PROBLEMS AND SOLUTIONS AT THE STAGE OF INNOVATIVE DEVELOPMENT OF SCIENCE, EDUCATION AND TECHNOLOGY.
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ACTIVE LEARNING

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Annotation: Active learning is an approach where learners participate in the learning process by building knowledge and understanding. In schools they will usually do this in response to learning opportunities designed by their teacher. This article discusses active learning methods.

Key words: active learning, school, information, teacher, children, methods, students, instruction.

For learners to make sense of new information and ideas, they need to make links with existing knowledge, so that they can process and then understand new material. This sense-making is an active process which can take place during a wide range of learning activities. It can be contrasted with a passive approach to learning in which the teacher primarily talks 'at' students and simply assumes they will make sense of what is said without needing to check.

Active learning requires students to think hard and to practise using new knowledge and skills in order to develop long-term recall and a deeper understanding. This deeper understanding will also enable learners to connect different ideas together and to think creatively, once the initial knowledge base is secure.

What is the theory behind active learning?

Active learning is based on a theory of learning called constructivism, which emphasises the fact that learners *construct* or *build* their understanding. Jean Piaget a psychologist and founder of constructivism, researched the cognitive development of children, observing that their knowledge was individually built up, bit by bit. In the process of making meaning, children replace or adapt their existing knowledge and understanding with deeper levels of understanding.

Learning happens as knowledge moves from short- to long-term memory and is incorporated into progressively more detailed and sophisticated mental models called schemas or schemata. Schemata can be thought of as categories we use to classify incoming information.

The theory of social constructivism says that learning happens primarily through social interaction with others, such as a teacher or a learner's peers. One prominent social constructivist, Lev Vygotsky, described the zone of proximal development (ZPD). This is the area where learning activities should be focused, lying between what the learner can achieve independently and what the learner can achieve with expert guidance.

Scaffolding describes the support a student or group of students receive as they work towards a learning goal. The idea of scaffolding was developed by cognitive psychologist Jerome Bruner researching oral language acquisition in children. Grounded in

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social constructivism, the process of scaffolding 'enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts'. Scaffolding learning is important to secure new knowledge and/or skills but equally, support should be withdrawn over time and when appropriate, to allow students to develop independence.

The revised Bloom's Taxonomy offers a classification of the types of knowledge and cognitive processes students use in order to learn. Active learning approaches will help students develop at every stage of Bloom's Taxonomy; it will enable learners to engage with the more complex cognitive processes such as evaluate and create, and build a knowledge base that begins with, but is not limited to, factual knowledge. For example, to develop metacognitive knowledge students need to be actively involved with, and aware of, their own learning.

What other terms are associated with active learning?

Other approaches and terminology which are associated with active learning include those listed below. These ideas were influenced by educators in the early 20th century such as John Dewey and Maria Montessori who advocated a child-centred approach. It should be noted that there is variation in definition and use of terms by different authors and some aspects may conflict:

Student-centred, or learner-centred learning, where students play an active role in their learning, with the teacher as an activator of learning, rather than an instructor. Inquiry-based, problem-based or discovery learning, where learners learn by addressing and posing questions, analysing evidence, connecting such evidence to pre-existing knowledge, drawing conclusions and reflecting upon their findings. Experiential learning, which broadly describes someone learning from direct experience.

What are the benefits of active learning?

Active learning builds both knowledge and understanding which students can then apply to new contexts and problems.

Active learning fosters students' learning and their autonomy, giving them greater involvement and control over their learning and giving them skills of life-long learning. This will also allow learners to develop their metacognitive thinking.

Active learning does not necessarily require small classes or high resource input. It is tempting to think that active learning cannot take place in schools with large group sizes and in classrooms with relatively limited resources. Learner-focused questioning and instruction with well-focused pair and group discussion can enable active learning in larger groups without high cost.

What are the misconceptions of active learning?

It is important that teachers are well informed about the theory underpinning active learning in order to avoid misconceptions, evaluate new ideas, employ strategies that are useful for their current context and purpose and avoid unhelpful extremes in their teaching.

Misinterpreting the role of the teacher. Active learning requires a sophisticated approach to teaching, employing a wide range of learning strategies. It involves careful

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scaffolding of tasks, a deep appreciation of how assessment can be used in support of learning, and a recognition of the need for differentiation, because learners are all at different starting points.

The learner is not expected to simply learn by themselves or in groups without the intervention of the teacher. Hattie distinguishes between the teacher as activator and the teacher as facilitator. As an activator, teachers are key agents in leading strategies which will include direct instruction and teaching metacognition. In contrast, a facilitator role could work better in strategies such as simulations and gaming, and problem-based learning. He reports that the effect size is greater when the teacher acts as an activator.

Misconceptions about active learning strategies. Active learning includes a wide range of teaching and learning strategies which do not necessarily involve learners moving around the room or undertaking group work. Active learning is happening if students are thinking hard and relating their new learning to existing ideas in a way that enables them to make progress. This means that carefully planned direct instruction, involving whole-class interactions (rather than the teacher just lecturing students with no follow-up), is also an effective teaching methodology associated with active learning.

All learners need the same approach at the same time. Although the rigidity of biologically driven stages of development (Piaget) has been challenged by newer research, younger children clearly have different needs and capabilities from older ones. Particular attention is required for strategies suitable for early years teaching. The needs of learners within a classroom will also be diverse. Activities should be well pitched and scaffolded to make sure all students make progress and that the teacher and students have high expectations of their learning.

It is always easy to know what a student has learnt. Learning takes place in learners' heads. This means it is challenging for the teacher (and sometimes the learner) to know what they have learnt and how well they have learnt it. It can be hard to identify and then help students move on from incorrect understandings (misconceptions) as they tend to select information that backs up their prior view (known as confirmation bias). The use of assessment for learning strategies such as high-quality questioning is therefore very.

How can schools make the best use of active learning?

Prioritise professional development in active learning. Encourage teachers to work together and to share practice that promotes the development of active learning in the classroom. For example, a group could meet regularly to reflect on a reading about active learning or to share their experiences of implementing a new strategy. It is also important to encourage teachers to update their subject knowledge and pedagogical content knowledge as appropriate for the age group(s) they teach.

As exams draw nearer it can be tempting to move away from active learning approaches. However, simply transmitting knowledge to learners will not fully prepare them for the demands of their exams. Developing a school ethos which focuses on student learning across a broad curriculum is essential to foster learners' understanding, enjoyment and ownership of their own learning, as well as good examination results.

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Evaluate the impact of new strategies that are implemented, whether these are tried across the whole school or by individual teachers or departments, and share the findings.

How can teachers make the best use of active learning?

Teachers should review and activate students' prior learning, and help them to make links with new material. They should continually elicit feedback on all students' learning through use of effective questioning, including all-student response systems. This feedback on student learning should be used to confirm or to adapt plans for future teaching.

New knowledge should be presented in small steps, with opportunities for well-scaffolded practice and review, for example, low-stakes testing at spaced intervals has been shown to increase recall. This is not to say that more open-ended inquiry-based approaches do not have their place. Indeed, Mourshed et al suggest that well-used inquiry-based approaches can raise attainment significantly, but only when they are used sparingly and are embedded in a wider context of high-quality teacher-directed learning.

Learners need adequate time to process new information. Students generally need to engage with fully explained content at least three times, and in different ways (not simply repetition of content), before they can remember it.

Teachers should encourage learners to be conscious and strategic in the cognitive strategies they employ. They should be supported in developing skills of planning, monitoring and evaluating their learning.

Given that learners construct knowledge through the medium of language teachers should enable learners to build knowledge through speaking, listening, reading and writing. The use of focused and high-quality dialogue, paired discussion and group work is important in processing new learning and fostering understanding.
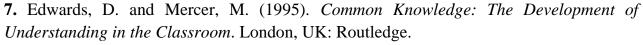
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