What is constructivism?

Constructivism began as a philosophy about how we view the world around us, how the world is known by the observer. It has its foundation in both ontology and epistemology. It had nothing to do at all with education. However, in the past century, together with results from cognitive psychology, there have been "myriad varieties of constructivist thought espoused by a number of highly regarded cognitive and social psychologists and educators" and these have spawned several learning approaches/practices or even learning theories, like child centered education, cooperative learning, problem-based learning, cognitive apprenticeship, etc. We may view Understanding by Design which the DepEd wants to propagate, as one of the latest practices in education that are based on constructivism.

The extreme case of constructivist thought is radical constructivism, which like idealism, claims that reality exists in ideas or ideals, only in the mind. Some authors consider Socrates as a constructivist. Other philosophers followed in his wake without being called constructivist. This type of constructivism has led to the educational belief that each person constructs all knowledge. There is nothing in the mind except that which is constructed by the individual. This contrasts with realism which believes that the world is independent of the knower and that knowledge could be transmitted by lecture and modeling.

What is constructivism in learning?

Constructivism in learning is a theory about how people learn. Simply, it says that we build or construct our own understanding and knowledge of the world, through experience and reflection, individually and collectively.

Each person is born with some knowledge base or structure and each of us keeps on building up that structure throughout our life through our own efforts and in interaction with others. We need to stress to our students that we cannot learn for them. They are in school to enlarge that knowledge structure. It is for that reason that students who do a lot of reading usually find it easier to learn than those who do not.

Constructivism says that when we encounter something new, we incorporate it with our previous knowledge through the complementary processes of assimilation and accommodation. Piaget gave us these two processes. The two are inseparable though at any instance one may predominate over the other.

When what we perceive or what is brought to our attention is something we can incorporate into our existing knowledge base, we are assimilating. (The diagram below illustrates this.)

When what we perceive or what is brought to our attention is something that does not fit our internal world, then we have to adjust to it. This is called accommodation. This process is more difficult and sometimes painful. What is confronting us may in fact contradict what we already think we know.
We are all familiar with student misunderstandings. A very good example of this is the mistaken notion that \(-7 > x < 5\) is a correct way of writing \(x < -7\) or \(x < 5\). In the last Math Challenge, one student would not accept that the first way is wrong. The supervisor had a difficult time as she had to face the lawyer of the family and had to call the MTAP office two or three times to settle the problem. The boy did not want to accept a written solution dictated to the supervisor. The supervisor was advised to get two or three textbooks with the correct solution to show them to the boy and his lawyer.

Faces of Constructivism

Douglas (1998) calls the different points of view/perspectives or popular beliefs on how constructivism impacts learning as “faces of constructivism. Some of these are:

* **Trivial constructivism** or personal constructivism believes that “knowledge is actively constructed by the learner, not passively received from the environment.” This is common to all varieties of constructivism and is perhaps what we really have to be convinced about. It is only when a student understands what is learned that there is a possibility of transfer.

* **Radical constructivism** adds to trivial constructivism the belief that the knower does not necessarily construct knowledge of a “real” world. For radical constructivists, there is no real world out there independent of the knower. As a philosophy, radical constructivism is akin to idealism.

* **Social constructivism** believes that while learners actively construct their knowledge, the learning is in collaboration with teachers, friends, students, administrators, and participants in all forms of activity. Vygotsky, a Russian, is considered as the founding father of Social Constructivism. He believed that constructs have social origins and that they are learned through our interaction with those around us.

* **Cultural constructivism** believes learning is done in collaboration with others as in social constructivism but it is also affected by cultural influences like custom, religion, biology, tools and language. Even books affect learning by their format and contents.

* **Critical constructivism** believes that the social and cultural environment affect learning but adds a critical dimension aimed at reforming the environment in order to improve the success of constructivism.

* **Constructionism** believes that learning takes place especially when the learner is constructing something for others to see.

How does a constructivist classroom differ from a traditional classroom?

The main difference is in the roles of the teacher and the student. The teacher is no longer an expert that imparts or transmits knowledge to passive students. The old theory that we were told in our education courses that a person is born with a blank mind, and the teacher as it were writes on a blank slate when teaching, has been completely rejected. Also, knowledge is no longer viewed as something inert but as something dynamic and ever changing.

However, some writers want us to realize that even in traditional classrooms, students construct their knowledge, only we do not remark it because it is not part of what we believe about learning. For whatever theory of learning we hold, assimilation and accommodation go on all the time as Piaget found in his research in the children he studied.

A comprehensive way to compare a traditional classroom and a constructivist classroom is as follows:

<table>
<thead>
<tr>
<th>Traditional Classroom</th>
<th>Constructivist Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum begins with the parts of the whole. Basic skills are emphasized.</td>
<td>Curriculum emphasizes big concepts, beginning with the whole and expanding to include parts.</td>
</tr>
<tr>
<td>Strict adherence to fixed curriculum is highly valued.</td>
<td>Pursuit of student questions and interests is valued.</td>
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<tr>
<td>Materials are primarily textbooks and workbooks.</td>
<td>Materials include primary sources and manipulative materials.</td>
</tr>
<tr>
<td>Learning is based on repetition.</td>
<td>Learning is interactive, building on what the student already knows.</td>
</tr>
<tr>
<td>Teachers disseminate information to students; students are recipients of knowledge.</td>
<td>Teachers have a dialogue with students, helping students construct their own knowledge.</td>
</tr>
<tr>
<td>The teacher’s role is directive and rooted in authority.</td>
<td>The teacher’s role is interactive, rooted in negotiation.</td>
</tr>
<tr>
<td>Assessment is through testing, correct answers.</td>
<td>Assessment includes student works, observations, and points of view as well as tests. Process is as important as product. Some forms of constructivism do not give written tests.</td>
</tr>
<tr>
<td>Knowledge is seen as inert.</td>
<td>Knowledge is seen as dynamic, ever changing with our experiences.</td>
</tr>
<tr>
<td>Students work primarily alone.</td>
<td>Students work primarily in groups.</td>
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</table>
What are some ways that I can use constructivism in my classroom?

Most probably, most of us are already using constructivism as a referent in our teaching. This is true if we use cooperative learning or student-centered learning. For example, do your students explore, use manipulatives, try things out, hypothesize, execute mathematical procedures, communicate results, defend results, or reflect on methods used and the generalization made? Do you pose open-ended questions that require students to discuss their answers or ask divergent questions to which students may give different answers? Let us remember that constructivism is not pedagogy but a philosophy of how people learn. It claims that "learning is a social process of making sense of experience in terms of what is already known", that we construct all the knowledge that is in our head. Hence, any method that will give our students the chance to construct their knowledge can be considered as based on constructivism.

According to Tobin in "The Mediational Constraint in the Reform of Mathematics Curricula" an article in the monograph "Constructivist Interpretations of Teaching and Learning Mathematics", any method that can promote the learning of students, that will enable them to construct their knowledge is acceptable. He writes,

In the classroom, teachers should provide opportunities for students to represent their knowledge in a variety of ways throughout the lesson by writing, using symbols, and assigning language to what is known. Student thinking needs to be stimulated by providing time to think so that students are able to engage in such processes as are required to evaluate the adequacy of specific knowledge, make connections, clarify, elaborate, build alternatives and speculate. For example, after 8 minutes of lecture and whole class interaction, the teacher might ask students to discuss for 2 minutes.

He further says that if possible, ask the students to write three questions for which they do not know the answers. Also, there should be a wait time of three seconds after a question or explanation.

Looking at constructivism in another way, we can ask what learning in a constructivist classroom looks like. We have to bear in mind the different faces of constructivism. All over the world, especially in the U.S.A., Australia, England and other European countries, educators are looking for ways to improve the results of mathematics education.

Within the last few decades, frustrations at the failure of what is called the "transmission approach" to teaching and learning mathematics have led mathematics educators to look to constructivism as a basis for some kind of alternative approach. There are differences on how much of constructivist thought could be used. However, there is some consensus on the theory that learners can construct meaningful knowledge only in relation to prior knowledge and experiences. Thus, there may be as many ways of basing mathematical instruction on constructivist thought as there are researchers. Some of the principles researchers try to implement and which we can implement are:

1. Learning is constructed or built. The knowledge structure of each student is continually enlarged. Each student has an accumulated store of knowledge onto which what is being learned is either added to by assimilation or accommodated after maybe some re-structuring of what is already in the storehouse.

An analogy may clarify what is the role of a teacher and how the learning takes place. We are all familiar with "pre-requisite knowledge". Each student may be imagined as building his own house of knowledge. The teacher who is involved in direct instruction, may be imagined as supplying each student with the materials needed for the construction. If a student has the pre-requisite knowledge, he can be considered as being in a position to receive the building materials and incorporate them in his knowledge structure. If, on the other hand, a student does not have the pre-requisite knowledge," either he rejects the material being supplied or he rearranges what is in his house of knowledge so as to accommodate what is being given to him.

2. Learning is active. The teacher explains, coaches, suggests or moderates but allows students time to discuss, talk about or reflect on what they are learning. The more difficult/abstract is the material being learned, the more the teacher must give the students time to digest it. This is usually better done through discussion and sharing of ideas. In mathematics, the teacher must allow the students to solve problems their own way. A student's method may be longer, but that is what he understands. That is the best for him.

In measurement, as much as possible, the pupils must be allowed to develop the different formulas their own way. With the availability of the internet, the teacher could always send the pupils to discover from it what ordinarily, the teacher presents.

3. Learning is reflective. The responsibility for learning rests on the students and not on the teacher. It is a good practice for a teacher to spend the last few minutes of a class by asking the students what is the main learning for the day, or what is it they think is important in what they learned that day. If a procedure has been learned, it may be good to ask a student who understood it to explain the how or why of the procedure.

4. Learning is collaborative. Any teacher who has relied heavily on cooperative learning knows how students learn more quickly by it. Through discussion or talking about what they are learning, students learn not only from themselves but from the strategies and methods used by their partners. In solving an open-ended problem, one idea of a teammate could trigger the correct solution by another.
5. Learning is inquiry/discovery based. Suppose a geometry class is asked how many diagonals any polygon has. By groups, the students will draw different polygons and find out how many diagonals each has. If at times the students do not seem to get anywhere, the teacher could ask questions that could lead to the answer. In the lower years a lot of manipulatives should be used to give the students experiential basis of the principles being learned.

6. Learning is evolving. Pupils first learn about single digit numbers, then 2 digit numbers and so on. This is the reason for the spiral basis of the mathematics curriculum.

Does Constructivism Work?

A. Benefits of constructivism

1. Children enjoy more when they are actively involved, rather than passive listeners. Saturday class facilitators see how students enjoy math and all want to go to the board to recite.

2. Education works best when it concentrates on thinking and understanding rather than on rote memorization.

3. Constructivist learning is transferable for students create organizing principles that they can take with them to learn other things in different settings.

4. Constructivism gives students ownership of what they learn for in general, what they learn is their own construction, not just received.

5. Students learn to question things and are better motivated.

6. Collaboration promotes social and communication skills.

B. Constructivism has been criticized for various reasons.

1. Some call it "elitist", that it has been most successful with children from privileged backgrounds and are fortunate for having committed parents and rich home environments. It seems many if not most of us believe this to some extent.

2. Collaborative work could lead to "group think" or to the tyranny of the majority in which a few dominant students could silence the majority. Or, if not properly supervised, some just depend on their teammates.

3. Some critics think that by rejecting evaluation through testing and other external criteria, constructivists have made themselves unaccountable for their students progress. This criticism has validity only when a teacher uses more or less radical constructivism as the basis of his/her teaching and never gives tests. However, it is true that the syllabus is seldom covered when radical constructivism is used.

4. There is research evidence that students in constructivist classrooms lag behind those in more traditional classrooms in basic skills.

5. Some researchers claim that novices, especially young learners, do not yet have the underlying mental models necessary for learning by doing. They suggest that guided discovery, rather than pure discovery, could lead to better results. They claim that "direct strong instructional guidance rather than constructivist-based minimal guidance during the instruction of novices to intermediate learners" is more effective.

Note: There are no available books on constructivism, only a monograph of the research communications of a group of the 7th International Congress on Mathematical Education was available. What is given above is from different articles taken from the Wikipedia and the Internet. Just surf the two by typing "Constructivism in Mathematics Education."