



The WAT 5Es Approach to Science

Rationale



The 5Es Science cycle is borne of the research of Johann Friedrich Herbart, a German philosopher, influenced American educational thought around the turn of the 20th century. For Herbart, the primary purpose of education is the development of character, and the process of developing character begins with the students' interest. Herbart considers concepts to be the fundamental building blocks of the mind, and the function of a concept is justification for including a concept in a course of study. In a contemporary sense, Herbart is interested in the creation and development of conceptual structures that would contribute to an individual's development of character. In modern terms, to improve the capital a person possesses when entering their adult life.

Herbart suggests two types of interest, one based on direct experiences with the natural world and the second based on social interactions. Science instruction can quite easily use the natural world and capitalise on the curiosity of students. In addition, teachers can introduce objects from the natural world and use them to help students accumulate a rich set of sense impressions. Herbart suggests the observation and collection of living organisms and the introduction of tools and machines (Herbart, 1901).

More recently, Herbart's model was evaluated and expanded upon by John Dewey. Dewey began his career as a science teacher. No doubt, the early influence of science explains the obvious connection between Dewey's conception of thinking and scientific inquiry. In *How We Think* (1910, 1933), Dewey outlines five key traits which are key to effective science instruction:

- (1) Defining the problem,
- (2) Noting conditions associated with the problem
- (3) Formulating a hypothesis for solving the problem
- (4) Elaborating the value of various solutions
- (5) Testing the ideas to see which provide the best solution for the problem.

In the present day, the BSCS (Biological Sciences Curriculum Study) have adapted the model further to bring it in line with the expectations of The National Curriculum (2014). The 5Es Learning Cycle is a method of structuring a science lesson that is based upon constructivist learning theory, based on best practices in science pedagogy and cognitive psychology. It is a recursive cycle of distinctive cognitive stages of learning which mirror the WAT teaching and learning cycle (see Science Sunshine Diagram):

"Engage" - This is the introduction to the lesson that motivates or hooks the students interest in the learning to follow. It can be a demonstration, a discussion, a reading or other activity used to tap into prior knowledge about the lesson and engage student's curiosity. It is used to uncover what students know and think about the concept or topic.

This is followed with an **"Explore"** activity that allows the students to have experiences with the concepts and ideas of the lesson. Students are encouraged to work together without direct instruction from the teacher. They observe, question, and investigate the concepts to develop fundamental awareness of the nature of the materials and ideas.

The **"Explain"** stage encourages students to explain concepts and definitions in their own words. Students are asked to justify and clarify their ideas. Formal definitions, explanations and labels are provided. This is done through such activities as discussions, chalk talks, films, etc. and can be didactic in nature.

The **"Extend"** stage allows students to apply their new labels, definitions, explanations and skills in new, but similar situations. It often involves experimental inquiry, investigative projects, problem



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solving and decision making. Lab work is common. Students frequently develop and complete their own well-designed investigations.

The **"Evaluate"** stage assesses both learning and teaching and can use a wide variety of informal and formal assessment strategies. Teachers frequently observe students as they apply new concepts and skills to assess students knowledge and skills, looking for evidence that the students have changed their thinking or behaviours. The opportunity to allow students to assess their own learning and group-process skills is often provided.

Even though the 5Es were just described in a linear order, there are times when it is appropriate to loop back into the cycle before going forward. For example, several explore/explain loops may need to occur before students have the full ability to move forward into an "Extend" session. Indeed, it may be that a science unit is based around these principles. (BSCS, 2016) Essentially, the approach is flexible but evidence of all elements of the cycle would be evidenced in science books.

