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Subject : ET 611 Learning Sciences

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Project- Rethinking education...on Mars

Prompt: Reflect on the design of the current school systems with respect to the theories of learning that we have read in this class. Whenever we talk about students and learning we think of classrooms with teachers and students. Since last year most of the teaching and learning has moved online where we have tried to preserve this notion of "classroom" as we know of. However, the disruption of the existing schooling process is also a good opportunity for us to stop and reflect on what we are doing right and wrong when it comes to facilitating learning.

1. Critically reflect on what works and doesn't work in the current way of teaching and learning. Articulate the good and bad aspects clearly. Keep the theories of learning in mind.
2. Imagine you are the chief architect of the "schooling system" on Mars. You have the ultimate authority to design learning experiences for students there. Propose a new learning experience that takes into account everything you have read till now. Visualise one day or a week in the life of a learner and share what happens throughout this duration.

Current way of Teaching & Learning:

The current way (typical school) of teaching learning consists of 5 major stakeholders namely, Student, Teacher, Parents, School Management and the Society. The curriculum and educational policies are decided based on the needs of the society (state or country). Based on the attributes of individuals expected to take part. The responsibility of effectively delivering these policies lie on the school management to create an optimal learning environment for students to learn and teachers to teach, meanwhile attracting the parents. Students typically attend the school for 2 semesters. With each semester around 3-4 months of school followed by 1-2 months winter/summer vacation. Students come

together at school and learn during school hours, typically 6-7 hours from 10 AM to 4 PM with a recess. The curriculum typically has subjects such as language, science, maths, social studies and physical education.

What works:

- Students develop a social connect (coming at a place for education)
- Curriculum actually covers many pertinent subjects (delivery might be another issue; mentioned below)
- Recess and game periods help students develop physical fitness and emotional wellbeing through sportsmanship
- New methods such as Project Based Learning, Group Discussion, Presentation do promote active learning and critical thinking
- The rote learning helps in developing memorization and other mental abilities
- The academic year creates a sense of growth in learning when they go to higher standards

What Doesn't work:

- Classroom size is too large, so active participation is not ensured
- There is a gap in the purpose and method of teaching and evaluation (example: scientific reasoning is evaluated simply based on memorization of questions and answers)
- The purpose of active learning strategies are shifted to goals (marks for presentation) rather than process (marks for understanding)
- Although good performers are encouraged (by providing ranks, etc.), low performers are not provided necessary scaffold or reinforcement
- Education policies are not revisited frequently, hence, a lack of knowledge in book relating to real world experience
- Teachers are not skilled and sometimes not motivated to incorporate various learning strategies in class for effective teaching.

Reflecting on Pros and Cons of Learning Theories (in current education system):

Theory of Learning	Pros	Cons
Constructivism	Active construction of knowledge	Harder concepts are difficult to construct without collaboration
Constructionism	Advancement of Technology More accessible to students	Artefacts can not be constructed in all contexts
Cognitive Apprenticeship	Learner learns from observation of masters in the domain	Learner may find it hard to learn without mentorship
Legitimate Peripheral Participation	Community influences learning experiences play a major role	Participation is mandatory for successful learning
Situated Learning	Multidimensional learning	Situations may be complex
Embodied Cognition	Action, Observation and Imagination	Metacognition is harder Not all experiences can be embodied

Rethinking Education on Mars:

It will not be a gigantic surprise if we are able to colonize Mars in the next 500 years or so. This giant leap for mankind is being stepped down as we speak. New ecosystems, new technology, new energy sources, and new resources; Mars may offer promises we have been always seeking. But with a completely new start comes completely new subtleties: a new law enforcement system, a new alien invasion pact (if we are ever to encounter extra-terrestrial life in the future). How about a new education system? If we manage to build a self-sustaining robust community on Mars, it should come equipped with basic human needs- and any Social theory of learning says that learning is inextricably linked to human nature. Therefore, for any hope of self-sustenance, a new education system must be incorporated into the Martian community.

Doing this would also help us perform many experiments: The concept of learning will be completely new on the planet and the potential learners will not have any conceptions about the system of education existing back on Earth. (poor them?) Hence, they will be a sample space for cognitive scientists all over the world. Maybe we can design a new learning framework that helps the subjects perform better than the corresponding ones on Earth, and this will be sufficient proof for the governments to change the Earthly

education systems- for good. Or, maybe the education system we have is good enough after all; We managed to get to Mars...

The course of this small project will take the following course: First, we discuss the existing system on Earth which has congealed into a primarily classroom based attribute. Then, we pick a few beneficial aspects and carry it forward to the Martian education system. Next, we place ourself in Mars and design a new prototype system which transcends from the Earthly system with some modifications. In the final course, I make mention of some possible technologies that do not exist as of now but may exist in the (distant) future. I have imagined that humans have colonized Mars for at least 50 Earth years (or enough time to have Martian births- births that occur on Mars!) This is to ensure that the first true recipients of a purely Martian education are Martian citizens themselves. We will also try to predict what a future education system would look like on Earth.

Learning is a continuous process that occurs from the birth to the death of a human. This was evident from different social theories of learning which took into account theories from various domains; situated experiences, identity, practice, and much more. So, we will have a critical analysis of the current system in place and identify the positives that can be carried over to the novel Martian system.

The theories that shall be held accountable for the justification of these points are Constructivism and Constructionism, Social theories and Scaffolding theories.

In the current way of learning, instructors do not tailor learning as a consequence of large classes and strict teaching schedules. However, all this is alleviated in the Martian system since the instructors are carefully handpicked. It is important to note that forms of constructivism, constructionism and social theories are being used very well at times in the present education system. What works and what does not is a very subjective question, and depends mostly on the learner. It may be in the freedom and the gratuity of the instructor or the mentor to tailor the learning experience according to the learner's needs. This gives to a notion called scaffolding, which is being achieved through various technological innovations today, like visualizations, augmented reality and 3D animations.

The question of what works can be answered best by the learner after he/she has analyzed his/her concepts from a metacognitive perspective. Constructionism and Theories of Situated experiences are very successful theories and can work well in most circumstances, barring specific contexts where artefacts cannot be constructed and the experience can not be completely situated. In more practical domains, constructionism may work very well. For example, in computer sciences, mathematics and economics. But in more abstract domains like chemistry, physics and social sciences, constructivism works better. This is

because abstraction leads to more abstract degrees of freedom in the cognitive structures and these allow for more varied interpretations in the brain. Social theories are always found in the background of any learning experience and pave way for a more situated learning experience in conjunction with theories of practice, identity, subjectivity, collectivity and power. Hence, learning according to a social theory happens irrespective of the abstractness of the subject.

In general, it is very hard to provide a learning theory that **always** works for a certain subject and a setting. But, we can optimize between the theories that we know and employ them in their area of maximum effectiveness to maximise the utility and the quality of the learning experience.

In the novel Martian education system, more onus will be laid on certain aspects of learning along with completely new elements to the curriculum like courses on crisis management. Evaluation will almost be always skill based with scaffolds augmenting computations. For example, students will be required to make numerical computations in the assignments and take-home exams but almost all live- assessments will require the knowledge of formulae and the origin of the terms in it.

Certain futuristic technologies have been assumed: Examples are-

- **Knowledge Network:** A virtual cloud which contains all the knowledge ever known to mankind in computerized memory. This can be accessed by humans using an augmentation device to their brain. This essentially unifies constructivism and constructionism because the knowledge and the experiences gained by one individual can be uploaded onto the K-Net and these can be downloaded at will by learners, who are seeking a situated experience. This is possible due to a machine called **Neuronics**.
- **Continuous Cognitive Feedback Machine:** Learning processes happening in the mind of the learner can be shared in real time with the instructor.
- **Scaffolding Machine:** A machine which analyses an individual's cognitive structure and suggests scaffolds which can be made available. The "goodness" of a certain cognitive structure will be judged by previous data.

Physical Education and **Crisis Management** will be given major importance; The students must be made resilient physically and mentally to handle any kind of situation that arises on the red planet.

Weeks will be broken up into online sols and offline sols which will be discussed in detail in the PPT presentation. Each week will have Sols, working sols and off-sol. The weeks may be Regular weeks, project weeks, seminar weeks or evaluation weeks. The content in a regular online lecture will be **significantly reduced** as compared to the Earthly system, so that students get more time to parse it. Lectures will also be made very interactive so that participation from all the students is guaranteed.

Evaluation weeks are like the semestral exams in college; Assessments will be given on each offline Sol and graded according to the skill based learning scheme.

Social interactions are allowed to happen whenever there are no classes so that facilitates social theories of learning to create an impact. Any student may take up to 6 courses, each of which have an **hour** of interaction time with the course instructor and more **provisionally**, during the online Sols. Further, there will not be an age limit while applying to the *Basic*, *Intermediate* or *Advanced* programmes. For example, an 18 year old may apply to the *Basic* programme while a 10 year old may apply to the *Advanced* programme.

The student selection must be diverse; (Because while colonizing Mars, diversity will almost always be ensured) The ones selected from the Earth will carry a certain bias towards the Earthly system but they will be monitored for better or worse performance. As Mars is colonized and terraformed in time, The Martian knowledge database and the Earthly knowledge database will be compared (by using technology) and this will give us an idea about the difference between the two systems.

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