. For example, slides may include:

- original explanatory and/or analytical text (in sentence or dot-point form)
- text extracts from pertinent primary or secondary sources
- images of material culture
- hyperlinked or embedded text
- audio and video content.

Examples may come from architecture, art, epigraphy, numismatics, papyrology, sculpture, and so on, with the proviso that the slides illustrate or support the explanatory and analytical text content.

Content typology is deliberately open ended to encourage a broad-based and wide-ranging approach to topic research (data collection, analysis, evaluation, and task generation). External students can discuss their experience of the LSE in the online unit learning journal and post questions about the learning activity in the online general discussion forum, or via personal email to the unit convenor. Internal students can both enter into discussion or ask questions in weekly tutorial sessions, and they may also consult with the unit convenor if desired (in person, or via email or phone).

Now let's look at an example. Figure 1 is the slide used in a lecture that has been chosen by a student as the basis for an LSE, and Figure 2 is one of the five additional slides generated by the student. Notice how the assignment marker has inserted feedback and corrections within the student's slide, using blue text.

Figure 1: Exemplar slide for LSE selected by student

The years from 23 B.C. to 19 B.C.

- Flood
- Disease
- Famine
- Disturbances of the peace

The Roman people (the *plebs*) want Augustus to be consul.

- Augustus in Parthia
- Faction-fighting in Rome
- Vacant consulship
- Rioting in Rome

The Roman people (the *plebs*) *really* want Augustus to be consul.

Figure 2: Additional slide for LSE generated by student

Disturbances of the Peace & Augustus in Parthia

- Augustus failed to stand for the consulship in 22 B.C. which led to widespread panic among the plebs and serious disturbances to the peace.
  What source(s) refer to this degree of civic unrest?
- Augustus named Lucius Sestius as his successor (Dio 53.32.8)
- Augustus travelled to Parthia regarding the return of battle standards previously lost by Crassus in the battle of Carrhae (Bunson, 416: ancient citation?).
- Rome was supposed to elect two consuls. However **faction fighting** prevented this, resulting in the **freedom of the Roman state** [I don't think you meant to say this] and also proving that old republican ways could not produce government stability
- Sestius remained without a co-consul. The plebs insisted the **consul vacancy** remain open in the case that Augustus returned to Rome to accept the position
  Source(s) for this item?

Bronze Bust of Augustus

Figure 3 is a slide inserted by the marker of the assignment, providing a grade for the task and a brief series of comments keyed to the LSE (for purposes of anonymity, the student's name has been omitted). For the LSE marking rubrics, see Appendix 1.

Figure 3: Feedback slide inserted by LSE marker

Comments and Grade

7/10

Thanks for this, [name of student]. You will find a few comments inserted throughout your presentation, which indicate where you might have provided additional information or guidance to your intended interpretation of the historical material you include.

You have enhanced my Slide # 13 from Lecture 4A in a variety of useful ways. Each of your slides identifies a particular element of the original slide and articulates additional historical information in clear point-form. To enrich the visual presentation, you have incorporated meaningful graphic images to illustrate and support your textual commentary.

At times you might have included relevant textual citations that indicate the sources of evidence for certain items of information included in your enhancement. Further, you might also have explored a few ideas in a little more depth, or at the least developed your points more fully to encapsulate everything you intended to say. In relation to the content of your presentation, I would have been interested to see further focus on the *popular* impetus underpinning the state of affairs that eventually necessitated Augustus' return to Italy and the city of Rome. Minor modification of your presentation was necessary so as to conform to accepted standards of expression.

All in all, [name of student], this is a solid Lecture Slide Enhancement, reflecting a sound degree of knowledge and understanding of the situation in Rome and abroad in the pivotal year of 23 B.C.

Cheers for now, Peter

We hope you can see from this case study how stimulating this learning activity is for students and teachers alike. The technique can be applied to almost any subject and we hope you will be able to apply it in your own courses.

Peter Keegan, Faculty of Arts

Usefulness of blended media task to enrich active learning

We designed the Lecture Slide Enhancement (LSE) learning activity to conform to and benefit from grounding in the principles of *active learning*. We believe that LSE embodies characteristics indicative of a learning activity which can be used for reflection and development across a variety of disciplines. In brief, the LSE:

- is strategically located and managed within an approved unit of undergraduate study in our course
- addresses academic, social and cultural adjustments that students may face on enrolling in a unit of advanced historical study
- provides time-relevant targeted information
- is inclusive of all campus and distance education student groups
- addresses special needs of particular groups
- makes academic expectations explicit
- includes teaching staff at a personal level
- develops required computing and e-learning skills
- recognises existing skills and experience
- is student centred rather than organisation centred
- is an integrated whole
- is part of an ongoing extended program of study
- is evaluated with outcomes and actions communicated to relevant stakeholders.

Empowered learning in microbiology through discovery-based **GROUP WORK**

In this case study we show you a practical way to implement discovery-based group work in laboratory environments, based on our experience with 200 and 300 level Microbiology and Medical Microbiology units.

In our program we empower groups of 2–3 students to both develop and tackle a research question to completion, or to interpret a case study in a self-directed, cooperative exploration. Our students have complete authority and control over their work; how and what will be carried out is determined by the group. To keep the groups focused, we conduct a weekly progress seminar which is part of their assessment. Lab demonstrators provide immediate written feedback on all aspects of the lab and group work so that these areas can be improved before the next seminar. We pay attention to several aspects including the experimental design and ensuing outcome; the depth of understanding of the task; supporting evidence for experimental results; trouble-shooting skills; time management; group cohesiveness; group communication; and presentation skills.

Not only does our approach result in highly engaged and motivated students, it also fosters a range of skills not generally cultivated in traditional methods, such as:

- Resourcefulness and critical thinking in learning (how am I going to approach, solve and/or salvage this?).
- Higher levels of conceptual understanding (self-directed discovery).
- Effective group work (time management, delivery of outcomes).
- Group interaction and communication (I am not alone).
- Logical and succinct delivery (how do I convey my message?).

In any discovery-based approach you need to manage the risk of students following an unproductive track by imposing at least some limited structure. We do this as follows:

- We give some initial direction through a very general and vague research topic at the start of the project as well as a brief interactive discussion to initiate thinking processes and discuss learning goals.
- We ask each student to take on a weekly rotating role of Presenter, Manager and Recorder in addition to a Reflector role. All leadership roles are therefore experienced by all members of a group. See Appendix 2 for a description of the roles.
- We conduct a meeting at the conclusion of each lab session to discuss all aspects of the groups as cooperative units, as well as aspects of each student's contribution to the project. This allows us to determine whether learning goals are in progress or have been achieved, and to recommend areas for improvement.
- We conduct time-limited (2 minutes) progress seminars at the end of each weekly session. This equates the learning experience to one of a real-world setting and empowers students to become decision-making individuals. In addition to acquiring an in-depth understanding of their work, time management and communication skills are greatly improved as these also become a measure of the success of the group.
- We require each group's weekly activity to be noted by the Recorder in group folders (3 pages allocated per week). The limited number of pages forces the group to express only relevant data and record their thought processes, trouble shooting and conclusions clearly and succinctly.

- At the end of the five-week period each student is required to submit a 200 word abstract based on the work. This component provides the opportunity for each individual student to contribute creatively; demonstrate their learned attributes; and be credited for their own ideas and conclusions.

To make this type of approach successful requires substantial effort. You need dedicated demonstrators willing to encourage students to think and reflect. Instead of simply providing answers, demonstrators must answer any questions with leading questions. Feedback should be in depth and address both strong and weak points of each group and its individual members. We have given a couple of examples in the boxes: Example 1 illustrates the feedback given to a poorly performing group and Example 2 that given to a successful group. We post feedback publicly online so that all learn from both the "errors" and accomplishments of other groups in the class. Importantly, feedback is not simply based on the opinion of a single marker following a restrictive guideline, but derives from the concerted comments, observations and discussions by the group of facilitators. We have found this 'facilitator/assessor meeting' to be also of great benefit for the demonstrators, as it enriches their learning experience as future educators.

In the two years since implementation of this innovative approach to learning we have found that using self-directed activities instils a sense of ownership and accountability for the work; of active engagement and of responsibility; camaraderie; and collegiality not seen in any of our conventional lab sessions.

Feedback to group – Example 1

According to all the demonstrators this group was incredibly overwhelmed by the whole experience on this first day of the project. I think the problem might lie in the inability for anyone in this group to actually go to the laboratory back bench just to find out what resources were provided as a starting point for their project. Therefore team members became very frustrated and tempers flared a little between group members. Hence the group did not progress with the task adequately. The group must revise their assigned roles particularly that of the Manager, if this assignment is to progress at all. The demonstrators felt that student J was left out of the group's discussion. Student J, the onus is also on you to speak up and demand to be heard as you did have some very good ideas but they were lost to the other members of the group. The folder notes and presentation do not reflect the same approach! Actually, they are completely different. This means that there is no discussion between the Recorder and the Presenter. Therefore, this is not a cohesive group at all. This group will need to address these concerns so that the learning goals are achieved as the project progresses. The notes in the folder must be provided in more detail so that your approach can be followed. What was the rationale for choosing the sampling sites presented? What is the classification for this body of water? i.e. secondary or tertiary activity? Project outcomes are incomplete. **2/5**

Feedback to group – Example 2

A well-managed group with each member being fully aware of their role. Group members meet to discuss then work separately to reach their planned goals and then meet again to discuss and develop their approach. The demonstrators commented that this is "such a great and dynamic group". Student R in the group was the first in the whole class to suggest transferring the BD membrane onto the Esculin agar without any prompting from us. Excellent thinking! This week's notes in the folder are both very thorough and yet easy to follow your reasoning and very supportive of your conclusions. If not done yet, please review your *Enterococcus* count from the EB agar plate. Student H, nice delivery of the progress seminar, you were stressing a bit. I did put you on the spot to answer a few questions, but I think it was just all in the stress of it because I had questioned you before and you did answer correctly, so there is no issue with your understanding of the tasks. Learning goals achieved, project outcomes delivered. Well done everyone. **5/5**

Our groups become highly focused on "getting it right" as they immerse themselves fully in their project. They demonstrate increased pre-class preparation; a questioning of the validity of their results; reassessment of conclusions; solving inconsistencies; and searching the literature for evidence that supports their findings.

In using this approach to learning never again is a laboratory session restricted to a rigid set of instructions "Add solution A to tube B and wait 10 minutes". This is learning in real time. The result is the evolution from a very restrictive mode of learning to a group-led exploration that yields inspired, proficient, decisive and problem-solving individuals able to achieve a far higher level of graduate capabilities than expected with the more traditional teacher-led exploration.

Finally, here are some comments from our students to illustrate the kinds of benefits they experienced from the group work.

- *The self-directed methodology allowed us to not be reliant on the demonstrators for answers and made us find our own. Sometimes the issue was more complicated than it seemed and made us work with new information that may have gone in the face of our current working theory. This gave an atmosphere much more like the real world, where you wouldn't be able to follow a cookbook, and simply jump to the next stage if something went wrong.*
- *The project was the best teaching component because I prefer to get hands-on experience and it got me more involved. I prefer the teaching to be more focused on application. For example, why? Rather than what. The 'cookbook' style doesn't help. I prefer to think about what I'm doing.*
- *I have learnt so much more because I had to research a lot of the work myself. If I had the chance to do it again I would have planned it better.*
- *By undertaking different roles each individual was able to work on the project through a different approach. This was very effective with the role of the manager being critical in the organisation of the group as a whole. It was an exciting, very interesting, fun and interactive approach into learning the main techniques, experimental set up and approaches in the world of microbiology.*
- *I enjoyed being a manager, presenter and recorder. All roles were beneficial to my learning style. I had to take charge of the group but I am working hard to concede that leadership to better work as a team and allow another's ideas to drive the direction of the group. Being a recorder and presenter was good practice for putting ideas coherently on paper and picking out what is important to say in seminars.*

M. Josie Lategan, Faculty of Science

Discovery-based learning

Discovery-based learning (DBL) is similar in concept to problem-based learning. The main difference is that DBL is structured around practical learning environments such as science labs. Students are required to *design and conduct their own experiments* in order to discover fundamental principles within a particular domain. In DBL, the student draws on their own past experience and existing knowledge to discover facts and relationships to be learned. Thus, for technical subjects DBL can be seen as putting theory into practice and relies to an extent on students having been pre-taught material, possibly in a traditional setting.

Research has shown that *assisted* DBL is more beneficial than unassisted DBL[5]. Since DBL is open ended there is a risk of students following an unproductive track; thus a balance must be struck between restricting students' paths of discovery and scaffolding the tasks. With DBL, students benefit from feedback, worked examples and elicited explanation when they are misconstructing.

A more recent variation of DBL, called Challenged Learning, encourages students to leverage the technology they use in their daily lives to solve real-world problems. The goal of Challenged Learning is for students to develop deeper knowledge of the subjects they are studying; accept and solve challenges; take action; share their experience; and enter into a global discussion about important issues[6]. The technologies used include extensive use of the internet for global connectivity to experts and other contributors, and readily accessible devices such as smartphones and tablets.

Group examinations in **BIOLOGICAL SCIENCES**

Most if not all teachers have attempted some form of group study in their classrooms, but have you ever considered group examinations?

Peer instruction

Peer instruction (PI) is a structured student interaction technique developed by Eric Mazur at Harvard University[7]. Its great strength lies in its ability to provide immediate feedback to lecturers in classroom environments about the level of understanding achieved by the students both before and after the learning activity. The procedure is as follows[8]:

1. The instructor presents students with 'ConcepTests' – qualitative (usually multiple choice) questions carefully constructed to engage student difficulties with fundamental concepts.
2. The students consider the problems individually and 'vote' for the correct answers such that the popularity of each answer can be determined and reported.
3. Students then discuss the issue with their neighbours for two minutes and vote again.
4. The issues are resolved with a class discussion and clarifications.

Research indicates that learning gains from PI are superior to traditional lectures and commensurate with other active learning pedagogies[9]. The main challenges in its implementation are (i) the effort required to create ConcepTests and (ii) the method of collecting votes. Free databases of ConcepTests are being collated to minimise duplication of effort, although currently these concentrate on the physical sciences[10]. Several electronic means of collecting votes in classrooms are available[11], but low-tech methods can also be usefully deployed. For example, students can vote on multiple choice answers by raising colour-coded index cards, which provides the instructor with a visual approximation of the overall level of concept acquisition in the classroom.

The concept almost sounds like sanctioned cheating, but the technique can lead to genuinely improved learning outcomes. In this case study I describe our experiences with this innovative technique and present the resulting improved outcomes. Of course there are negative aspects to this approach too, as I discuss below.

We implemented a trial of a group examination in BIOL115, a first year undergraduate unit in biological sciences that focuses on cell and molecular biology. There are no specific prerequisites for this unit, except that students must have completed science-based units at the Higher School Certificate level. The unit itself is a prerequisite for a number of second year units offered by the Department of Biological Sciences and the Department of Chemistry and Biomolecular Sciences. As such, students will develop a broad range of competencies in scientific, literacy and numeracy skills. The unit is offered in internal, external and composite (mixed) modes. In recent years, the numbers of students enrolled in BIOL115 have increased substantially, creating logistical issues, especially in the area of content delivery and assessments. Consequently, there is an increased reliance on electronic modes of lesson delivery and assessment.

There is evidence from other studies that group examinations may promote deep learning[12]. We designed our exercise to demonstrate that learning in small groups does lead to superior learning outcomes. Specifically, we wanted to examine if group examination reaps the benefits of collaborative learning (speed of learning, depth of learning, clarification of doubts, learning through enquiry) and whether the technique led the students to reflect on their performance in the context of an examination.

Group examination is a two-stage process which involves both individual and collaborative efforts at answering questions[13]. The approach we adopted in this study required students to attempt the examination first on their own. This was followed by the second stage, where students were allowed to repeat the assessment in collaboration with fellow students. We expected this would allow students to reflect on their learning through self and peer appraisals. Although students are driven by the incentive to improve their grades, collaborative examinations offer them a tangible opportunity to reflect on their deficiencies and potentially improve their performance in subsequent examinations.

The examination was multiple choice (30 questions in 60 minutes). At the end of the first stage (individual attempts), the exam papers and answer sheets were collected and the students were issued with fresh copies of the same exam paper and answer sheets. They were then allowed to gather in groups and discuss their answers to the questions. However, this time students were allowed only 30 minutes to complete their group activity. Both their individual and group attempts were marked, and the students were told that their final mark would be the higher of the two attempts. Preliminary analysis of the data suggests that most students improved their grade during the group examination when compared to their individual effort (average improvement of 31.5%).

We monitored the student discussions during the group examination and we also sought feedback at the end of the exercise. By all accounts the students enjoyed the concept of group examination. They remarked on the benefits of an 'informal' examination environment and indicated that the discussion helped clarify their doubts and approaches to answering the questions. The instant feedback that students received from their peers enhanced the retention of concepts that were assessed in the examination. The time constraint meant that student discussions were focused on answering the questions. All students who were interviewed unequivocally indicated that the activity increased their learning and understanding of the topics. They also indicated that they would form small groups as part of their learning strategies; external students indicated that they would use technologies such as Skype for that purpose. Although students had the option of not undertaking the second stage of the examination (collaborative effort), all of the students did attempt it.

There are some negative aspects to this technique. For instance, some students found dealing with conflicts to be an issue and felt that they had to come to a consensus (although it was made clear to the students that they need not accept the verdicts of the majority). Some felt that they did not want other students to benefit from their own work. Despite this, they nevertheless participated in the collaborative examination. A small group of students showed large gains in performance when individual performance was compared to their group effort. It is very likely that these students did not study for the examination, but relied on the group discussions to help them through it.

Group examinations are a novel and innovative approach to collaborative learning and self-reflection. It provides for a positive educational experience, wherein students are able to evaluate their own learning in a non-competitive environment. Based on our experience, we believe group examinations contribute to quality teaching and learning approaches.

Sham Nair, Faculty of Science

Can you believe what you read? Science in **NEWSPAPERS**

In this case study we describe an example of problem- or inquiry-based learning, in which students engage with ideas without relying on lecturer intercession[14].

Our method incorporates several active learning techniques, including group work, critical analysis of documents and peer review. We wanted a student-centred activity in which they would learn by doing. Feedback came not only from tutors but also from peers via the students making comparisons with another team's work. We planned this activity for the beginning of the course, so it was designed to be engaging but not overly demanding.

The activity was given in "Introduction to Marine Science", a core unit of the Marine Science degree. We designed it to cover critical reading of primary and secondary level literature, as well as database search and research skills. It also supports the more general aim of scientific literacy. However, the techniques are not restricted to the scientific field and you should find them readily adaptable to other subjects.

The task was group based and work was recorded in a wiki. We presented each group of up to 5 or 6 students with an article from a general newspaper, based on recent research in marine science. You need to take care in choosing news articles that are clearly written and well-structured, and that are based on accessible research at an appropriate level of difficulty. We asked the groups to use database searches to find the original published research plus two other journal articles on the same subject. They then had to compare the content and conclusions of the newspaper article with the research and produce a 400 word summary analysing the newspaper article in the light of the original and related research.

We taught the unit in two streams, in which students attended on different days each week. We gave a different article to each group within a stream, but each article was also given to one group in the other stream. The idea was to have two groups, one in each stream, working separately on the same article.

We set up the wiki with instructions as well as two pages per group: one page for organising group work, the second for producing the final report. As far as possible, the wiki was set up so that groups did not need to create their own pages, and instructions and templates were readily available. Each stream could only see its own wiki, including the pages of the other groups, at this stage. We have provided the instructions and page templates in Appendix 3[15]. Once the reports were done, each stream's wiki-based reports were released to the other stream for in-class peer analysis of the findings. This debriefing phase is important in emphasising transferable skills and continuing to question research findings[16].

Problem-based learning

Problem based learning (PBL) is a popular technique in medical schools where it has been used in a number of different countries around the world for over 50 years, but the technique can be used in any domain. Rather than presenting content, as in traditional classroom techniques, in PBL the teacher poses a problem for the students to solve, usually in groups. The main characteristics of PBL can be summarised as follows[17]:

- students explore real-world, open-ended problems
- learning is largely self-directed, including planning, implementation and evaluation
- the activities are usually conducted in small groups
- teachers take the role of facilitators
- learning outcomes emphasise not only content knowledge but also process and learning attitudes.

There are various ways to structure a PBL unit. One set of guidelines recommends considering eight tasks for students to engage in during the process[18]:

1. explore the problem
2. identify the learning issues
3. attempt a solution using existing knowledge
4. identify the learning needs
5. set goals and allocate tasks
6. individual study
7. share with the group
8. assess and reflect on the process.

PBL focuses not just on content knowledge but also fosters the acquisition of other important skills such as self-directed learning; critical thinking and reasoning; finding and using appropriate resources; communication; teamwork; and leadership[19]. A comparison between PBL and traditional teaching techniques might look something like this[20]:

Traditional teaching techniques	Problem-based learning
Instructor is a knowledge transmitter	Instructor is a problem setter and a coach
Students are passive learners	Students actively formulate their own solutions
Students apply acquired knowledge in tests	Students develop metacognitive learning strategies
Problems are well-structured	Problems are loosely structured
Learning is content based and subject focused	Learning focus is on the process of problem solving

Preparation for the activity:

- library training in the use of journal databases
- coverage in class and via readings of relevant scientific methods and their limitations[21].

Follow-up activities or variations might include:

- Asking students to include additional media resources in the wiki that explain the science or show the original data where it is available to the public.
- Requiring the students to themselves find an article to research.
- Asking the students to write a newspaper article, or produce a video or audio news report, based on published scientific research.
- Having the students re-write or edit a problematic newspaper article to be more accurate.
- Contacting the original researchers for their response to the newspaper article to compare with the students' conclusions.

We tested the activity (not using wikis) with an Advanced Biology tutorial group, which prompted an excellent discussion and great interest. The students could not believe the distortion of the newspaper article compared to the original papers that they had found. Here is what the students themselves came up with:

- Sometimes several papers could have been used as the source material. This was a great point to raise, in that the discussion was then directed towards which paper it probably was; this meant that they had to have read the papers!
- Sometimes the article was taken directly from a media release or even a website release of breaking news from an institution. This point was good for discussion as the students were surprised that journalists had been so lazy as to use a press release word for word and do no external checking.
- Some students went to the extent of searching websites for additional data or maps of the issue. Supporting materials could also be included in a wiki-based report.

In terms of marking and evaluation, it was clear to us from the trial tutorial group that some students did not bother to do anything at all, but nonetheless tried to join in the discussion. The first question was the best one: which article did you read and what did you think of it? This immediately indicated who had done what.

A wiki might help to show who has contributed, but the discussion in tutorials will also be interesting. This may result in a two-scheme mark: one for the wiki report (group mark) and another for tutorial participation (individual mark).

Finally, although too late for the Advanced Biology tutorial group, critiques of the newspaper article arrived, in response to requests, from researchers who undertook the original work. This kind of information would be useful to hand out during discussion to see if the student's views align with that of the researcher.

We anticipated the following benefits:

- Skills in critical reading of scientific articles. Students do not necessarily have skills in critical analysis of science-based articles or research. In a study of first and second year university students' interpretations of media reports of science, 'participants … seemed to have an inflated view of their own understanding'[22]. Further, 'students were biased towards truth ascription. That is, statements were interpreted with a degree of certainty higher than they were expressed.'[23]
- Lifelong learning skills – relating science to everyday life and basing social and individual decisions on critical reading of reports of scientific research. Another similar activity using newspaper reports of psychology research found that students were better able to appreciate the influences of research procedures and the limits of media reporting[24].
- Reading around the subject.
- Early meaningful practice of database and online searching.

Of course there are also drawbacks to active learning methods. The task represents a way of studying that may be challenging to many students and relies on detailed guidance. It requires students to manage group dynamics early in the course, while dealing with an unfamiliar mode of activity. The guiding questions may need to be detailed and quite leading for novice students[25]. In an activity using historical newspaper articles, Hawkins and Gildart (2010) state that 'students … will need some guidance in order to effectively use this resource'[26].

This approach could be used in any subject where students are required to evaluate research. Hanging the activity on a journalist's view of research focuses students' thoughts by way of comparison: the article offers a possibly distorted or one-sided view on which students have to make judgments supported by original research.

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Use of rubrics in translation quality **ASSESSMENT**

We conducted a case study to examine the idea that active learning techniques could be used to improve on a standard assessment model for the Master of Translation and Interpreting program at Macquarie University.

Work-integrated learning (WIL)

Placement of students at real workplaces allows them to integrate theoretical knowledge learned in the classroom with the practical knowledge available through hands-on involvement in a professional environment[27]. Commonly reported professional aptitudes resulting from practical work placements include both personal and professional skills such as confidence; collaboration; decision making; self-management; knowledge of workplace systems; workplace competencies; critical thinking; professional networking; professional behaviour; and leadership[28].

Development of course curricula needs to take into account the expected learning experiences of students within the workplace. Care is needed to ensure that workplace activities allocated to students within course curricula are realistic in order to facilitate student learning and skill development[29]. Furthermore, curricula can be made more meaningful and beneficial to the teaching context based on student feedback on field experience; for example regarding practice-based skills that were not originally included within the university curriculum ('learning on the job' experiences)[30].

Designing a fair and consistent mode of assessment for WIL placements poses some challenges. Some researchers suggest that the best outcomes result from self-reflective assessment methods such as journals, logbooks, portfolios and presentations[31].

Macquarie University has a well-established department called PACE[32] that can help you place students in the community for work-integrated learning.

This assessment model is generally referred as the NAATI (the Australian *National Accreditation Authority for Translators and Interpreters)* model. We recruited 15 students enrolled in a postgraduate unit, TRAN 827 "Research Methods in Translation and Interpreting", in 2011 for the study.

There were five stages in the study, namely:

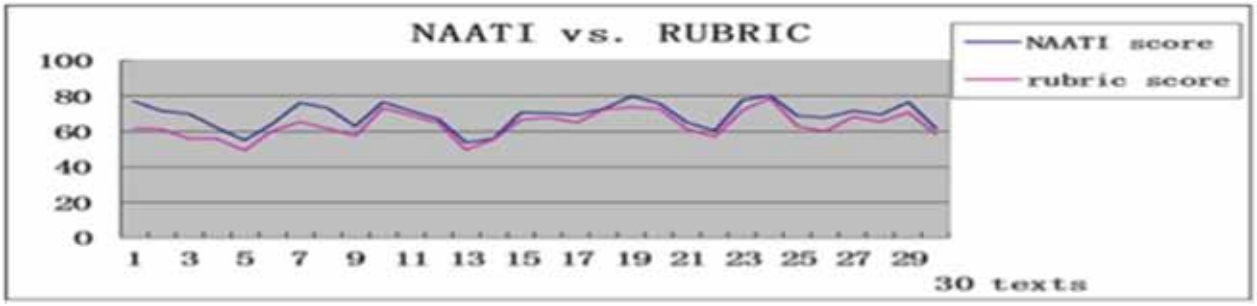
1. creation of instructional assessment rubrics
2. assessment training
3. assessment tasks
4. interviews
5. a post-assessment survey.

We applied active learning techniques to stages 1 to 3; the creation of assessment rubrics was done collaboratively by the whole group with guidance from the teacher. Assessment training allowed group interaction, and the assessment tasks included peer-assessment and self-assessment as well as teacher assessment. In addition, to test the reliability and validity of the group-constructed rubric against the NAATI assessment model, stages 4 and 5 allowed us to also investigate the student reaction to the exercise through direct feedback.

We asked our students to translate two English texts[33] (*Indigenous history of Sydney* and *Hot tea may increase risk of esophageal cancer*) into Chinese. Then we asked them to assess the translation quality of 10 versions of the translated texts (8 from peers and 2 from self), with the identities of the other students concealed. All the 30 translated texts were also assessed by one of the Unit teachers, using both the NAATI error deduction method and the collaboratively constructed rubric assessment. The results are shown in the graph.

We found a noticeable difference in the results between the two assessment models. There is a much bigger gap in the average scores between the self, peer and teacher assessment using the NAATI error deduction system (self 75, peer 69.6, teacher 62.9) than using rubrics assessment (self 68.4, peer 61.8, teacher 61). This might indicate that the holistic rubric assessment is more reliable than the NAATI error deduction method; however, notice the similar trend lines of the two different assessment methods, which seems to suggest that both assessment methods are valid in differentiating the quality of translation. These results tend to support the view that the techniques employed can indeed improve on existing assessment models. Presumably, similar results could be achieved in other domains; for example, you might use the approach to help improve the effectiveness of examination questions.

We required students to first use the rubric scorecards to do self- and peer-assessment, which were available online to group members. We then encouraged them to use the interactive resources of the online learning environment, such as asynchronous discussion boards, to negotiate the scores through exchanges of opinions. When there were disagreements on scores between group members, they could obtain further guidance provided in a much more elaborate online comment bank, which complemented the rubric with detailed explanation and authentic examples from previous translations.



The active learning techniques we applied were designed to harness the power of collective intelligence and network effects. We encouraged group members to share information and resources. For example, during the training phase students were asked to compile a 'DIY (Do-It-Yourself) corpus' of all documents relevant to the translation task, and each member allowed other members to have access to their DIY corpus. Through the interactive and open group assessment discussion, students became more aware of some potential translation problems and their own errors, and so they were better positioned to revise their own draft translation. Meanwhile, they were also ready to produce one collaborative, high-quality piece of group translation for later peer review between groups. The purposes of the task were to provide students with opportunities to see the inherent inter-subjective nature of translation quality assessment, and engage them in a collaborative learning environment of multiple perspectives[34].

Student feedback indicates other benefits from the techniques used. Noticeably, no participant thought that self-assessment using the NAATI method was reliable due to their low consciousness of their own errors. Yet, surprisingly, in terms of helpfulness to professional development, no participant responded that the assessment of their own translation was not relevant to professional development as translators; and two of the participants even thought that self-assessment by rubrics was the most helpful of all the assessment types. This positive perception might be a benefit of creating and applying rubrics to self-assessment – it is a process that facilitates students' understanding of assessment and translation quality, and thereby increases their awareness of responsibility for their own learning and performance[35].

The word 'assess' is derived from the Latin word *assidere* which means 'to sit beside'. This reminds us that in the process of assessment, teachers should not sit above students as judges in court to declare whether they are 'guilty' or 'innocent', but sit beside students as partners in teams to achieve one common goal through providing the support they need. In this sense, assessment is not simply a testing and judging (ranking) instrument, but more a nurturing and mentoring tool in the learning and teaching process. If we can use the metaphor of a journey of adventure to describe the process of learning and teaching, then creating instructional rubrics is like showing students how to make a map with clear routes to their destination; using rubrics for assessment is like providing students with information on their positions and direction within the whole picture; and generating feedback by a rubrics comment bank is like guiding students to work out the best way forward to their destination.

When staff teams can work together in developing the online rubrics and comment bank, the jointly constructed resources will not only improve consistency and trustworthiness in assessment but also facilitate efficiency in marking and providing effective feedback for students. In conclusion, using assessment rubrics in translator education is far beyond the issue of translation quality assessment; it is more about engaging students in collaborative and active learning within a framework of social constructivist assessment.

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If you want to **KNOW MORE**

If you would like to find out more about active learning theory and techniques, here are some resources with useful and practical information.

Biggs, J. (2003) *Teaching for quality learning*. (2nd edition) Buckingham: Society for Research into Higher Education and Open University Press.

Blumenfeld, P., Marx, R., Solloway, E. & Krajcik, J. (1996) Learning with peers: From small group cooperation to collaborative communities. *Educational Researcher*, 25, 37–40.

Chickering, A.W. & Gamson, Z.F. (1987) Seven principles for good practice. *AAHE Bulletin*, 39, 3–7.

Costley, C. (2007) Work-based learning: Assessment and evaluation in higher education. *Assessment & Evaluation in Higher Education*, 32(1), 1–9.

Crebert, G., Bates, M., Bell, B., Patrick, C.-J. & Cragnolini, V. (2004) Developing generic skills at university, during work placement and in employment: Graduates' perceptions. *Higher Education Research and Development*, 23(2), 147–165.

Driver, R., Asojo, R., Leach, J., Mortimer, E. & Scott, P. (1994) Constructing scientific knowledge in the classroom. *Educational Researcher*, 23, 5–12.

Gibbs, G. (1988) *Learning by doing: A guide to teaching and learning methods*. London, UK: Further Education Unit.

Healey, M. & Roberts, J. (2004) Introduction – Active learning and the swap shop. In M. Healey & J. Roberts (Eds.) *Engaged students in active learning: Case studies in geography* (pp. 1–5). Gloucestershire, UK: Geography Discipline Network.

James, R., McInnes, C. & Devlin, M. (2002) Assessing learning in Australian Universities. Melbourne: Centre for the Study of Higher Education, The University of Melbourne and The Australian Universities Teaching Committee. Available at http://www.cshe.unimelb.edu.au/assessinglearning/docs/AssessingLearning.pdf

Kolb, D.A. (1984) *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ, USA: Prentice-Hall.

Lizzio, A. & Wilson, K. (2004) Action learning in higher education: An investigation of its potential to develop professional capability. *Studies in Higher Education*, 29(4), 469–488.

Michael., J. & Modell, H. (2003) *Active learning in secondary and college science classrooms: A working model of helping the learner to learn*. Mahwah, NJ, USA: Erlbaum.

Prosser, M. & Trigwell, K. (1999) *Understanding learning and teaching: The experience of higher education*. Buckingham: Open University Press and Society for Research into Higher Education.

Race, P. (2001) *The lecturer's toolkit: A resource for developing learning, teaching and assessment*. (2nd edition) London, UK: Kogan Page.

Ramsden, P. (2003) *Learning to teach in higher education*. (2nd edition) London, UK: Routledge Falmer.

Rhodes, G. & Shiel, G. (2007) Meeting the needs of the workplace and the learner through work-based learning. *Journal of Workplace Learning*, 19(3), 173–187.

Rickard, W. (2002) Work-based learning in health: Evaluating the experience of learners, community agencies and teachers. *Teaching in Higher Education*, 7(1), 47–63.

Walczyk, J.J. & Ramsey, L.L. (2003) Use of learner-centered instruction in college science and mathematics classrooms. *Journal of Research in Science Teaching*, 40, 566–584.

Appendices

Appendix 1. LSE marking rubrics

	NA **No attempt; or the answer is copied or substantially copied (0)**	POOR **Meets some of the criteria at unacceptable level (F)**	SATISFACTORY **Meets basic assignment criteria (P)**	GOOD **Meets all requirements at a proficient (CR) level**	EXEMPLARY **Meets required criteria at a highly proficient (HD-D) level**
Knowledge of subject matter	No attempt; or the answer is copied or substantially copied	Displays only a minimal grasp of the concepts covered. Does not expand upon the central concepts	Illustrates basic knowledge of topic without applying or expanding ideas. Properly uses tutorial vocabulary	Provides new or expanded ideas about the chosen lecture slide and make a practical application	Provides new or expanded ideas that reflect high-level critical thinking about the chosen lecture slide and demonstrate practical application
Evidence of research	No attempt; or the answer is copied or substantially copied	Some research used but fails to support ideas. Uses citations with significant errors	Uses research to support ideas; properly cites research with minor errors	Research clearly connected to ideas; proper references used	Research applied to support and extend ideas
Grammar, punctuation, spelling; PowerPoint or Open Sourceware (OS) presentation	No attempt; or the answer is copied or substantially copied	Substantial errors with weak sentence structure. Uses PowerPoint (or OS) ineffectively – irrelevant images; unrelated text	Minimal errors in grammar, punctuation and spelling. Uses PowerPoint (or OS) – some relevant images; descriptive text	Minimal errors. Varied sentence structure. Uses PowerPoint (or OS) efficiently – relevant images; supporting text	Absence of errors. Uses PowerPoint (or OS) effectively – relevant images; instructive text
Addresses the assigned topic	No attempt; or the answer is copied or substantially copied	References chosen slide but does not address relevant issues	Indirectly responds to chosen lecture slide	Directly responds to chosen lecture slide	Directly responds to chosen lecture slide, provides additional insights
Originality	No attempt; or the answer is copied or substantially copied	Random original thoughts; no cohesion among ideas presented	Alludes to an original idea but with no clear connection to the chosen lecture slide	Evidence of original thought apparent throughout with a reference to the chosen lecture slide	Evidence of original thought apparent throughout; clear application of historical understanding

Appendix 2. Group work – instructions for students

Here is an example (highly condensed) of the set of instructions describing the roles. These are provided in the folders allocated to the student groups at the beginning of the project.

Group allocation template:

WEEK	PRESENTER/REFLECTOR	MANAGER/REFLECTOR	RECORDER/REFLECTOR
1			
2			
3			
4			
5			

Each member of the group will receive the group mark. Every week the group is to work together on a research project – investigate, discuss, reflect and present. Each member of the group is to take on a different role for every week of the project.

Main and auxiliary responsibilities of each role

WEEK	PRESENTER/REFLECTOR	MANAGER/REFLECTOR	RECORDER/REFLECTOR
Main	Contributes to the design and presents the weekly seminar.	Manages time for activities; delegates and ensures all necessary work is completed. Manages roles of group members. Facilitates discussion.	Records all laboratory work in the folder provided. Collects folder containing assessor feedback three days after the laboratory session.
Aux	Participates in laboratory work. Reflects and contributes to discussion.	Participates in laboratory work. Reflects and contributes to discussion. Contributes to the design of the weekly seminar.	Participates in laboratory work, reflects and contributes to discussion. Contributes to the design of the weekly seminar.

Objective of the assignment

General objective – an investigation for the presence of faecal organisms in environmental waters.

Instructions

Every week each student in the Presenter role will be required to deliver a progress seminar (total of 4 seminars). This seminar – together with your folder notes depicting your group activity, results, approach, design as well as including the demonstrator's and tutor's assessment of group in terms of cohesiveness, extent of understanding of the task, ability to discuss the topic, presentation skills, etc. – will make up 5% of the total mark for the project (total 25%). A 200 word abstract containing the approach, results and conclusions for the group work must be submitted by each student at the end of the project (week 5). This will be assessed as an individual contribution (5%).

Appendix 3. Wiki learning task

Part A – Condensed wiki instructions

(hyperlinks removed)

Assessment Activity 1.

The links to the pages you need to work on are below:

- your article on Sea Ice
- your team and timeline: Article 1 Team
- your findings and where you work on your final report: Article 1 Report.

To add to any page, click on the 'Edit' tab. The pages we have set up for you should be enough, but to create a new page simply place two square brackets before and after the new page name, save, and click on the ensuing link to create a new page. To link back to an existing page, put the page name between pairs of square brackets.

Instructions

To start, you must identify your team members and responsibilities. Some of you may have more than one task:

- Project manager:
- Style editor:
- Fact checker:
- Reference searchers:

The team must:

- Provide a list of tasks and the timeline for when they are due posted in the wiki at their first meeting.
- The team must contribute together on the answer to Task 5 below.

Your tasks are to:

1. Identify what the article suggests are the main points (max 3).
2. Find the original source of the information (using principally keywords, author name, and maybe journal name, consider the date) in the article by using a **research database search**.
3. Critically examine the three points asserted by the newspaper article and compare it with the source information.
4. Find two other scientific journal articles on the same topic published in the last two years by using a **citation index** such as:
   - *BIOSIS Citation Index*
   - *Web of Science or Knowledge*
   - *Scopus*
   - *Google Scholar*
   - Think about using the advanced option on your search to delimit your search: e.g. publications in the last 2 years, the use of keywords on the original article.
5. Using all three articles, write 400 words on the accuracy of the newspaper article's account of the original published science and whether other recent science supports one side or the other.

Part B – Wiki report template

(hyperlinks removed)

Responsibilities and Timeline in this group are found on the page: Article 1 Team.

Return to Instructions on the page Article 1 Group.

Format this page (or an additional page if required) as you think will illustrate your findings best. Below is a very basic example.

Background

- Original source for article.
- Found using the database.
- How the article differed from the original source.
- Other articles found using various citation indexes.
  - Two best articles selected by the team.

Report

(Max 400 words)

Part C – Wiki team page

(hyperlinks removed)

TEAM SEA ICE consists of:

- Project manager:
- Style editor:
- Fact checker:
- Reference searchers:
- Other personnel:

TIMELINE FOR TASKS:

- Provide a table of tasks, who's responsible and the date they are agreed as due and posted in the Wiki.

Go to your Team's Article 1 Report.
Return to Instructions on the page Article 1 Group.

Endnotes

1 Prince, M. (2004) Does active learning work? A review of the research. Journal of Engineering Education, 93, 223–231.

2 Michael, J. (2006) Where's the evidence that active learning works? *Advances in Physiology Education*, 30, 159–167.

3 Hake, R. (1998) Interactive-engagement vs. traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics,* 66(1), p. 64.

4 Laws, P., Sokoloff, D. & Thornton, R. (1999) Promoting active learning using the results of physics education research. *UniServe Science News*, available at http://sydney.edu.au/science/uniserve_science/newsletter/vol13/sokoloff.html

5 Alfieri, L., Brooks, P. & Aldrich, N .(2011) Does discovery-based instruction enhance learning? *Journal of Educational Psychology,* 103(1), 1–18.

6 See The Innovative Scholar (2011) *Discovery, problem and challenged based learning*. Available at http://innovativescholar.com/2011/04/21/discovery-problem-and-challenged-based-learning/

7 See Mazur's own description online at http://mazur.harvard.edu/research/detailspage.php?rowid=8

8 Redish, E. (2006) *Peer instruction problems: Introduction to the method*. The Physics Suite. Available at http://www.physics.umd.edu/perg/role/PIProbs/

9 Fagen, A., Crouch, C. & Mazur, E. (2002) Peer instruction: Results from a range of classrooms. *The Physics Teacher*, 40, 206–209.

10 Project Galileo, see http://galileo.harvard.edu/

11 Redish, E. (2006). *Peer instruction problems: Introduction to the method*. The Physics Suite. Available at http://www.physics.umd.edu/perg/role/PIProbs/

12 Hartley, C.A. (2011) *Group examinations as an engaged learning supplement to individual examinations*. Effective Learning Strategies Forum. Available at http://commons.aaahq.org/files/c7979ca39a/ELS_Hartley__Individual_and_Group_Exams_AAA_Annual_2011_Commons_Post.pdf

13 Cortright, R.N., Collins, H.L., Rodenbaugh, D.W. & DiCarlo, S.T. (2003) Student retention of course content is improved by collaborative-group testing. *Advances in Physiology Education*, 27, 102–108; Stearns, S. A. (1996) Collaborative exams as learning tools. *College Teaching*, 44, 111–112.

14 Hawkins, R. & G ildart, K. (2010) *Promoting the digital literacy of historians at the University of Wolverhampton using nineteenth century British Library newspapers online*. Available at http://www2.warwick.ac.uk/fac/cross_fac/heahistory/resources/cs_hawkins_digitalliteracy_20100426.pdf

15 On reviewing Hall and Seery's (2006) approach (see next footnote), the task may be revised to use worksheets of questions to structure inquiry, as provided in their appendix. Their students complete the questions before meeting as a group, encouraging in-depth analysis.

16 Hall, S. & Seery, B. (2006) Beyond the facts: Helping students evaluate media reports of psychological research. *Teaching of Psychology*, 33(2), 101–104.

17 Kwan, A. (2009) Problem-based learning. In Tight, M. et al. (eds.) *The Routledge International Handbook of Higher Education* (pp. 91–108). New York: Taylor & Francis.

18 Woods, D.R. (1994) *Problem-based learning : How to gain the most from PBL*. McMaster University, Canada: Woods Publishing.

19 Kwan, A. (2009) op cit.

20 Shepherd, A. & Cosgriff, B. (1998) Problem-based learning: A bridge between planning education and planning practice. *Journal of Planning Education and Research*, 17, 348–357.

21 Ibid.

22 Norris, S., Phillips, L. & Korpan, C. (2003) University students' interpretation of media reports of science and its relationship to background knowledge, interest, and reading difficulty. *Public Understanding of Science*, 12, p. 139.

23 Ibid., p. 125.

24 Ibid., 123–145.

25 Hall, S. & Seery, B. (2006) Beyond the facts: Helping students evaluate media reports of psychological research. *Teaching of Psychology*, 33(2), 101–104.

26 Hawkins, R. & Gildart, K. (2010) *Promoting the digital literacy of historians at the University of Wolverhampton using nineteenth century British Library newspapers online*. Available at http://www2.warwick.ac.uk/fac/cross_fac/heahistory/resources/cs_hawkins_digitalliteracy_20100426.pdf

27 Collin, K. & Tynjala, P. (2003) Integrating theory and practice? Employees' and students' experiences of learning at work. *Journal of Workplace Learning*, 15(7/8), 338–344.

28 Dreuth, L. & Dreuth-Fewell, M. (2002) A model of student learning in community service field placements. *Active Learning in Higher Education,* 3(3), 251–264.

29 Bates, M. (2008) Work-integrated curricula in university programs. *Higher Education Research and Development*, 27(4), 305–317.

30 Beeth, M. E. & Adadan, E. (2006) The influences of university-based coursework on field experience. *Journal of Science Teacher Education*, 17(2), 103–120.

31 Boud, D. & Falchikov, N. (2006) Aligning assessment with long-term learning. *Assessment & Evaluation in Higher Education*, 31(4), 399–413.

32 Participation and Community Engagement: see http://students.mq.edu.au/opportunities/participation_and_community_engagement/

33 The two texts were originally created by Ms Helen Slatyer, who used them for the TRAN 827 group research project on self, peer and teacher assessment of translation in 2010. Thanks for her permission to use the texts for this study.

34 Kiraly, Donald C. (2000) *A social constructivist approach to translator education: Empowerment from theory to practice*. Manchester, UK: Saint Jerome Publishing.

35 Robinson, B., López Rodríguezy, C.I. & Tercedor Sánchez, M.I. (2006) Self-assessment in translator training. *Perspectives: Studies in Translatology*, 14 (3), 115–138.

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- keep your students engaged and motivated?
- improve your students' conceptual understanding?
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