Lesson Plan Word Statement: Grand Unified Learning Theory

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Background

The three lesson plans on Newton's Laws of Motion included in this workshop are based on a grand unified learning theory, which has its origins in Davey's (2011) 'Constructive Neurophenomenology', but which has been expanded to include parts of behaviorism, connectivism, cognitivism, brain-based learning, constructionism, and maturationism.The lesson plans are structured around the 4mat learning cycle and include various instructional strategies based on the learning theories mentioned earlier. While the lesson plans do include parts from different learning theories, they are broadly based on a constructivist framework. The central tenets are underlined below.

Goal of Education

Rather than beginning with the question 'what is knowledge?', as Pritchard(2014) goes on to elaborate in detail, we would like, to begin with, the question 'Why do we educate our children?' Partly, the answer is 'to help them live a fulfilled life'. That means that students are capable of thinking critically, earning a livelihood, having empathy for others, etc.' We realize that such an aim requires two opposing views to coexist. The aim of having empathy, appreciating diversity requires an acknowledgment of at least some degree of 'relativism' (Swoyer, 2014) and the concept of others' minds (Pritchard, 2014). Earning a livelihood, solving practical problems requires an understanding of what Vygotsky calls 'scientific concepts' (Fosnot, 2013). Our lesson plans incorporate both, an understanding of the scientific concept of Newton's laws and the opportunities to explore, share, collaborate, co-create and express students' opinions and perspectives.

Nature of Knowledge and Science Teaching

The lesson plans have been designed from a position of 'direct realism' (Pritchard, 2014). While we acknowledge some degree of 'relativism' (Swoyer, 2014) regarding cultural practices and opinions, we believe that there exists a world independent of the mind. Thus while we acknowledge that Newton's laws as conventionally understood are tentative and falsifiable (Pritchard, 2014), yet they best explain the observed phenomenon regarding forces and motion. This is in sync with Piaget's assertion that 'Knowledge, could be treated not as a more or less accurate representation of external things, situations, and events, but rather as a mapping of actions and conceptual operations that have proven viable in the knowing subject's experience' (Fosnot, 2013). Our lesson plans, are designed to incorporate opportunities to map the experiences of the learners to the most viable explanations of the same (which turn out to be the Newton's laws of motion). We reject the idea of radical constructivism in Science teaching because of the numerous problems associated with it, such as, students acquiring false beliefs as underscored by Nola (1997) and Pritchard (2014). Therefore, we accept Mvududu and Thiel-Burgess' (2012) assertion that 'the best of constructivist pedagogy can be had without constructivist epistemology.'

Constructivist Foundations

Our lesson plans based on the 4mat cycle have a firm constructivist base. They follow all the four criteria mentioned by Baviskar, Hartle and Whitney (2009) namely – eliciting prior knowledge (connect phase), creating cognitive dissonance (attend, image, inform phase), application of new knowledge with feedback (extend and refine phase) and reflection on learning

(perform phase). Additionally, the lesson plans also incorporate the practice phase. This phase, while considered behaviorist, is important in developing compatible memory constructs and vocabulary (Fosnot, 2013). Van Bommel, Kwakman and Boshuizen (2012) caution that often situational learning does not transfer the formal language that the students need in their professional career. Thus, this step has been intentionally included. The lesson plans are structured around the concepts of assimilation, accommodation, equilibration (Fosnot, 2013).This is evident in the way the teacher shows demos of balanced and unbalanced forces, hands-on experiments, PhET simulations, and asks pointed questions to the students to explain, reflect and conclude (attend, image and inform phase). The lesson plans also fulfill the criteria of constructivist learning as proposed by So (2002) namely –

1. Using pupils' existing knowledge to guide teaching (referring to everyday phenomenon concerning forces and motions and asking them what happens next and why). This is useful in tapping into the Zone of potential construction (Norton and D'Ambrosio, 2008) thereby exposing the mental models of the students.
2. Guiding pupils to generate explanations and alternative interpretations and devising incisive questions (showing different demonstrations and asking pointed questions to help students analyze, explain, debate and conclude the laws of motion)
3. Choosing materials and activities for pupils to test ideas (students explore the effect of friction on motion by moving different objects on different materials such as moving a ball on different materials such as clothes, ice, water, sand, etc.)
4. Providing a classroom atmosphere conducive to the discussion (Opportunities for group discussion, explanation, and presentation).

5. Provide opportunities for pupils to utilize new ideas (students make their models of roller coasters, students design their labs/ games based on Newton's laws of motion).

Learning Spiral

The learning process is understood to be complex and fundamentally nonlinear in nature (Fosnot, 2013). While the design of the lesson plans uses the 4mat cycle which is cyclical and sequential in nature, the process of demonstration, reflection, explanation, questioning embedded in each activity is free flowing. All the lesson plans are intentionally centered around the theme of 'Forces and Motion' to demonstrate how the same topic could spiral towards increasing depth over the school years and how previous knowledge could be used to revisit the same concepts again with a different perspective and new questions. The design of the lesson plan is by prescribed learning levels in the BC Curriculum. In this sense, the lesson plans are also based on Maturationism (Rand & Gesell, 1931).

Assessment

The lesson plans provide a variety of ideas for diagnostic, formative, and summative assessment like KWL charts, physical models, and presentations. As suggested by Hattie and Timperley (2007), following learning experiences have been incorporated into the lesson plans to guide the three basic questions of – "How am I going?", "Where am I going?" and "Where to next?" –

1. Opportunities for feedback on task- time on task, information put in writing reports, completing web-quests, worksheets.

2. Feedback on the processing- cognitive and meta-cognitive strategies used, feedback on understanding and thought process while implementing labs/ games / projects.
3. Feedback on self-regulation – reflection on performance, reflection logs, interviews etc.

The lesson plan also elaborates about different Ed Tech tools like weblogs, simulations, collaborative online documents, mobile apps and more in Symbaloo web-mixes to aid the teacher in designing learning experiences and assessments. As stressed by Hattie and Timperley (2007), assessment is used as a mechanism to enhance the learning process further and to consolidate learning by teachers or students.

Salient Features

The lesson plans provide opportunities for scaffolding by encouraging clarifications and redirecting the students by offering new possibilities for consideration. The zone of proximal development is tapped through peer learning through group work. The lesson plan touches upon both – propositional knowledge (Newton's laws of motion) and ability knowledge (solving word problems, physically assembling models) as explained by (Pritchard, 2014). They include use of different media, like pictures, audio visuals, and physical models to cater to all the five senses as stressed in Phenomenology. This also helps in facilitating learning for students with learning differences without segregating them from other students as suggested by Dudley-Marling (2004). Lastly, the lesson plans includes working on real life projects in line with constructionism, situated learning and with Fosnot's (2013) assertion that problematic contexts engage children in a way that keeps them grounded.

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