Research on college teaching and learning: Applying what we know[1]

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What can research tell us about the way college students learn, and how we might teach to maximize learning effectiveness? In fact it says a great deal, and offers useful insights from a surprising range of international sources and methodological approaches. It is a daunting task to distil what is known into a short list of guiding principles that might facilitate instructional decision-making, curriculum planning, and classroom practice. But unless and until we try to apply the knowledge derived from relevant research, we run the risk of teaching and promoting learning in ways that owe more to tradition than effective practice. And if we fail to apply this knowledge, the current interest in learning will not move beyond talk to action, which would be a tragedy we cannot afford.

Right from the beginning we must recognise that all learning is self-directed -- in the sense that no-one can learn on behalf of another. Learning is an inevitable and natural human activity, and takes place in a wide variety of contexts and through many different agencies in addition to formal educational institutions and professional teachers. At the same time, teachers do make a difference, especially through their role in motivating students, providing guidance on learning strategies, offering feedback on students' performance, and generally serving as "validators" of students' own learning efforts and accomplishments.

The following set of precepts is derived from research on post-secondary education in a variety of countries (Australia, Europe, and Asia, as well as North America) and which uses different methodological approaches (quantitative and qualitative, individual empirical studies and meta-analyses, cultural studies as well as psychological research). We have paid particular attention to research conducted in college and university settings (as contrasted, for example, to work with young children or animals), and suggest that these precepts should be at the forefront of our thinking as we plan curriculum and implement instruction.

Motivation and Engagement. Learning is most effective when there are intrinsic rewards for the learner, for example in terms of skill mastery, self-development, or self-esteem. This in turn implies regular and helpful feedback from the teacher (see the precept on feedback and practice). Effective learning requires student engagement and application to a learning task, and stimulating such engagement is one of the greatest challenges for teachers. Teacher commitment and enthusiasm seem to promote student engagement, though it also appears that there are many different ways to communicate such commitment (apart from a flamboyant lecture style, for example), both in the classroom and beyond.

Active Learning. The greatest responsibility of the teacher is not the communication of subject-matter content, but the selection and design of appropriate learning tasks. Mastery and transfer are most effective when the tasks set closely replicate those that the learner will encounter in life and work situations beyond

the classroom. In other words the tasks must be created or adapted to fit the subject matter, the learning context, and the particular learners being taught.

Practice and Feedback. Learning a skill, whether physical (playing a sport or a musical instrument) or cognitive (effective problem-solving and decision-making) requires practice, with provision of constructive feedback on how well the task is being performed so that change and improvement can take place.

Modelling. Learning sometimes takes place vicariously, or by example. Hence students can learn through emulating a model – in the direct sense by imitating a teacher's skill performance (the basis of apprenticeship) and indirectly by taking on general attributes of the teacher (for example, through role modelling). Although a good deal of learning can occur through watching a demonstration by an expert, in most cases observation alone is not enough, and learning will require more explicit analysis of the steps involved in the task, coupled with supervised practice that provides feedback on task performance.

Transfer. An underlying assumption of higher education is that knowledge and skills learned in the classroom will transfer to a range of situations in the outside world. For this to occur effectively it is important that students have practice applying their learning in situations similar to those they will encounter elsewhere ("situated learning"). Transfer can also be negative in the sense that cook-book prescriptions for analysing and solving problems may be applied inappropriately. The ideal learner is one who has the flexibility to select and adapt from a range of approaches, especially when encountering a novel situation or problem. But, in turn, flexibility will

develop to the extent that it is encouraged by teachers.

Teacher-Learner Interaction. There is considerable research demonstrating that personal interaction between teacher and student can have major positive effects on cognitive development. Reasons for this are not completely clear, but it seems plausible that one-on-one interaction gives important feedback to the learner, perhaps promotes reflection about learning, and may serve as a type "validation" for the learner's accomplishments.

Workload. A number of studies indicate that, although the typical amount of academic work done by students varies considerably (from student to student and in relation to the learning context), most learners have an upper limit to the hours they can or will commit to study. Increasing workload seems to have a negative impact on the *quality* of learning. For example, very high student workloads seem to be associated with shallower learning approaches. Another aspect of workload involves the level of difficulty of the learning task (discussed further in the precept on assessment), which has to balance the need to challenge learners against the risks of discouraging best effort.

Assessing Student Work. Assessment seems to be most effective when it is done fairly frequently, when feedback is provided quickly, and is constructive (in the sense that it points the way to change and improvement in task performance). To use assessment as a way of motivating students, the assignments we set have to be sufficiently challenging to demand effort and creativity, while not so hard that most students will simply give up prematurely. Making assessment tasks unreasonably difficult (more "rigorous") is generally

counterproductive for the majority of students. There is also evidence that offering student some say in how they are assessed (e.g. by offering a choice of assignments) encourages more engagement with the task and leads to deeper learning.

Self-Evaluation and Reflection. One problem with most assessment is that it is something that is "done to us" rather than part of everyday learning. The skill to honestly appraise our own work, and that of others is an important life skill that is required in many work settings. Such self-evaluation also serves as a source of reflection about our own learning approaches and effectiveness, which can allow us to be strategic and change our learning methods when circumstances demand it.

Individual differences in learning. There have been many attempts to develop measures of "learning style" – for example, visual versus verbal, "thinking" versus "intuitive", and so on. But is not clear how teachers can address individual needs while trying to maximize learning for a wide range of students. At the same time, alerting students to possible differences in style can be a way of making learning processes more explicit and encouraging reflection about learning. Allowing students some choice in assessment tasks also enhances opportunities to demonstrate learning in different ways.

Learning Approaches. The way that students approach learning or conceptualize their own learning goals has been the topic of extensive research over the past two decades, and has contributed substantially to our understanding of teaching and learning in higher education settings. Most researchers distinguish between "deep" and "surface" approaches, also known as a "meaning orientation" as contrasted with a "reproducing orientation". Learning approaches are thought to be more malleable than learning styles and, sadly, there is evidence that the design of learning experiences may actually encourage a move to more surface learning, largely because of the nature of most assessment tasks (exams and tests).

Learning Climate. The broader context within which learning takes place has been found to influence the quality of learning in college students. For example, deeper learning is associated with more student-centred teaching, clear learning goals, some choice in what is learned and how it is assessed, a positive social climate, vocational relevance of courses, opportunities for personal contact with the teacher, and negatively related to heavy workload and undue reliance on didactic classroom instruction (as opposed to encouragement of individual study beyond the classroom).

Peer Learning. Traditionally, higher education has emphasised individual learning and individualised assessment that encourages competition between students and discourages collaboration. However, in most life and work situations, many important tasks involve learning, and this usually requires team work and cooperation. Despite some faculty scepticism, there is considerable evidence that learning from peers is more effective than learning from formal instruction. One way of preparing students as lifelong learners is to encourage team learning, for example by introducing cooperative exercises in the classroom, or team projects that can be done outside. The benefits of team work can be substantially enhanced when students are involved in assessment of both the product and process of cooperative learning, including the contributions of fellow team members.

Technology and learning. On the whole, the effective use of technology in education has been driven far more by learners than by teachers or institutions. While technologies such as television and computers have had a profound impact on culture and behavior, it can be argued that their impact on college teaching has been only indirect. In contrast, technology has profoundly affected the way students study – think, for example, of the effect of the Xerox copier, word-processors, and the Internet. When considering use of technology for teaching, it is important to clarify our educational goals and ensure that they are in fact served by the technologies we employ. Otherwise there is a danger that technology will largely serve to replicate traditional methods that have been found to be ineffective.

Lifelong Learning. Because of the rapid rate of change in work and society, advocates of lifelong learning have argued plausibly that a major goal of higher education should be to teach generic learning skills or "learning how to learn". This implies that the *process* of learning may be even more important than just *what* is learned (learning content). The effective lifelong and life-wide learner will have available a variety of learning strategies that can be applied in new situations. According to this view, learning itself is a skill, and teachers can help students develop it. This implies that learning processes should be made as explicit as possible for learners, subject to examination and discussion in the classroom, and that student reflection about their own learning should be encouraged as an important way to effect self-understanding ("metacognition"[2]) and improvement.

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[2] A learner's understanding of the learning strategies being used and ability to make appropriate decisions about learning.

Self-Directed Learning. Although teachers and learning context can have a major influence, intentional learning is not inevitable, and individual learners have ultimate responsibility for what and how they learn. The best way that teachers can contribute to this process is to provide an environment that allows learners some control over their own learning environment, which appears to enhance motivation and engagement, increase learning effectiveness, and encourage more self-direction and autonomy.

The purpose of this short paper is to organise what is known about learning into a set of short but practical precepts. Overarching principles help us see what is best established and most important in this vast domain of research on learning. However, like a living organism comprising many separate parts and systems, learning too operates not discretely, but as an interconnected whole. These precepts, although presented separately, in fact overlap, depend on each other, and frequently operate conjointly. The relationships between them are dynamic: they evolve and change within individual learners, with different learning tasks, and as teachers intervene and seek to manipulate them successfully. This is a very complex process and not one that is easily undertaken, but it demands our best efforts at articulation and understanding because learning is the central function of education.

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