Question bank on learning theories

The entire ET course was based on Learning theories both in terms of the content and the format. Therefore we were very keen on understanding the theories and principles of learning in depth. Creating meaningful questions requires one to know the subject in depth. Hence we decided on creating a question bank for Learning Theories. There was also the realization that " The answers we seek lie in the questions we ask" i. e. the more we ask the " right" questions the clearer the topic becomes.

There were two more factors that influenced this decision. One was the mid sem and the quality of questions asked. The other was the lecture on alternative assessment questions which helped us realize that the questions need not necessarily be the traditional " describe a theory", " write about …. " kind of question. In fact questions can be designed to help students learn as much or more in the test rather than in the class. The aim of the question need not necessarily be to find out what the student does not know but rather to help the student clarify issues.

Another influencing factor was the idea that what we will create could have practical utility and could be actually used in classroom situations sometime in the future. Bloom's taxonomy provided us with the realization that there is a structured way of assessing what the student has learnt on a particular topic. This learning is not just restricted to recall of concepts but can be extended to application, evaluation and even creation. When the group members were debating on the list of probable topics, we realized that each of us had been fascinated by the idea of applying Bloom's taxonomy in our respective areas.

So this seemed like a good opportunity to actually do it. The only challenge now was to decide upon a common area of convergence of topic. Since learning theories was a topic that we had already covered in ET 801, and given the centrality of learning to the research process, it seemed but natural that this is what we would converge upon. The Journey We started with scoping the project. It was agreed upon that the entire arena of learning is too broad and we need to restrict our focus to a few select topics.

After reading the available literature on learning, we narrowed down to the following areas: * Generic – What is learning? General Principles of learning. * Three main schools – Basic tenets, Main Proponents and application * Behaviorism * Cognitivism * Constructivism * Comprehensive – Interplay between the principles and theories of the 3 schools The aim was to focus upon the understanding and application level of these rather than mere " textbook recall". The next step was to choose a framework to design the questions. We were oscillating between Alternative Assessment Questions and Bloom's taxonomy.

In the end, we chose Bloom's taxonomy as we felt that it was a more comprehensive way of assessing the learning that had taken place. This ensured that the questions that we developed spanned the entire range of learning – from recalling the content to evaluating and creating meaning out of the content. Attempts have been made to ensure that the question bank has questions on all levels of Bloom's taxonomy for all the three schools of learning. We have restricted the number of recall questions and have focused more on the apply level and higher order questions.

The decision was taken consciously since the recall questions are the easiest to construct and have the least of value in learning. The next decision step was to agree upon whether we wanted to create the questions level wise or whether we just wanted to create an eclectic set and categorize them later. We chose the latter since it did not restrict the thinking process by imposing a pre-defined structure. It also allowed for easier collaboration. The process of generating questions involved the use of internet resources as well as creating our own questions.

For the internet-sourced questions, there was a lot of discussion and debate in order to ensure consistency, relevance and quality. This resulted in a lot of modifications and omissions. Along with creating the questions, we also kept plugging in the evaluation criteria. The next step was tagging the questions based on the school they belonged to and the level of Bloom's taxonomy. We ended the project with a report and a presentation along with the prized question bank that we had created. Context and content Target audience

The question bank is designed for instructors running graduate courses on learning theories. Purpose of questions The questions can be used as a in-class revision tool, as a tool to encourage students to take charge of their learning (think-pair-share activity, convince your friend, what if anything, is wrong with…). The questions can also be used as a trigger for projects during the course work. These questions can also be used for the purpose of formative or summative evaluation – either at the end of sub-topics or at the end of the course itself.

To that end, the questions have been pre-organized in subcategories. Some of the questions have also been purposefully designed keeping in mind the fact that the instructor would need the creative freedom to change / modify the questions as per the contextual and learner needs. Overview of the Learning theories What is learning Learning can be defined as any relatively permanent change in behavior that occurs as a result of practice or experience. This definition has 3 important elements – * Learning is a change in behavior, for better or worse. It is a change that can take place through practice or experience * It is a relatively permanent change.

Hence, learning is different from changes due to maturation and instinctual responses. Behaviorism Behaviorism was the school of thought in psychology that sought to measure only observable behaviors. Founded by John B. Watson and outlined in his seminal 1913 paper Psychology as the Behaviorist View It, the behaviorist standpoint held that psychology was an experimental and objective science and that internal mental processes should not be considered because they could not be directly observed and measured.

It is a theory of learning based upon the idea that all behaviors are acquired through conditioning. Conditioning occurs through interaction with the environment.. There are two major types of conditioning: * Classical conditioning is a technique used in behavioral training in which a naturally occurring stimulus is paired with a response. Next, a previously neutral stimulus is paired with the naturally occurring stimulus. Eventually, the previously neutral stimulus comes to evoke the response without the presence of the naturally occurring stimulus.

The two elements are then known as the conditioned stimulus and the conditioned response. * Operant conditioning (sometimes referred to as instrumental conditioning) is a method of learning that occurs through rewards and punishments for behavior. Through operant conditioning, an association is made between a behavior and a consequence for that behavior. Some key players in the development of the behaviorist theory were Pavlov, Watson, Thorndike and Skinner. Pavlov (1849 – 1936) Pavlov's most famous experiment involved food, a dog and a bell. Food| Unconditioned Stimulus|

His theory, Connectionism, stated that learning was the formation of a connection between stimulus and response. * The " law of effect" stated that when a connection between a stimulus and response is positively rewarded it will be strengthened and when it is negatively rewarded it will be weakened. Thorndike later revised this " law" when he found that negative reward, (punishment) did not necessarily weaken bonds, and that some seemingly pleasurable consequences do not necessarily motivate performance. * The " law of exercise" held that the more an S-R (stimulus response) bond is practiced the stronger it will become.

As with the law of effect, the law of exercise also had to be updated when Thorndike found that practice without feedback does not necessarily enhance performance. * The " law of readiness" : because of the structure of the nervous system, certain conduction units, in a given situation, are more predisposed to conduct than others. Thorndike's laws were based on the stimulus-response hypothesis. He believed that a neural bond would be

established between the stimulus and response when the response was positive. Learning takes place when the bonds are formed into patterns of behavior (Saettler, 1990).

Watson (1878 – 1958) John B. Watson was the first American psychologist to use Pavlov's ideas. Like Thorndike, he was originally involved in animal research, but later became involved in the study of human behavior. He is credited with coining the term ' behaviorism'. Watson believed that humans are born with a few reflexes and the emotional reactions of love and rage. All other behavior is established through stimulus-response associations through conditioning. Watson demonstrated classical conditioning in an experiment involving a young child (Albert) and a white rat.

Originally, Albert was unafraid of the rat; but Watson created a sudden loud noise whenever Albert touched the rat. Because Albert was frightened by the loud noise, he soon became conditioned to fear and avoid the rat. The fear was generalized to other small animals. Watson then " extinguished" the fear by presenting the rat without the loud noise. Skinner (1904 – 1990) Like Pavlov, Watson and Thorndike, Skinner believed in the stimulus-response pattern of conditioned behavior. His theory dealt with changes in observable behavior, ignoring the possibility of any processes occurring in the mind.

Skinner's work differs from that of his predecessors (classical conditioning), in that he studied operant behavior (voluntary behaviors used in operating on the environment). Skinner's Operant Conditioning Mechanisms * Positive Reinforcement or reward: Responses that are rewarded are likely to be repeated. (Good grades reinforce careful study.) * Negative Reinforcement:

Responses that allow escape from painful or undesirable situations are likely to be repeated. (Being excused from writing a final because of good term work.) * Extinction or Non-Reinforcement : Responses that are not reinforced are not likely to be repeated. Ignoring student misbehavior should extinguish that behavior.)

Punishment: Responses that bring painful or undesirable consequences will be suppressed, but may reappear if reinforcement contingencies change. (Penalizing late students by withdrawing privileges should stop their lateness.) Behavioral Shaping If placed in a cage an animal may take a very long time to figure out that pressing a lever will produce food. To accomplish such behavior successive approximations of the behavior are rewarded until the animal learns the association between the lever and the food reward.

To begin shaping, the animal may be rewarded for simply turning in the direction of the lever, then for moving toward the lever, for brushing against the lever, and finally for pawing the lever. Behavioral chaining occurs when a succession of steps need to be learned. The animal would master each step in sequence until the entire sequence is learned. Reinforcement Schedules Once the desired behavioral response is accomplished, reinforcement does not have to be 100%; in fact it can be maintained more successfully through what Skinner referred to as partial reinforcement schedules.

Partial reinforcement schedules include interval schedules and ratio schedules. * Fixed Interval Schedules: the target response is reinforced after a fixed amount of time has passed since the last reinforcement. * Variable Interval Schedules: similar to fixed interval schedules, but the amount of

time that must pass between reinforcement varies. * Fixed Ratio Schedules: a fixed number of correct responses must occur before reinforcement may recur. * Variable Ratio Schedules: the number of correct repetitions of the correct response for reinforcement varies.

Variable interval and especially, variable ratio schedules produce steadier and more persistent rates of response because the learners cannot predict when the reinforcement will come although they know that they will eventually succeed. Cognitivism As early as the 1920's people began to find limitations in the behaviorist approach to understanding learning. Edward Tolman found that rats used in an experiment appeared to have a mental map of the maze he was using. When he closed off a certain portion of the maze, the rats did not bother to try a certain path because they " knew" that it led to the blocked path.

Visually, the rats could not see that the path would result in failure, yet they chose to take a longer route that they knew would be successful. Behaviorists were unable to explain certain social behaviors. For example, children do not imitate all behavior that has been reinforced. Furthermore, they may model new behavior days or weeks after their first initial observation without having been reinforced for the behavior. Cognitive theory attempts to explain human behavior by understanding the thought processes. The assumption is that humans are logical beings that make the choices that make the most sense to them.

Information processing is a commonly used description of the mental process, comparing the human mind to a computer. The brain is considered

to be roughly equivalent to a computer, providing the necessary hardware for the computational process to take place. Our thoughts, feelings and emotions are the actual computations. Cognitive theorists recognize that much learning involves associations established through contiguity and repetition. They also acknowledge the importance of reinforcement, although they stress its role in providing feedback about the correctness of responses over its role as a motivator.

However, even while accepting such behavioristic concepts, cognitive theorists view learning as involving the acquisition or reorganization of the cognitive structures through which humans process and store information. Key Concepts of Cognitive Theory * Schema – An internal knowledge structure. New information is compared to existing cognitive structures called " schema". Schema may be combined, extended or altered to accommodate new information. * Three-Stage Information Processing Model – input first enters a sensory register, then is processed in short-term memory, and then is transferred to long-term memory for storage and retrieval. Sensory Register – receives input from senses which lasts from less than a second to four seconds and then disappears through decay or replacement.

Much of the information never reaches short term memory but all information is monitored at some level and acted upon if necessary. * Short-Term Memory (STM) – sensory input that is important or interesting is transferred from the sensory register to the STM. Memory can be retained here for up to 20 seconds or more if rehearsed repeatedly. Short-term

memory can hold up to 7 plus or minus 2 items. STM capacity can be increased if material is chunked into meaningful parts. Long-Term Memory and Storage (LTM) – stores information from STM for long term use. Long-term memory has unlimited capacity. Some materials are " forced" into LTM by rote memorization and over learning. Deeper levels of processing such as generating linkages between old and new information are much better for successful retention of material. * Meaningful Effects – Meaningful information is easier to learn and remember. (Cofer, 1971, in Good and Brophy, 1990) If a learner links relatively meaningless information with prior schema it will be easier to retain.

Wittrock, Marks, & Doctorow, 1975, in Good and Brophy, 1990) * Serial Position Effects – It is easier to remember items from the beginning or end of a list rather than those in the middle of the list, unless that item is distinctly different. * Practice Effects – Practicing or rehearsing improves retention especially when it is distributed practice. By distributing practices the learner associates the material with many different contexts rather than the one context afforded by mass practice. * Transfer Effects- The effects of rior learning on learning new tasks or material. * Interference Effects – Occurs when prior learning interferes with the learning of new material. * Organization Effects – When a learner categorizes input such as a grocery list, it is easier to remember. * Levels of Processing Effects – Words may be processed at a low-level sensory analysis of their physical characteristics to high-level semantic analysis of their meaning. (Craik and Lockhart, 1972, in Good and Brophy, 1990)

The more deeply a word is process the easier it will be to remember. State Dependent Effects – If learning takes place within a certain context it will be easier to remember within that context rather than in a new context. * Mnemonic Effects – Mnemonics are strategies used by learners to organize relatively meaningless input into more meaningful images or semantic contexts. For example, the notes of a musical scale can be remembered by the rhyme: Every Good Boy Deserves Fruit. * Schema Effects – If information does not fit a person's schema it may be more difficult for them to remember and what they remember or how they conceive of it may also be affected by their prior schema.

Advance Organizers – Ausebels advance organizers prepare the learner for the material they are about to learn. They are not simply outlines of the material, but are material that will enable the student to make sense out of the lesson. Information Processing Approach People, like computers, acquire information from the environment. Both people and computers store information and retrieve it when applicable to current tasks; both are limited in the amount of information they can process at a given time; both transform information to produce new information; both return information to the environment.

The most widely accepted theory is labeled the " stage theory," based on the work of Atkinson and Shriffin, 1986). The stage model assumes that the brain embodies a nervous system that processes the information from the time of the input to the time of storage in long-term memory. The system comprises three main stages that contain different physiological properties: the sensory

registers, short-term memory and long-term memory. The sensory registers briefly store representations of external stimuli from the environment until the information can be transferred further.

There appears to be different sensory registers for each sense. The sensory registers can hold information for only a very brief period of time. The information is assumed to be lost from the registers unless it is passed along into short-term memory. Short-term memory can be thought of as conscious memory because, in addition to holding information, it allows information to be manipulated, interpreted and transformed. The new information in short-term memory, by subjection to further processing, may be transferred to and made part of long-term memory.

Long-term memory is a relatively unlimited and permanent repository of information. Long term memory stores for later use of information. Once the information is stored in the long-term memory, it stays. The information processing model highlights the basic mechanisms in terms of stages and the processes, and the representation and storage of information: 1. Three main stages in which the information is operated on: sensory memory, short-term memory (temporary working memory), and long-term memory 2.

The processes of transforming the information from input to output within each stage and from output to input between these stages, e. g. attention/pattern recognition, encoding and retrieval. 3. Representation and storage of information, e. g. network models (Collins and Quillian, 1969), Propositional Models (Klatzky, 1980; Anderson, 1976); Piaget's Cognitive Development Piaget (1970) proposed that children progress through an

invariant sequence of four stages: * Sensorimotor stage (Birth to 2 years old).

The infant builds an understanding of himself or herself and reality (and how things work) through interactions with the environment. It is able to differentiate between itself and other objects. Learning takes place via assimilation (the organization of information and absorbing it into existing schema) and accommodation (when an object cannot be assimilated and the schemata have to be modified to include the object. * Preoperational stage (ages 2 to 4). The child is not yet able to conceptualize abstractly and needs concrete physical situations.

Objects are classified in simple ways, especially by important features. * Concrete operations (ages 7 to 11). As physical experience accumulates, accomodation is increased. The child begins to think abstractly and conceptualize, creating logical structures that explain his or her physical experiences. * Formal operations (beginning at ages 11 to 15). Cognition reaches its final form. By this stage, the person no longer requires concrete objects to make rational judgements. He or she is capable of deductive and hypothetical reasoning.

His or her ability for abstract thinking is very similar to an adult. These stages are not arbitrary, but are assumed to reflect qualitative differences in children's cognitive abilities. Being controlled by the logical structures in the different developmental stages, learners cannot be taught key cognitive tasks if they have not reached a particular stage of development. Also, Piaget (1985) suggested that learning process is iterative, in which new

information is shaped to fit with the learner's existing knowledge, and existing knowledge is itself modified to accommodate the new information.

The major concepts in this cognitive process include: * Assimilation: it occurs when a child perceives new objects or events in terms of existing schemes or operations. This is a process of fitting new information into existing cognitive structures. * Accommodation: it has occurred when existing schemes or operations must be modified to account for a new experience. This is a process of modifying existing cognitive structures based upon new information. * Equilibration: it is the master developmental process, encompassing both assimilation and accommodation.

Anomalies of experience create a state of disequilibrium which can be only resolved when a more adaptive, more sophisticated mode of thought is adopted. Schema Theory Bartlett first introduced the notion of schema as early as 1932 in order to explain why people reconstructed a story when recalling it so as to make more sense of it in terms of their own knowledge and experience. According to Bartlett, the story is assimilated to pre-stored schemata based on previous experience. Schema can be defined as a data structure for representing the generic concepts stored in memory.

According to schema theory, the knowledge we have stored in memory is organized as a set of schemata or mental representations, each of which incorporates all the knowledge of a given type of object or event that we have acquired from past experience. Schema theory provides an account to the knowledge structure and emphasizes the fact that what we remember is influenced by what we already know. Schemata facilitate both encoding and

retrieval. Moreover, the mental structures are active. Memory can be reconstructed through the integration of current experience with prior knowledge.

In other words, schemata represent an active process and can change over time as a result of new experiences and learning. There are two information resources: the incoming from the outside world and information already stored in memory. The analysis of the sensory information coming in from the outside is known as bottom-up processing or data-driven processing because it relies on the data received via the senses. The information already stored in the memory in the form of prior knowledge influences our expectations and helps us to interpret the current input.

This influence of prior knowledge is known as top-down or conceptual-driven processing. Schemata operate in a top-down direction to help us interpret the bottom-up flow of information from the world. Characteristics of schema: 1. Schema represents knowledge of all kinds from simple to complex. 2. Schema can be linked together into related systems. 3. A schema has slots which may be filled with fixed, compulsory values or with variable, optional values. 4. Schema incorporates all the different kinds of knowledge we have accumulated, including both generalizations derived from our personal experience and facts we have been taught.

Various schemata at different levels may be activity engaged in reorganizing and interpreting new inputs. Constructivism Bartlett (1932) pioneered the constructivist that postulates that learners construct their own reality or at least interpret it based upon their perceptions of experiences, so an

individual's knowledge is a function of one's prior experiences, mental structures, and beliefs that are used to interpret objects and events. It posits that learning is an active, constructive process. The learner is an information constructor.

People actively construct or create their own subjective representations of objective reality. Learning is an active, contextualized process of constructing knowledge rather than acquiring it. Knowledge is constructed based on personal experiences and hypotheses of the environment. Learners continuously test these hypotheses through social negotiation. Each person has a different interpretation and construction of knowledge process. The learner is not a blank slate (tabula rasa) but brings past experiences and cultural factors to a situation.

It is argued that the responsibility of learning should reside increasingly with the learner. This emphasizes the importance of the learner being actively involved in the learning process. Learners construct their own understanding and that they do not simply mirror and reflect what they read. They look for meaning and try to find regularity and order in the events of the world even in the absence of full or complete information. The motivation to learn is strongly dependent on the learner's confidence in his or her potential for learning.

These feelings of competence and belief in potential to solve new problems, are derived from first-hand experience of mastery of problems in the past and are much more powerful than any external acknowledgment and motivation. By experiencing the successful completion of challenging tasks,

learners gain confidence and motivation to embark on more complex challenges. Instructors have to adapt to the role of facilitators and not teachers. Whereas a teacher gives a didactic lecture that covers the subject matter, a facilitator helps the learner to get to his or her own understanding of the content.

The emphasis thus turns away from the instructor and the content, and towards the learner. The learning environment should also be designed to support and challenge the learner's thinking. While it is advocated to give the learner ownership of the problem and solution process, it is not the case that any activity or any solution is adequate. The critical goal is to support the learner in becoming an effective thinker. This can be achieved by assuming multiple roles, such as consultant and coach. Learning is viewed as being facilitated by co-operative processes.

A few strategies for cooperative learning include * Reciprocal Questioning: students work together to ask and answer questions * Jigsaw Classroom: students become " experts" on one part of a group project and teach it to the others in their group * Structured Controversies: Students work together to research a particular controversy This school also emphasizes the concept of dynamic assessment, which is a way of assessing the true potential of learners and differs significantly from conventional tests.

The role of the assessor becomes one of entering into dialogue with the persons being assessed to find out their current level of performance on any task and sharing with them possible ways in which that performance might be improved on a subsequent occasion. Instructors should see assessment

as a continuous and interactive process that measures the achievement of the learner, the quality of the learning experience and courseware. The feedback created by the assessment process serves as a direct foundation for further development.

The Assumptions of Constructivism – Merrill * knowledge is constructed from experience learning is a personal interpretation of the world * learning is an active process in which meaning is developed on the basis of experience * conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning * learning should be situated in realistic settings; testing should be integrated with the task and not a separate activity A common misunderstanding regarding constructivism is that instructors should never tell students anything directly but, instead, should always allow them to construct knowledge for themselves.

This is actually confusing a theory of pedagogy (teaching) with a theory of knowing. Constructivism assumes that all knowledge is constructed from the learner's previous knowledge, regardless of how one is taught. Thus, even listening to a lecture involves active attempts to construct new knowledge. Vygotsky's Social Development Theory Vygotsky's theory is one of the foundations of constructivism. It asserts three major themes: 1. Social interaction plays a fundamental role in the process of cognitive development.

In contrast to Jean Piaget's understanding of child development (in which development necessarily precedes learning), Vygotsky felt social learning

precedes development. 2. The More Knowledgeable Other (MKO) – The MKO refers to anyone who has a better understanding or a higher ability level than the learner, with respect to a particular task, process, or concept. The MKO is normally thought of as being a teacher, coach, or older adult, but the MKO could also be peers, a younger person, or even computers.

The Zone of Proximal Development (ZPD) – The ZPD is the distance between a student's ability to perform a ask under adult guidance and/or with peer collaboration and the student's ability solving the problem independently. According to Vygotsky, learning occurred in this zone. Many schools have traditionally held a transmissionist or instructionist model in which a teacher or lecturer ' transmits' information to students. In contrast, Vygotsky's theory promotes learning contexts in which students play an active role in learning. Roles of the teacher and student are therefore shifted, as a teacher should collaborate with his or her students in order to help facilitate meaning construction in students.

Learning therefore becomes a reciprocal experience for the students and teacher. Discovery Learning (Bruner) Jerome Bruner advocated discovery learning. This is an inquiry-based, constructivist learning theory that takes place in problem solving situations where the learner draws on his or her own past experience and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments.

As a result, students may be more likely to remember concepts and knowledge discovered on their own (in contrast to a transmissionist model). Models that are based upon discovery learning model include: guided discovery, problem-based learning, simulation-based learning, case-based learning, incidental learning, among others. Proponents of this theory believe that discovery learning has many advantages, including: * encourages active engagement * promotes motivation * promotes autonomy, responsibility, independence * the development of creativity and problem solving skills. a tailored learning experience Critics have sometimes cited disadvantages including: * creation of cognitive overload * potential misconceptions * teachers may fail to detect problems and misconceptions Learning Theories – Some Strengths and Weaknesses

What are the perceived strengths and weaknesses of using certain theoretical approaches to instructional design? Behaviorism Weakness -the learner may find themselves in a situation where the stimulus for the correct response does not occur, therefore the learner cannot respond. A worker who has been conditioned to respond to a certain cue at work stops production when an anomaly occurs because they do not understand the system. Strength – the learner is focused on a clear goal and can respond automatically to the cues of that goal. – W. W. II pilots were conditioned to react to silhouettes of enemy planes, a response which one would hope became automatic. Cognitivism Weakness – the learner learns a way to accomplish a task, but it may not be the best way, or suited to the learner or the situation. For example, logging onto the internet on one computer may not be the same as logging in on another computer.

Strength – the goal is to train learners to do a task the same way to enable consistency. – Logging onto and off of a workplace computer is the same for all employees; it may be important do an exact routine to avoid problems. Constructivism Weakness – in a situation where conformity is essential divergent thinking and action may cause problems. Imagine the fun Revenue Canada would have if every person decided to report their taxes in their own way – although, there probably are some very " constructive" approaches used within the system we have.