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Research Findings on University Teaching Methods

This paper is a synopsis of university teaching methods whose effectiveness is supported by research findings, as presented by Entwistle (2010). The book is in the CETL Library (see References below).

Skills vs. Knowledge and Understanding

Teaching methods are too context-dependent for one general approach to work in all subject areas. However, it is reasonable to expect to find certain general principles of teaching and learning to guide effective practice within subject areas. Research can offer a conceptual framework and detailed findings to guide the way we think about teaching and learning in specific contexts (p. 16).

For skills mastery, behavioural psychology has given us the effective practice of varied repetition (of practiced actions that are systematically rewarded) in contrasting circumstances and reward through prompt feedback about relative success (p. 20).

For knowledge and understanding, cognitive psychology shows that gaining attention is critical. Learning involves an interplay between short term and long term memory. Attention-getting in teaching seems to be a matter of creating learning events which trigger episodic memory (where events are stored) and long term semantic memory (where concepts are stored) together. Effective teaching methods use mnemonics, illustrations, and anecdotes to take advantage of important cross-links between the two. Neurological research indicates that aroused interest puts neurons on "stand-by" and the complex linkages and neuronal pathways are experienced as memory and understanding. Repeated use of connections (repetition, application activities) results in myelinisation, insulating the links within a neural network, making it more efficient. The experience of understanding or mastering a newly established skill produces a feeling of wellbeing from chemicals released in the brain, reinforcing the skills or understanding (p. 21).

> "By spreading activation, the conscious mind summons information from the store of long-term memory … and holds it for a brief period in short-term memory. During this time it processes the information … while scenarios arising from the information compete for dominance. As the scenarios of consciousness fly by, driven by stimuli and drawing upon memories of prior scenarios, they are weighted and modified by emotion … which animates the neural networks created by spreading activation that enlarges imagery and engages emotion" (Wilson, 1998, 119, 121-123, 126).

Universities must move beyond skills acquisition to help students acquire personal understandings of underlying principles and fundamental concepts and ways of thinking germane to their discipline in order to have learning that lasts and sets them up to be successful in a complex, fast-changing society and workplace (p. 43).

Strike a Balance in Outcomes-Based Education

"While there is benefit to some degree of mastery of instrumental knowledge, the danger of an over-reliance on tightly specified outcomes under the auspices of quality assurance is that it [negatively] affects the quality of learning that then takes place" (p. 19).

"Subject matter that is construed, constructed and presented in instrumentalist, technical terms will facilitate … [equivalent] outcomes, effective for the mastery of key skills and competencies. In contrast, learning that requires the development of higher forms of knowledge and knowing, entailing transformation of perspective and worldview, relies on more sophisticated views of subject matter and of learning" (O'Brien, 2008a, 151).

Interplay between the Big Picture and Details

When it comes to approaches to learning, consider holists vs. serialists. Deep learning depends on alternation between the two processes as students examine the implications of evidence in detail and also the patterns of interconnections which relate ideas and concepts (Pp. 24, 25). Research shows deep learning is related to incorporating the big picture and detail, relating ideas, using evidence, having an interest in ideas, having intrinsic motivation, and a view of learning as transforming, not reproducing. Students learn better when they take greater responsibility for their own learning (self-regulation) and make an organized effort (p. 25).

Psychological studies show that prior knowledge, general ability, and fundamental personality traits affect outcomes in learning, but are not very amenable to change after adolescence. However, specific abilities, self-confidence, interest, motivation, and learning strategies also affect outcomes in learning but are affected by university experiences (instructors can influence these). (p. 25)

> "…a disposition to understand for yourself in academic study, involving a symbiotic relationship between learning strategies and the confidence to use them effectively, a willingness to put a concentrated effort into reaching a personal understanding of academic topics, and also an alertness to possibilities for learning provided within a learning environment and to opportunities for using understanding thereafter. Such a disposition involves a continuing inclination to engage with learning so as to reach a personal understanding, and yet it can be stimulated, systematically encouraged and supported through the teaching and learning experiences provided." (p. 26).

"Conceptual learning depends on students being able to discern the critical features of a concept or topic, and the relationships between those features, simultaneously" (p. 26). The difference between "discerning" and "being told" is critical. The features must be experienced, and the way to experience them is to experience how they vary.

To improve the quality of student outcomes from learning, students must be made aware of the target level of understanding and how that understanding can be achieved. They need to be made aware of the experience of learning about the topic (the teaching and learning techniques being used and why

they are being used, what they are intended to accomplish). Students need opportunities to recognize the significance of different perspectives through carefully varied tasks and explicit discussion of a concept's critical features (p. 27).

Approaches Across and Within Disciplines

There are some common approaches across disciplines, such as: the need to validate knowledge either against observations in the physical world or against a consensus of scholarly interpretations; a search for coherence or internal consistency among evidence and arguments; and critical or analytic thinking in reaching interpretations of evidence.

Teaching methods need to be customized to fit the discipline. Approaches need to fit the ways of thinking within the discipline e.g., physics: highly theoretical and abstract; engineering: very practical; psychology: inference. There must be a discussion with students about the nature of ways of thinking in a discipline and the way in which conclusions are validated (p. 30).

Do teachers present a subject in terms of how they see its structure and meaning, or do they also recognize the value in making that knowledge accessible to students at the stage they are currently in? Is the approach teacher-focused, content-oriented, student-focused, or learning-oriented (p. 31)? Think of three overlapping knowledge bases—subject knowledge, the range of teaching methods available, and how students learn their subject. The nature of the subject area affects how instructors think about pedagogy (p. 31).

The main differences in approaches to teaching are related to whether the instructor sees the subject as broadly integrated or a series of discrete packages (p. 31).

Specific Effective Teaching and Learning Techniques

Threshold concepts tie basic concepts together and require big shifts in thinking about the subject on the part of students and in pedagogical thinking on the part of instructors (p. 33). Peer instruction à la Eric Mazur (misunderstandings or problem areas are used as teaching and learning opportunities) is an effective tool in dealing with threshold concepts (p. 34). Concept maps that make hierarchical relationships between concepts explicit are also useful in this context. The success of concept maps depends on engaging the cognitive activities involved in developing personal understanding (p. 34).

Problem-based learning using authentic problems (not textbook, by-the-book teaching) (p. 43) encourages students to take responsibility for their own learning and think critically and deeply about abstract concepts in relation to everyday problems (p. 34).

Linking the nature of the knowledge in the discipline (its "inner logic") to the specific set of methods most likely to work in that discipline helps students learn (p. 36). Instructors should think critically about the nature of their subject area and make explicit the ways of thinking and practicing that they want students to acquire, and then identify threshold concepts which can open up the subject for students but often presents a (temporary) stumbling block (p. 36).

Students learn better if they have (or can develop) intrinsic interest, have a willingness to invest effort, and monitor the effect of their learning and studying processes, while being alert to opportunities for developing their deeper understanding (Pp. 37-38).

Assessment is the main driver of study behaviour and students' approaches to learning (p. 42). Assessment activities that are open-ended, encourage engagement with the topic, and require personal understanding align with deep learning. Multiple choice formats encourage surface learning. A combination of multiple choice questions that require application of concepts and short answer questions that require conceptual understanding work well (p. 42).

Students learn better if there is support for individual learning: meetings with individuals and small group tutorial classes, and discussion of students' developing understanding. As resources decline, online materials and timetabling of small group sessions may help with this.

To be set up to succeed in today's world, students must be made aware of what is needed when facing new challenges, be able to monitor their own thinking processes and task execution, and recognize opportunities in their environment that can help them. They must have a sufficiently sophisticated understanding of knowledge and learning and the disposition to seek deep learning (p. 43). Deep learning includes thinking critically about evidence and looking for links between new ideas and previous knowledge that integrate understanding into knowledge objects (mental models that interpret and act within the domain). It helps if they can develop "throughlines"—critical thinking practices that help see underneath different perspectives, compensate for bias, etc.

References

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