AICEI PROCEEDINGS

Teaching with the Constructivist Theory for Multiple Teaching Strategies and Expected Assessment Results

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Abstract

This paper will address and portray the concept that effective teaching is achieved with help of various innovative methods to achieve the desired results in undergraduate and graduate levels.

Learning processes depend on individual properties of learners like age, level of experience, knowledge and interest which usually span a wide range. Thus, there is no best teaching strategy that applies to every learning situation.

Knowledge, of course, is central to education, and learning should not be forgotten

Constructivism is an approach to teaching and learning based on the premise that cognition (learning) is the result of "mental construction." In other words, students learn by fitting new information together with what they already know. Many believe that learning is affected by the context in which an idea is taught as well as by students' beliefs and attitudes.

Such theories have been put through actual testing at the University to promote greater understanding and development of the concept “strong minds fuel strong organizations”. Hence we must capitalize on our natural styles and then build systems to satisfy needs. Only through an individual learning process can we re-create our environments and ourselves.

***Keywords*:** *teaching, strategies, assessment, results, students.*

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1. Introduction

Learning can be defined formally as the act, process or experience of gaining knowledge or skills. Learning helps us to move from novices to experts and allows us to gain new knowledge and abilities. It is therefore not just about memorizing facts but the active process of integrating new experiences and information with existing concepts.

The process of absorbing ideas communicated to them by teachers, students take those ideas and assimilate them with their pre-existing notions and experience to modify their knowledge and understanding in a more complex, complete and refined way. Teaching is the process which supports this construction and reconstruction of new knowledge rather than the communication of knowledge.

Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences.

Regardless of who is involved or the philosophical framework at work, the design of instruction for adults normally involves an analysis of learning needs and goals and subsequent development of a delivery system or approach for meeting such needs. It includes such activities as developing learning materials, designing instructional activities, determining techniques for involving learners, facilitating learning activities, and carrying out some evaluation efforts. Constructivism as a theory of learning has existed for over one hundred years but has not been widely accepted or applied in both private and public schools. Modern technology is significantly impacting society and our daily lives. Universities and Colleges have and will continue to reflect societal change in our country and abroad. There is a strong link between effective use of modern technology and the theory of constructivism, as this paper will demonstrate. This link is so strong that it will cause a fundamental shift away from didactic techniques to a unifying constructivist framework.

2. How is constructivism being used to enhance learning

Constructivism is a popular buzzword in contemporary education, although constructivist ideas have been in use long before the actual word. Constructivism has a relativist ontology, which holds that knowledge and realities are experientially and socially constructed. Constructivism can be described as a referent or a way of explaining how a learner acquires knowledge. Circa 400 B.C. Socrates postulated that knowledge was akin to perception.

According to Socrates, there are two basic assumptions when viewing knowledge from a constructivist perspective. Knowledge is subjective, similar to perspective, and knowledge is constructed by the learner, hence the term constructivism. Knowledge, like science,

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can be a verb. It is a process, which is under constant scrutiny and revision by the knower.

Prior Knowledge

Good teaching has always recognized that educators must start "where the child is". Where the child is, has traditionally been defined by what the child was missing, which in education has been classified as acceptable knowledge. However, educators are now defining where the child is by what the child has mastered through prior knowledge.

According to Ausubel (1968), the most important factor influencing learning is what the learner already knows. In order for meaningful learning to occur the learner must already possess concepts on which to anchor new ideas. These anchoring concepts are what we call prior knowledge. Prior knowledge is knowledge that has been subsumed by the learner from life experiences, and life experiences begin when life begins.

Prior knowledge is an important consideration within a constructivist framework because what a student has already constructed in the way of prior knowledge affects further knowledge construction.

Defining Constructivism

Constructivism is more than just a learning theory; it involves learning as an active process in which learners construct new ideas or concepts based upon their current and past knowledge.

Learning can be defined formally as the act, process or experience of gaining knowledge or skills. Learning helps us to move from novices to experts and allows us to gain new knowledge and abilities. Learning strengthens the brain by building new pathways and increasing connections that can be relied upon while learning more. Definitions that are more complex add words such as comprehension and mastery through experience and study. The experience and background helps us to learn new concepts.

Types of learners

Howard Gardner proposed the theory of multiple intelligences. The theory is being applied throughout the world in homes, schools (at all levels), communities, and adult training programs. This theory holds that every human possesses several distinct intellectual faculties, rather than a single trait called ‘intelligence’, each with its own way of developing and operating. Gardner proposes that there is not a single intelligence but there are seven of them namely:

- Visual /Spatial intelligence – They deal with the ability to perceive images.
- Musical intelligence – It deals with the ability to create or interpret music.

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- Verbal intelligence - It deals with the abilities in the complex acquisition, formation and processing of language. Thinking symbolically and reasoning abstractly fall under this category, as does the ability to create conceptual verbal patterns. Reading, writing and the development of symbolic writing and language skills-anagrams, palindromes, metaphors, similes, puns and analogies come under this heading.

- Logical/Mathematical Intelligence - It deals with the ability to think logically; inductively and to some degree deductively; categorically; to recognize patterns, both geometric and numerical; as well as the ability to see and work with abstract concepts.
- Interpersonal Intelligence – This kind deal with the ability to understand and communicate with others and to facilitate relationships and group processes.
- Intrapersonal Intelligence – This deals with the ability to be somewhat insulated from ones peers; to have a strong sense of self; to have leadership abilities in reference to making decisions that may not be popular with others. This strong sense of self creates a certain amount of immunity from peer pressure.
- Bodily / Kinesthetic Intelligence – It deals with the gift of physical movement, which of both the fine and /or the large muscle systems.

3. Motivation factors

Most students of intelligence, however, are now coming to the realization that intelligence cannot be conceptualized, or measured with accuracy, independent of the particular contexts in which an individual happens to live, work, and play, and of the opportunities and values provided by that milieu.

The theory of *B.F. Skinner* is based upon the idea that learning is a function of change in overt behavior. Changes in behavior are the result of an individual's response to events (stimuli) that occur in the environment. When a particular Stimulus-Response (S-R) pattern is reinforced (rewarded), the individual is conditioned to respond. The distinctive characteristic of operant conditioning is that the organism can emit responses instead of only eliciting response due to an external stimulus.

Reinforcement is the key element in Skinner's S-R theory. A re-enforcer is anything that strengthens the desired response. It could be verbal praise, a good grade or a feeling of increased accomplishment or satisfaction. The theory also covers negative re-enforcers, any stimulus that results in the increased frequency of a response when it is withdrawn (different from adversive stimuli -- punishment -- which result in reduced responses).

4. Reinforcement theory

There are certain principles that are specified for operant

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conditioning. Behavior that is positively reinforced will reoccur. Intermittent reinforcement is particularly effective, and information should be presented in small amounts so that responses can be reinforced. Reinforcements will generalize across similar stimuli ("stimulus generalization") producing secondary conditioning

By way of example, the implications of reinforcement theory as applied to the development of programmed instruction can be understood.

- Practice should take the form of question (stimulus) - answer (response) frames which expose the student to the subject in gradual steps
- Require that the learner make a response for every frame and receive immediate feedback
- Try to arrange the difficulty of the questions so the response is always correct and hence a positive reinforcement
- Ensure that good performance in the lesson is paired with secondary reinforcers such as verbal praise, prizes and good grades.

5. Constructive learning

Here are some of the guiding principles of constructivist thinking that we must keep in mind. These ideas are predicted on the belief that learning consists of individuals' constructed meanings:

- Learning is an active process in which the learner uses sensory input and constructs meaning out of it. The more traditional formulation of this idea involves the terminology of the active learner needs to do something; that learning is not the passive acceptance of knowledge which exists "out there" but that learning involves the learner s engaging with the world.
- People learn to learn as they learn: learning consists both of constructing meaning and constructing systems of meaning. Each meaning we construct makes us better able to give meaning to other sensations which can fit a similar pattern.
- The crucial action of constructing meaning is mental: it happens in the mind. Physical actions, hands-on experience may be necessary for learning, but it is not sufficient; we need to provide activities which engage the mind as well as the hands.
- Learning involves language: the language we use influences learning. On the empirical level, researchers have noted that people talk to themselves as they learn. On a more general level, there is a

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collection of arguments, that language and learning are inextricably intertwined.

- Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit.
- Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives: we learn in relationship to what else we know, what we believe, our prejudices and our fears.
- One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. The more we know, the more we can learn.
- It takes time to learn: learning is not instantaneous. For significant learning we need to revisit ideas, ponder them try them out, play with them and use them.
- Motivation is a key component in learning. Not only is it the case that motivation helps learning, it is essential for learning. This ideas of motivation as described here is broadly conceived to include an understanding of ways in which the knowledge can be used.

6. Behavior and different ways of learning

Jean Piaget was mainly interested in the biological influences on "how we come to know". He believed that what distinguishes human beings from other animals is our ability to do abstract symbolic reasoning. There are two major aspects to his theory: the process of coming to know and the stages we move through as we gradually acquire this ability. As a biologist, Piaget was interested in how an organism adapts to its environment.

Behavior is controlled through mental organizations called schemes that the individual uses to represent the world and designate action. This adaptation is driven by a biological drive to obtain balance between schemes and the environment.

Learning processes depend on the individual properties of learners like age, level of experience, knowledge and interest which usually span a wide range. Thus, there is no best teaching strategy that applies to every learning situation. In fact, even for a single learner the best strategy may change over time.

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Behaviorism

The behaviorist approach is based on the assumption that behaviors can be steered by external stimuli. Certain stimuli (S) cause related behavioral responses (R). Stimulus-response pairs (S-R pairs) can be chained and become habits. Teaching goals are to be achieved by presenting selected information and questions or exercises as stimuli that are expected to cause certain behavior, to the learner. If the learner reacts in the expected way his or her behavioral response will be confirmed.

Cognitivism

Cognitivism which relates to the theories of Piaget (Piaget 1977) and Bruner (Bruner 1966) considers the learner as an individual that processes external stimuli actively and independently and that can therefore not be steered by external impulses. As opposed to the behaviorist view, the cognitivists believe that learning is based on cognitive structures. It is assumed that the learner perceives, interprets and processes impressions in a selective way according to his or her level of experience and personal evolution.

Constructivism

From the perspective of constructivism the potential of teaching media to steer learning processes is considered even lower than from the cognitivistic point of view. The active processing of external impulses is rated even higher. The learner is assumed to construct reality individually based on his or her subjective experience structures

Constructivism considers knowledge not as a reflection of an external reality but rather as a function of perceptual processes. From this point of view learning material is to consist just of collections of information units and tools that form the input of the learning processes built by the individual.

Multiple teaching strategies

Courses and seminars normally contain components belonging to different learn-theoretical positions. We are convinced that all approaches should be taken into consideration. However, which learning theory is best suited to support learning processes depends on the teaching goals and the individual properties of the learner, i.e. level of experience and education, age, learning habits.

Likewise, a constructivistic strategy could be provided by a collection of informative components and tools that allow the learner to construct or change the learning environment, in a certain way being an author him - or herself. Besides, a coaching support and

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facilities for human communication should be provided.

7. Constructivism and the scientific learning cycle

What makes students go through the agony of such reconstructing? The answer appears to be the disequilibrium caused by new data which cannot be explained by the old model, and the inability to solve required problems. It is interesting to compare the constructivist view of learning with the traditional view of knowledge which is implicitly assumed by many professors.

In the traditional view knowledge exists independent of the individual. The mind is a ***tabula rasa***, a blank tablet, upon which a picture of reality can be painted.

If the student is attentive, learning occurs when the teacher unloads his or her almost perfect picture of reality through well-designed and well presented lectures. Most experienced professors can attest that this model does not work for most students.

Unfortunately, the traditional model focuses on the delivery system and not on the learner. Or, in computer language, the focus is on output devices and not input devices. The minds of the learners are not blank tablets upon which the teacher can write at will. The constructivist theory says the tablets are not initially blank and only the individual can do the writing.

The traditional delivery system or the frontal system, the non-interactive lecture, satisfies the conditions of the traditional theory, but not the conditions of the constructivist theory. Fortunately, lectures can be modified so that the conditions necessary for learning are satisfied.

Construction of a memory board is a group activity, which makes it useful for support and motivation, particularly for the extroverts in the class. Working in groups also provides social pressure for students to change constructs which appear to be incorrect.

Constructivism can help to explain how individuals solve problems. Problem solving appears to require both a general problem-solving strategy and specific knowledge. For routine problems, the specific knowledge structure is probably sufficient since it includes a pattern for solving routine problems.

Exploration Cycle

In the exploration phase, students explore new phenomena with minimal guidance. In this phase they discover for themselves some of the patterns and concepts involved. The exploration can be done individually or in groups.

In the second phase, called term introduction, invention, conceptual invention, or concept introduction, the professor introduces terms and definitions. Students are encouraged to use these new terms to describe the patterns as completely as possible. The professor then fills in the missing parts of the pattern to give a complete scientific picture. This phase can be accomplished through

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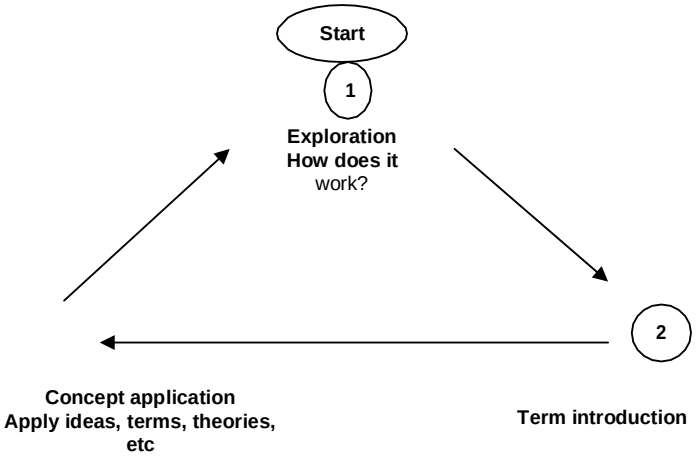
lecture, readings, video, guided discussion, and so forth.

In the third phase, concept application, concept expansion, or idea expansion, students apply the new ideas, terms, and patterns to new examples. This phase can involve homework, group discussions, or laboratory.



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8. Auditory, Kinesthetic, and Visual Modes

People use three different modes for perceiving the world: auditory, kinesthetic, and visual. Everyone without a major physical handicap has the ability to use all three modes. For example, at a feast you can first enjoy the sight of the food and the table. Then you can enjoy the smell, taste, and feel (all kinesthetic) of the food and drink.

Finally, after the meal you can sit back and enjoy the feast again by talking about how wonderful it was. As in other aspects of learning, most of us have developed a favorite mode of perception for learning about the world. This favorite mode affects how we learn in different situations (Felder and Silverman, 1988; Murr, 1988; Waldron, 1986).

Kinesthetic learning includes taste, touch, smell, and feelings. Kinesthetic learning is important for chefs, athletes, therapists, artists, skilled crafts persons, and others. Kinesthetic learning occurs in engineering education when students work in laboratories and handle real components such as circuit boards, valves, and machine tools.

Passing objects around during a lecture not only spices up the class but also incorporates kinesthetic learning. Touch can be useful to understand the smoothness of objects or the heat generated when a bearing is binding.

Success and praise can help engender a positive attitude (feelings) toward the course, while failure and criticism do the reverse. Although criticism is often necessary, professors should never try to humiliate or belittle students. Writing about something is a good way to learn, partly because it involves both kinesthetic and auditory learning.

Visual learners prefer to process information in pictures, and they prefer to learn from pictures, charts, diagrams, figures, actual equipment, photographs, graphic images, and so forth. This appears to be the preferred mode of learning for most people.

The phrase, “A picture is worth a thousand words,” is a common-sense way of saying that most people prefer visual learning. Visual information appears to be easier to understand and place into memory than words.

Auditory teaching methods are most commonly used in modern education systems. This includes lectures and print material.

Writing words or equations on the blackboard is also a visual representation of an auditory method. Few people prefer to use auditory learning if given a choice; however, the Western educational system does not usually provide for a choice. Successful students

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have adjusted to auditory teaching styles before they reach college.

If the learner both saw and heard, then retention was 50 percent; if the learner said something, retention was 70 percent; and if the learner said and did something, the retention was 90 percent. Thus, auditory styles of teaching should be heavily supplemented with visual and, to a lesser extent, kinesthetic learning opportunities.

9. Kolb's learning cycle

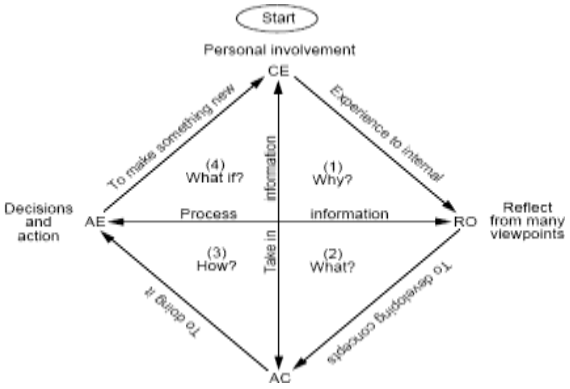
Kolb (1984, 1985) developed a two-dimensional circular or three-dimensional spiral model of how people learn.

The first of these, active experimentation (AE) versus reflective observation (RO)

This dichotomy refers to how individuals prefer to transform experience into knowledge. Individuals who favor active experimentation like to get things done and see results. Reflective observers prefer to examine ideas from several angles and to delay action.

Most college education is geared to abstract conceptualization, but retention (hence long-term learning) is enhanced by use of other stages in addition. Requiring more active involvement by students' increased learning because additional stages in the learning cycle are used. Cooperative education and summer jobs aid learning because they involve the student in doing and in concrete experience.

Kolb Cycle



10. Motivation

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Regardless of the student's learning style and basic intelligence, they will not learn if not motivated. Unfortunately, "nobody can't teach nobody nothing", thus student motivation is crucial to learning. Although much of this motivation is beyond the teacher's control, he or she can do a great deal either to motivate or de-motivate students.

Motivation is usually considered either intrinsic or extrinsic. Intrinsic motivation is internal. It often satisfies basic human needs which include physiological needs, as well as the need for safety, belongingness, love, esteem, and, finally, self-actualization.

Extrinsic motivation is externally controlled and includes many things that the instructor can do, including grading, providing encouragement and friendship, and so forth. The differences between intrinsic and extrinsic motivation are not always sharp. For example, a high salary might be considered to be an extrinsic motivator, but it can also enhance an individual's self esteem.

11. Maslow's Hierarchy of Needs

According to Maslow's theory of motivation, when a need is unfulfilled, the individual is very motivated to fulfill that need. Once needs at the lower levels are satisfied, higher-level needs become important and the individual becomes motivated to satisfy these needs. If one of the lower-level needs is suddenly not satisfied, then this need becomes the most important need until it is again satisfied.

For example, a Ph.D. in management who is lost in the woods and starving thinks only about food and rescue, not about abstract theory. Maslow noted that the hierarchy is not invariably followed by all individuals. Professors have an important role to play in helping to satisfy belongingness needs.

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Maslow's Pyramid of Hierarchy

The highest level in Maslow's hierarchy, self-actualization, is the need for individuals to reach their potential. The need to self-actualize is what causes individuals to write poetry at 2 A.M. when they have to report to a respectable, well-paying job at 8 A.M. Cooking gourmet meals when something simpler would suffice may represent the need to self-actualize.

Creativity and the need to create can be considered part of the need to self-actualize. Maslow notes that for extremely creative individuals the need to create may be more important than the lower needs. People require time to learn how to satisfy their needs. Thus self-actualization occurs in mature individuals and based on Maslow's studies is uncommon. Self-actualized students are more likely to be encountered in graduate or continuing education class

12. Expected Assessment

Overall student score in the upper grades

Instructor		
Course		
Semester	Midterm	Final
Student count	28	27
Student absent		
Level	Regular undergraduate	

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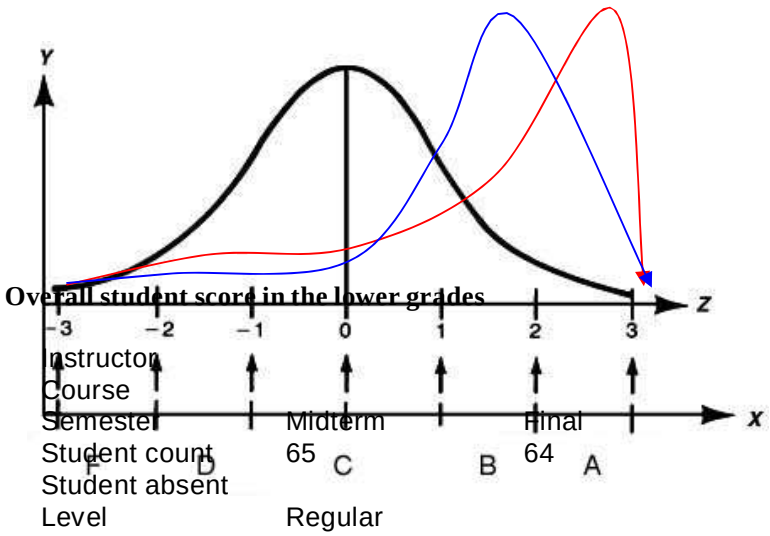
		Received Midterm		Received Final		Expected	
1	> 50	=	=			=	=
2	50-59	1	28%	=	0	2	10%
3	60-69	1	28%	=	0	6	20%
4	70-79	=	0	1	4%	12	40%
5	80-89	4	14%	15	55%	6	20%
6	90-100	22	78%	11	40%	2	10%

Midterm Mean = 91, Final Mean = 88

SD Language of instruction (English)

Lecture type: Interactive teaching



Overall student score in the lower grades

Instructor

Course

Semester

Student count Midterm 65 Final 64

Student absent

Level Regular

		Received Midterm		Received Final		Expected	
1	> 50	=	=			=	=
2	50-59	59	90%	41	64%	7	10%

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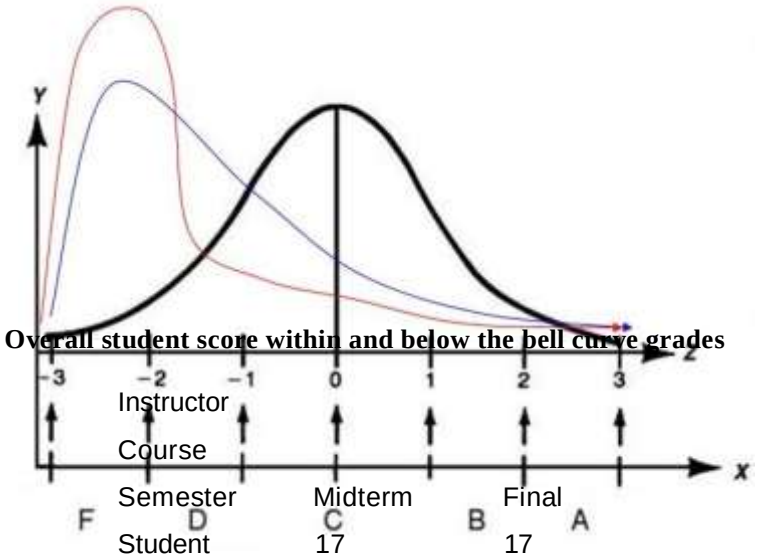
3	60-69	6	9%	14	22%	13	20%
4	70-79	=	0	5	7%	26	40%
5	80-89	=	0	1	2%	13	20%
6	90-100	=	0	3	5%	7	10%

Midterm Mean = 55 Final mean = 61
SD Language of instruction (Macedonian)
Lecture type: Frontal teaching



Overall student score within and below the bell curve grades

Instructor
Course
Semester Midterm Final
Student count 17 17
Student absent
Received Midterm
Received Final
Expected
Level Upper level undergraduate

1	> 50	=	=			=	=
2	50-59	5	29%	3	17%	2	10%
3	60-69	5	29%	6	35%	4	20%
4	70-79	2	11%	7	41%	6	40%
5	80-89	4	23%	1	23%	4	20%
6	90-100	1	6%	=	0	1	10%

Midterm Mean = 70 Final mean = 68.5
SD Language of instruction (English)
Lecture type: Interactive teaching

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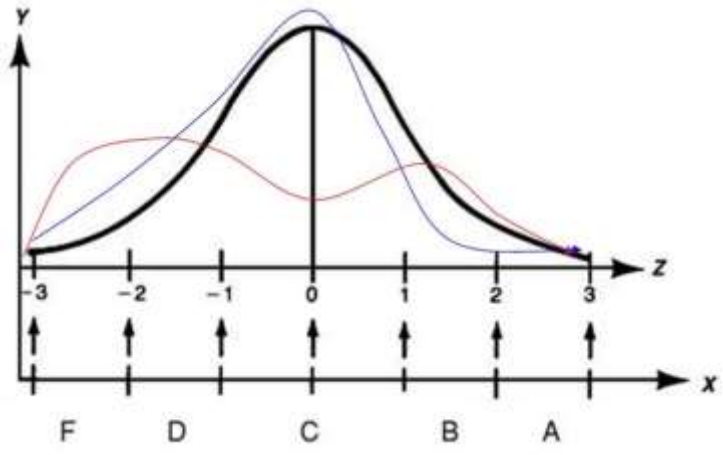

Overall student score does not produce bell curve grades

	Instructor						
	Course						
	Semester		Midterm		Final		
	Student count		22		23		
	Student absent						
	Level		Regular				
		Received Midterm		Received Final		Expected	
1	> 50	=	=			=	=
2	50-59	8	36%	1	4%	2	10%
3	60-69	8	36%	3	13%	4	20%
4	70-79	4	18%	7	30%	9	40%
5	80-89	1	3%	5	22%	4	20%
6	90-100	1	3%	7	30%	3	10%

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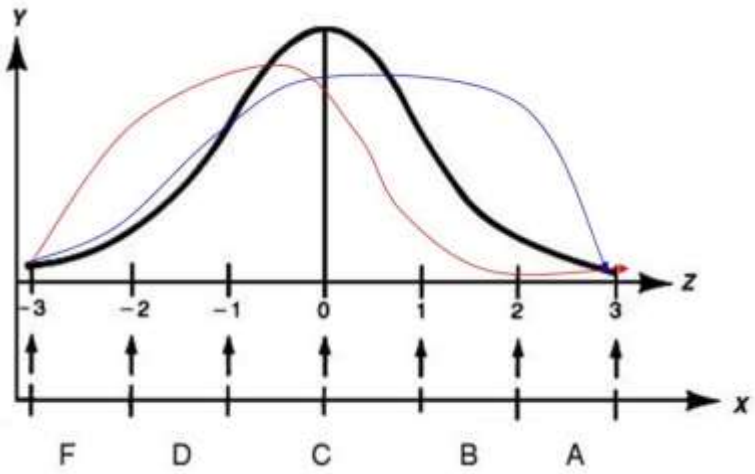
Midterm Mean = 65 Final mean = 81
SD Language of instruction (English)
Lecture type: Combined Frontal/Interactive teaching



Overall student score within the bell curve grades

Instructor
Course
Semester Midterm Final
Student count 21 20
Student absent

Level	Received Midterm		Received Final		Lowered grade	Expected
1	> 50	=	=		=	=
2	50-59	2	9%	=	2	10%
3	60-69	3	14%	6	28%	4	20%
4	70-79	9	42%	6	28%	7	40%
5	80-89	6	28%	7	33%	4	20%
6	90-100	1	5%	1	4%	2	10%

Midterm Mean = 75.5 Final mean = 76.5
SD Language of instruction (English)
Lecture type: Interactive teaching

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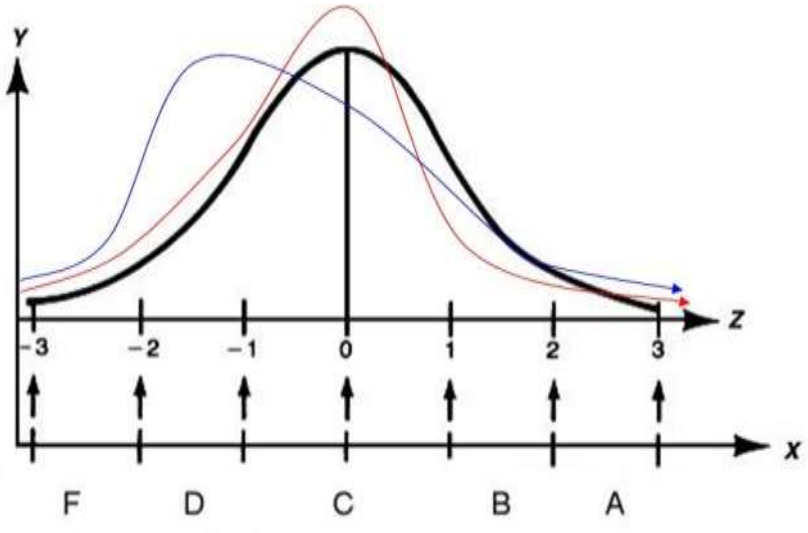

13. Conclusion

To put it in a nutshell, no two human beings learn the same way, maybe identical twins but they were not the focus of this study.

There are many strategies for improving student's learning and greater performance. Some of them were discussed, and some of them will yet be discovered, but what is true, constructivism plays a pivotal role in every day life, whether we learn to ride a bicycle or fly a plane, it is the way that we are taught and we simply learn.

The conclusive results from 5 different groups of classes, displays modes of teaching and assessment. To some extent, the overall value is either in the low or high end of the scale. In certain cases mismanagement of classes occurs, this produces outstanding results that are not factual or misrepresented.

The final product of education, student knowledge retention and professional development is what can be offered to the job market.

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