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Learning and Teaching Theory for Engineering Academics

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Teaching is as a set of processes and procedures used by the teacher for the purpose of making learning happen. Traditional teaching is based on a premise that the teacher causes learning to occur and students are regarded as tape recorders or empty vessels that need to be filled with information. However, employers require graduates who have ability to think creatively and to make independent decisions based on available knowledge and evidence. To get creative individuals with critical thinking, new teaching methods are required that enable shift from one-way transmission of information from tutor to students (passive learning) to the student centred learning approach in which the student takes the initiative (active learning).

‘Learning-by-doing’ promotes student initiative and effective learning. We remember 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we see and hear, 70% of what we say and 90% of what we say and do (Metcalf, 1997). If not retrieved, information received through the sensory register is lost in less than a second, either through spontaneous decay or entry of new data. The longer information is retained in the short-term memory, the greater the chance that it will be transmitted to the long-term memory. The data are transferred to the long-term memory through the learning process consisting of four stages (Kolb, 1984): (1) Concrete Experience; (2) Reflective Observation; (3) Abstract Conceptualisation and (4) Active Experimentation. As shown in Figure 1, the cycle is continuous process with concrete experience being the basis for reflective observation, which allows generalization and development of new concepts. The concepts are then tested in new situations, which lead to more concrete experience. Honey and Mumford (1986) have identified four types of learners, each having a different preferred way of learning.

Lecturers need to adopt approaches to teaching that enable students who have different learning styles to learn effectively. This means that versatile teaching methods have to be implemented to ensure that the learning is accessible to the largest number of students. It is especially important in science and technology based fields. This lecture will give an insight into different teaching methods practiced in the Chemical Engineering Department at Loughborough University for the purpose of developing student creativity and promoting different learning styles.

\[ \text{Activist} \]
\[ \text{Concret Experience} \]
\[ \text{Active Experimentation} \]
\[ \text{Reflective Observation} \]
\[ \text{Abstract Conceptualization} \]
\[ \text{Theorist} \]

Figure 1. The Kolb Learning Cycle (Kolb, 1984) with the linked Honey and Mumford Learning styles (Honey and Mumford, 1986).

References