

# Teaching Surveying: What is important?

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## SUMMARY

Much has been published on the topics of teaching and learning. Conferences and journals often report on teaching and learning innovations and I look forward to learning about them at this conference. In contrast, this paper goes back to the basics and addresses several questions about what is important when teaching surveying. Focussing on students and their learning is important, but here I intentionally focus on teacher-centred matters not the whole of the field of education. A list of twenty important aspects of teaching is compiled and discussed in brief without resorting to educational jargon. Some of the questions discussed include: Does teaching need to be innovative? Are university teaching and learning strategic plans useful? Many other questions are included in the paper to encourage readers to think about their teaching.

Whilst educational researchers have good reasons to suggest teaching methods should be based on research and evidence, this paper is an opinion piece based on experience. It is not a report on research into Teaching and Learning or a review of the literature. Instead, the list of important aspects of teaching surveying is kept simple so that it might be considered by academics who are new to teaching surveying or who are not currently passionate about teaching. The list and discussions might also assist surveyors who supervise new graduates and current students.

Teaching is more than merely providing copious information for students to remember or absorb. It is proposed that the important aspects include: the teachers' attitude to teaching and to their topic; preparation; knowing the students; variety; involving students; respect; assessment; feedback; rewards for the teacher and the longevity of the teacher; technology; efficiency; improvements; group work; enabling understanding and depth of learning; and supervision methods. Some examples of the applications of these ideas to surveying education are included. Further examples can be obtained from discussions with the author.

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## 1. INTRODUCTION

This paper accompanies a brief flash-mode presentation and is about getting back to the basics of teaching and focuses on the teacher's activities. The purpose of this paper and presentation is to commence a discussion rather than to give a lecture so that other teachers of surveying can think about this topic and suggest or add their own important thoughts or examples. This paper does present material, so it is not merely a teaching workshop where you feel you have contributed by discussions but perhaps gained little.

Education experts say teaching should be evidence based (don't just teach the way you think will work) and often they prefer to focus on the learner. The following list is based on my studies of effective teaching of surveying. The list is somewhat ordered according to my personal ranking of priorities, with the more important first. I have been teaching for more than twenty years in courses on least squares, introductory surveying for surveyors and as service teaching for other engineers, advanced surveying for specialise projects, survey camps, surveying computations, computer programming, and several other courses.

At universities surveying teachers often decide the curriculum, they teach, set and mark the examinations and decide who passes and fails. There may be independent overseers but it is a larger responsibility than most secondary teachers carry.

One way to learn about the principles of good education is to attend courses and workshops. Another way is to read some good educational literature. My suggestion is to start with at least one of: Angelo (1993), Brown and Atkins (1988), Brown (1978), or Gibbs and Habeshaw (1989). Alternatively you can reflect on your own experiences and combine the best of your own ideas and those of the experts.

While a prerequisite for teaching is to have some students to teach, it is even better to have students who are interested in your course (subject, paper). Currently there are some university programs (degrees) struggling to enrol sufficient students to be able to produce enough graduates to meet the profession's and the community's needs, but that is a topic for another paper.

## 2. IMPORTANT ASPECTS OF TEACHING SURVEYING

### 2.1 Attitude

The teacher's attitude to teaching is, in my opinion, the most important aspect of good teaching. With the right attitude most of the rest follows. In my opinion the right attitude is that teaching is important and that it is worth devoting time and effort to do it well. My main

goal as a teacher is to **give** students something in every class. The ‘something’ may be useful, or interesting, or motivational, or something that improves their understanding or ability. It is probably more important for students to learn something in a class than to be entertained even with relevant case studies. If you feel teaching is a chore, or students use up time you want to spend on other things, then you are unlikely to be a good teacher.

Remember your experiences when you were a student, or better, be a student again for a short while. That might be an incentive to be a good teacher.

## **2.2 Explain**

How well a teacher can explain a topic or concept is very important. But when you do explain something to a student, don’t ask them if they understand because they might say yes, even when they don’t understand. Instead, to get useful feedback, ask students to do something that will demonstrate how well they understand or at least get them to explain the concept back to you but in different words.

For clear explanations a teacher or surveying supervisor needs to:

- know exactly what they want to explain and what the student should know about the topic;
- structure the explanation by emphasising key points and connect various sections together;
- use simple questions to focus attention on what you want to explain;
- state each key point or principle briefly, without the fine detail of elaborations and qualifying statements;
- use examples or illustrations;
- repeat the key points using different words;
- listen, don’t just talk.

To give good instructions or explanations think about the task, try to make explicit the automatic and spontaneous procedures, and try to anticipate and clarify any ambiguities a listener might have. The best instructions are "custom made" for the listener.

## **2.3 Prepare**

Prepare for your classes. Classes and materials for students are just as important as presentations and papers at international research conferences or for grant applications. Be aware of the environment you set in class. Do you intimidate them, humiliate them, bore them, excite them, fill them with confidence or interest? Anxious students perform badly. Enthusiasm, interest and motivation are key elements. Are you so busy with other university matters that you don’t get enough time to think in depth about your teaching? An example of good preparation occurs when teachers get the equipment or software well before class and use it themselves. They may also write instructions for student use when new equipment or new software is purchased. If you haven’t used the latest version of the software or haven’t

used the GPS or total station since last year then how are you going to debug students' problems as they use them?

Reflection and feedback are important parts of preparation. Soon after a class or while marking exams and assignments, think about what happened and how it might be improved, then make some notes or changes to your materials ready for next the next time you teach that class (next year?).

## **2.4 Know your students**

Students are not all the same; they are not a homogenous group. They may have different interests, motivations and backgrounds and learn differently to each other and to the teacher. Mature students learn differently to younger students. Overconfident students often do not see a need for the supervisor to be present to point out any errors or problems in their work.

Some students may be reluctant to ask their teacher questions. They may be shy, they may not want the supervisor to think they are incompetent, or they fear it may affect their assessment.

Learning is more effective when students' prior experience and prior knowledge are recognised and built on. So if you know that some of your students have work experience in surveying, draw on that in your classes. The other students also benefit from the diversity of those experiences. Some students with work experience may be overconfident, or they may apply short cut methods in cases when they should not be used. Getting those students to "unlearn" something can be a challenge for a teacher. But remember that some of your students, especially in the first year classes with students directly from high school, may not understand or know some of the concepts and terms that you take for granted. For example, a student may seem to know how to use a handheld GPS for navigation purposes, but may think that it transmits a signal if he gets lost in the bush. The teacher will not know this if they do not carefully observe students and seek feedback from students.

## **2.5 Variety**

Use a variety of teaching methods and materials because students learn in different ways and their learning can be better supported by the use of multiple teaching methods and modes of instruction. Also vary your methods because attention span is limited. Have short breaks, stop talking and ask them questions, get them to do something, change your type of display (talking only, blackboard, computer screen, video, cartoons...), or motivate them by showing the importance or relevance of the topic. Sometimes you can develop a climate of inquiry where students feel appropriately challenged, and activities are linked to research and scholarship. Such activities, that are interesting and challenging are often enjoyable, so they can enhance the learning experience.

## **2.6 Involve students**

Learning is effective when students are actively engaged in the learning process. Allow students some role or responsibility for their learning. For example, they design the survey in the field practical, or they choose the essay or assignment title, or which topics from a list to teach in the course/subject. Consider peer or self assessment as a way to involve students in their education. One way to improve on your previous year's lecture is to add questions for students, or things for students to do, into your lecture.

When students are encouraged to take responsibility for their own learning, they are more likely to develop higher order thinking skills such as analysis, synthesis, and evaluation. Inspiring students and fostering meaningful learning requires truly connecting with them. This involves lecturers in more than just selecting which Powerpoint slides to use. If the teacher lectures by just reading slides and the slides are on the internet, students wonder whether it is worth attending.

Students also become more engaged in the learning process if they can see the relevance of their studies to professional or personal contexts. So ask them questions about how the topic might relate to their future work projects. Also, describe case studies of your own survey projects, or those of your graduates, or those of other surveyors, that relate to or apply the topic of the current class.

Encouraging and allowing students to reflect (think about their learning) allows them to explore their experiences, challenge current beliefs, and develop new practices and understandings. Some teachers ask students to submit written journals of these reflections.

Students may lose attention in lectures quite quickly. One way to sustain students' attention and enhance their learning is to break a lecture into manageable components. You can intersperse material with activities for students to do based on the lecture material, such as tackle a problem or discuss a question in small groups. Give students time and opportunity to ask questions and create an atmosphere that invites questioning and student participation. Perhaps use a provocative question to capture students' interest.

If talking between students and teachers and among students (in and out of class) is encouraged it can improve student motivation and their involvement (engagement) can be increased.

It is especially important for tutorial classes (which usually have fewer students than lectures) to involve students. It is sad to see a tutorial where the teacher talks most of the time, or merely presents worked solutions of problems to students.

## **2.7 Involve yourself**

It is important for teachers to attend tutorials, laboratories, field classes and to do marking (or at least some of the marking in very large classes and some of the classes if they are run several times on each topic) so that they get feedback on their students' learning. It is not

good, in my opinion, for a professor to give a lecture and get an assistant to do all the tutorials and marking.

Should a teacher run a tutorial like a lecture: stand out the front and merely write worked solutions to calculation problems on the board? Or should students be doing the problem solving themselves? I much prefer the latter and find a good way to do this is in a computer lab where the teacher walks around the room, looks over students' shoulders at the monitors as the students work and helps them individually. There are ways to do that remotely but I prefer to be in the lab with them.

Allowing students to learn from their own experiences is a valuable teaching method. However, simply watching students work can be boring and unproductive for the teacher or supervisor. So the supervisor may need to seek questions from the students or be involved by doing some of the survey task with them. If you have time for some one-to-one teaching, try being the student's field hand and observe her actions, or listen as you get him to explain to you some concept or how to do something.

Where the teacher and student work together the teacher should resist the temptation to solve the problem for the student. It is better to offer several solutions and let the student choose. The teacher must balance between too much and not enough supervision. When students have plenty of talent, teachers should keep out of their way. A disadvantage of working closely together is that when a problem arises or when making a decision, students may ask for help instead of thinking for themselves and testing their idea by trying it. One effective method is to have the student perform the role of surveyor and the teacher to perform the duties of the assistant (as well as watching the student's actions).

A teacher who doesn't get involved may prefer to wait for students to ask for help, may lack confidence in their own ability to help, may prefer to use the time more "productively" or on another activity, or may simply find the supervision or teaching unrewarding.

## 2.8 Aims and objectives

What are the aims and objectives of this particular lecture, or of this whole course? It is worth taking the time to think about that question for our classes. It is a question universities like to ask their teachers. Hopefully the university requirements for documenting those matters do not become a chore. Students should gain **more than knowledge and skills**. So don't just fill students up with information to memorise. Relate new information to their existing knowledge. Some students try to memorise instead of developing understanding and professional level abilities in problem solving etc, but the teacher's actions can affect their style of learning. Show them the whole picture: where does this part of the field practical or lecture fit into the whole course; why is it being done?

Design an engaging and relevant curriculum because clearly articulated learning outcomes and course requirements increase student motivation and improve learning.

Teachers need to think about the question: what are we trying to teach? Various employers of our graduates have a variety of requirements. When survey tasks involve applying facts, rules and procedures to 'straight forward' problems then a student needs technical training. For example, a supervisor would talk and demonstrate while students listen, read and study. The supervisor can then watch a student attempt the problem, detect any errors and show the student what is correct. Do we want to produce surveyors who can only use the instruments, do the calculations and drawings or do we want more? Do we want students to think, be creative, and perhaps find better methods? For example, boundary definition surveys have standard implementation rules, but there is considerable discretion on how they are performed.

When a survey task is an unusual case with no standard solution surveyors have to improvise, invent and test their own strategies based on experience in other tasks and experimentation within this task. Value judgements may be required. The range and variety of past experiences help to make a surveyor successful at solving new tasks. Each new task, and reflection on it, adds to this repertoire. So teachers (or supervising surveyors) help students learn to work competently in situations where there are no right answers or where standard procedures are not applicable. This means that to 'think like a surveyor' students need to learn not only facts and methods but also forms of inquiry (research, trials, testing, thinking) to be able to develop new methods to solve individual problems. Students also need to appreciate the standards, care and attention required of professionals.

When 'surface' learning students remember a lot of information. When they are 'deep' learning students understand concepts and become able to analyse and solve problems. I think it is important for students to learn at least some topics in considerable depth. For example with digital levelling if a student is taught and can understand how the instrument reads the bar code staff and determines the height reading - the correlation process - they will know more about the effects of focus, lighting and shading on the staff and other aspects. This is preferable to just learning how to choose a menu option and assuming the instrument is sending out a signal like an EDM. There should, of course, be much more breadth to a surveying degree than learning only about measurements (as in this example) and calculations. We don't have time to teach everything in depth, but it is vital that some topics are treated in depth. So the aim is for education not just training; understanding, not just information by rote learning - memorising.

## **2.9 Respect**

How can a teacher cope with or deal with a student who is disrespectful, behaves badly or unfairly, puts little effort into their learning or is otherwise unpleasant to deal with? A general answer is to try to gain their respect, let's hope that such problem cases do not happen often.

Earning students' respect can take time, but is very valuable. There are cultural differences around the world, so not all students automatically respect their teachers. For the teacher, a good attitude to teaching and a good knowledge of the subject and how to teach it, help build respect. We need to start again with each new first year class, but once respect is gained it can

make a huge difference to students' attention and behaviour in class, to their attempts to cheat, or their attendance or submission of assignments on time. It also affects the way they talk to you and respond to your requests. Teaching the same students in several successive courses (and survey camps) over the length of their degree becomes easier once their respect is gained.

## **2.10 Assessment and feedback**

Assessment and feedback are major topics in educational literature; here are a few brief thoughts on them. Tasks like assignments and exams which are assessed (marked) will receive the most attention by students. Those task unassessed such as optional tutorial problems will often be ignored. But beware of too much assessment which overloads students. Remember students have other demands on their time and energy, not just your subject. Too much workload may encourage students to learn superficially, or to ignore some topics, or to cheat.

The more anxious the students are, the more likely they are to cheat or plagiarise. It is the responsibility of the student not to do so, and it is the responsibility of the teacher to design assessment in a way that minimises the opportunity to cheat and reduces student anxieties. Some ways to do that are: not having one exam or submission worth almost 100% of the course mark; not giving all the students the same data to process or the same topic to write about in assignments; including supervised formal examinations; giving students the opportunity in some cases to submit drafts or their assignments or lab/tutorial work or to resubmit assignments after being given feedback.

When classes are small it is possible to give students individual feedback on their assignments and exams. They usually appreciate and benefit from their teacher going through their paper with them pointing out errors or weaknesses, and how things could be improved.

## **2.11 Survey camps, practical classes and group work**

Surveying degrees have a long history of including field classes and survey camps. Survey camps usually involve students living and working together for about a week and are held off-campus. They provide more learning opportunities than on-campus classes or work experience and they also help develop an good atmosphere or spirit within the student group and their school. Schon (1990) discusses the use of these 'practicums' in the education of professionals. They are artificial, simulated approximations of the real world that have the essential features of a survey practice. They usually take a lot of effort to prepare properly. They often simplify the problem and avoid some real world pressures, constraints and distractions. Students experiment at low risk and there is a variable pace and focus of work. Student actions can be reversed, repeated or improved and errors corrected. But a survey camp/practicum fails if it overloads students or if it leaves out too many important aspects of real world practice.



Survey camps and field classes usually include the best aspects of group work because the tasks can not usually be done by an individual. Group work is effective when the task requires more than one student to be able to do the task. One example is the design of a control traverse network to determine where to place marks and how to take the measurements. If it is a task like an assignment report where one person could do all the work then groups may not be effective. Learning cooperatively with peers - rather than as individuals or in a competitive way - may also help students to develop interpersonal, professional, and cognitive skills to a higher level.

This type of teaching can also effectively involve learning by doing as part of a cycle - *think* about underlying theory, *plan* and design the task, *experience*/do the task, *reflect* upon the experience, think about the underlying theory ... So beware of students blindly following supplied instructions for a practical field class. Have briefings where you explain what you want to do and why, **and debriefings** where you discuss what went well, what didn't, what they would do if they were to do that task again. Such an approach is good practice for field classes, survey camps, computer laboratory classes, assignments and projects.

Problem-based and/or project-based learning have been well documented in Engineering and Surveying educational literature. Survey camps usually include project-based learning and problem-based learning. An example of a task at a survey camp is to determine the volume (and its  $\pm$ ) of a conical water tower. Student groups design their own measurements and analysis methods to overcome site constraints and other issues.

Finally, I suggest that when redesigning degree programs that survey camps are retained in the program, because good camps are worth their cost.

## 2.12 Rewards for the teacher

“Good teaching is its own reward”. High quality teaching and learning and the welfare of staff and students are often key elements of a university’s mission. One of the rewards of teaching is knowing that it is a fundamentally important activity for society and for the individual students. Other rewards are the satisfaction of doing a good job, getting good feedback from students and from other staff who use your materials or methods, getting awards or titles or salary increases. However being ‘rewarded’ by being promoted to a position where you do less teaching may not be so good for students. Whenever a good teacher gets given an extra administrative or marketing task because it is somehow related to students, then this is hardly a reward for good teaching – it might just reduce the time they can devote to their teaching. Do your students have a culture of applauding a lecturer after a particularly good lecture (not counting the courtesy applause given to guest lecturers)?

Changing a university culture that focuses on and rewards research performance as its main priority is not easy. But individual teachers can still try to do good teaching even if they are not rewarded or worse, are penalised for spending ‘too’ much time and effort on their teaching.

### 2.13 Longevity (length of quality service) of the teacher

New teachers can be enthusiastic, but what if their enthusiasm and attitude fades after some years? How can we keep a teacher interested in the topics they teach or to keep improving the way they teach over time? One way is to do research into, or development of, some of the topics. For example, I wrote a Least Squares textbook and Least Squares network analysis software. Having my own software - even though there are plenty of alternatives - allows me to modify it when required to assist students' learning, and to know what is happening inside the program when a student gets an unexpected problem while using it. Another thing I do is to continually update my class materials to incorporate new technology or new case studies. Even traditional courses like basic survey computations can benefit from updates. I think it is important for a teacher to keep improving their methods and materials each year, not just to be spectacularly good for the first few years with innovations and energy but then to tire. If you don't change methods and materials then teaching might become boring. Apart from first year surveying textbooks there are not many up to date texts on senior surveying courses. That presents an opportunity for teachers to get active and keep interested in their topics.

I recommend teachers visit other universities that teach Surveying. The aim is to observe and discuss some of the best aspects of their teaching and learning in action and possibly demonstrate your best teaching ideas. If you collect some of their material or methods then modify and customise them before use at your university. Do not just collect PowerPoint files and assessment questions. It is important to collect ideas on their use of active learning methods and teaching that is student-centered. Also, observe their student assessment methods and standard of submissions (e.g. assignments, laboratory exercises and examinations).

Of course, teachers need to keep up to date technically with the use of instruments and software, but they also need to do real surveys from time to time to exercise their problem solving skills. This can also provide case study material for classes. Doing research, listening to professional surveyors' seminars, attending research conferences and reading journals also form part of a teacher's currency and longevity as a **good** teacher.

### 2.14 Efficiency

One of the best ways to be more efficient, without reducing quality of education, is to involve students in their own learning. A teacher should not treat a student as "cheap labour", but a class full of students can produce useful material for use by other students in the following years. For example, you could have them prepare or present teaching material for their peers and future students, involve them in self and peer assessment, get them to do 'data' collection (measurements, library and web searching) that can be used by next year's students. Use the results of students' work, for example get them to transcribe a guest's lecture or make tutorial questions, or use the students' exam answers as parts of worked solutions for future students. If they submit assignments can they be combined to make a large project as part of a teaching or research or community project? Consider getting students to write the course textbook or study notes or summary (perhaps via a wiki).

Another efficiency for teachers is to encourage students to help each other, but not cheat – they know the difference. Good students, who can easily complete their task, will learn even better if they can teach their peers as well as doing the job themselves.

## **2.15 Technology and Innovation**

Some, but not all, teaching innovations are technology based. Learning can be enhanced and independent learning skills developed through appropriate use of information and communication technologies. Over the last thirty years teaching technology has changed often. Which technologies have you tried? What will be next?

Too much of any one technology can be boring - remember variety is important. A change of teaching technology can be interesting and motivating for the teacher, and novel for the students. It can also be a chance to refresh, edit, update and improve existing teaching material and methods, but it can be time consuming, so some care needs to be taken to ensure the results are effective and worth the investment. Make sure the technology is applied for educational results, because, for example, some PowerPoint presentations are horrible. In my opinion, it is effective to speak to a diagram, photo or map but it is **not** effective to read all the words that are written on a text filled slide.

Examples of the application and evaluation of technology in the teaching of surveying such as computer based learning and educational games are given in Harvey (1997) and Harvey (1994). One measure of the success of an application of technology is whether other teachers adopt the products of the technological development. Otherwise the success of the product may be due more to the developer's enthusiasm and interest than to the inherent nature of the product.

What is more important, the innovativeness (how new) or the quality of the teaching? In general, I support the funding of innovative Learning and Teaching projects but I think we also need to improve some of the traditional aspects of campus based teaching. Video or audio recordings of lectures help, but the student is not able to ask questions and get immediate answers. On campus classes should be worth the student's travel and attendance time. If their teachers are supplying class material on the web or writing worked solutions to problems on the board, and students can read them quicker that way, then the teachers should be "value adding" in the class time. I like to see students doing things in class - individually and/or groups as appropriate and having dialogue with their teachers. Also, the teachers can show their enthusiasm and emphasise parts of the material, that may be lost by just reading downloaded files.

## **2.16 Evaluation of teaching and learning**

How do you know if, or when, your teaching is good? If teaching is good, then it will be very rewarding and the feedback will be loud and clear. Your students will be learning, and you can see that when you mark their exams and assignments. Employers of your former students will tell you, and graduates will do well in their careers. Good teachers sometimes get asked

by students for help in other courses not their own, and asked for help by their graduates - their learning doesn't stop at the end of the final year of their degree.

Of course, surveys of student satisfaction will be conducted for each course and perhaps other staff will be consulted for their opinions. But students may not realise how well they have been taught until many years later. A problem is that some students may reward a popular personality or someone who sets straightforward assessment tasks - but have they really learnt much?

A useful evaluation of educational material and methods is that they are successful if students and other staff choose to use them and continue to use them, and do not just rely on the initial enthusiasm of the person who produced them. Generally this evaluation test takes years to conduct properly.

### **2.17 Future-proof education in Surveying**

In Harvey (1998) I discussed how university teachers can prepare graduates to be the new generation of surveyors. If students are only trained in technical skills their training will probably become out of date. One approach is to foster general skills in students' education as well as specific technical skills. General skills are those that may be transferred when a surveyor's career path changes. Examples of general skills for surveyors include problem solving, numeracy, communication, technology usage, knowing how to learn, time management, self evaluation and self reliance, general business skills, critical thinking, and being able to work effectively in teams or independently.

Another approach is lead them to practise life long learning. Good university teachers have always thought about educating students in a way that considers they will be working for many years after graduation and will use changing technology for new applications. To prepare for changes people have tried to predict which technical skills may be useful in the future - not always with success. Perhaps graduates have to be capable of teaching themselves how to use new technology.

### **2.18 On the job training and work experience**

On the job training has a long tradition in surveying when Master Surveyors individually trained their pupils. Harvey and Weatherby (2001) discuss ideas for current surveyors on how to teach their new recruits on-the-job. The ideas are also useful for academics who supervise thesis and research students.

Students who work over long vacations, work a day or two per week during term, whose fathers are surveyors, who have survey technician qualifications, or who have worked for some years prior to entering university, learn by being exposed and involved in the process of doing surveys. However, the quality of training is the essential element, not merely the number of years of experience. Ask students what they have learnt, not simply what they have done. Documenting their thoughts in a journal or report clarifies and preserves them.

The work should involve thinking about what they have done (reflection) and discussion with others. One way to get students to reflect more is to ask them to think of alternative methods or improvements. If there is more than one supervisor for a job then students should hear the discussions between the supervisors about the survey.

Another way students can learn about surveying is by working on their own. Learning on their own by, for example, leading a field party or managing a project, allows students to experiment, forces them to solve their problems and to take responsibility for their work. However, it also means many things they learn may be 'reinventing the wheel'. Students need to learn to detect and correct their own errors. Students may not realise that there are better ways to do the task than the way they have chosen, and a remote supervisor may not notice some weakness or flaws in the student's work.

Work experience can build students' confidence but beware of students who become overconfident and are reluctant to add checks to their work because they think they do not make mistakes.

### **2.19 Reflection by students and by their teachers**

Competent professional surveyors and teachers improve by thinking about the processes involved, by doing unusual surveys or trying alternative teaching methods, as well as hearing about the experiences of other professionals. If we can teach students to think about (reflect on) their actions then they become reflective practitioners. The thinking builds their knowledge base, skill level and ability to practice. Reflection is the accumulation of survey wisdom, not merely information.

As well as getting students to reflect on their actions and supervisors to reflect on their mentoring, there should be discussions between supervisor and student and between students, especially about the unusual, difficult or controversial aspects of the job and about alternative ideas.

### **2.20 Learning and Teaching Plans, Course Outlines, Graduate Attributes**

Universities and their departments commonly prepare Learning and Teaching Strategic Plans. These are well intended and present strategies to lead the development, implementation, monitoring and continuous improvement of teaching and research training programs. These plans might include answers to questions: How do we get staff interested in teaching? How do we reward good teachers? and What should we do with staff who are not good teachers? But who reads these documents apart from their authors? Who benefits if they are not read or if their proposed actions are not implemented? Perhaps they should be written by a person who has no interest or skill in teaching; they might then learn something by the process!

Universities often require their teaching staff to prepare documents for course outlines and graduate attributes - the qualities and skills the university hopes its students will develop as a

result of their university studies - and graduate capabilities statements for their courses (subjects). Perhaps we should also investigate and document the performances and achievements of graduates years after their graduation. These documents are important but are they written merely for university or accreditation purposes? If the requirements are too strict, too regimented, or seen as a chore then a lot of damage might be done to the teachers' motivation.

What attributes do we want our graduates to have? Universities and professional societies often list the attributes and include abilities to apply knowledge with in-depth technical competence, communicate effectively, identify and solve problems, function as an individual and in teams, with the capacity to be a leader, and the capacity to undertake lifelong learning. Are these attributes addressed in our courses or do we hope someone else does it in their part of the degree? Do we place too much emphasis on technical skills and not enough on the broader roles of the surveying profession? Are we sufficiently considering community and global concerns, ethical conduct, sustainable development and environmental issues?

### 3. CONCLUSIONS AND RECOMMENDATIONS

One way to learn about the principles of good education is to attend courses and workshops. Another way is to read some good educational literature. Alternatively you can reflect on your own experiences and those of your peers, or even combine the best of both your own ideas and those of the experts. To improve your teaching, remember the good and bad features of your learning. However, people learn in different ways; what was best for you may not suit everyone. All students have some ability and knowledge use it and build on it.

No teacher or supervisor will ever be perfect, but this paper has suggested ways to improve the quality of teaching. These ideas can be summarised as a simple list of the section headings, but I believe the attitudes of teacher and student are more important than following a list of recommended methods. Professional teachers provide support, encouragement, positive feedback and enjoy a rewarding role. It is important for teachers to want to be good teachers and to keep improving, it is not so important for them to be popular, well liked or good entertainers.

Students learn by experience but they learn more by thinking about (reflecting on) what they are doing - before, during and after. Students learn from their mistakes, but only if they are aware that they have made a mistake and know how to avoid it next time. A teacher, or surveyor in a supervisory role, can assist by showing a student what mistakes they have made, or demonstrating better survey methods, by asking the student to demonstrate what they have learnt, and by working with the student on some tasks.

There are different methods of teaching, each or a combination of them, is appropriate for different contexts because students are not all similar - they learn in different ways. So include a variety of methods. Gibbs and Habeshaw (1989) say: "There is no **one** way to teach effectively" - "see if it works for you".

#### 4. REFERENCES

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