Constructivism
vs.
Social Cognition Theory

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Introduction

To study the relation between the theories of Constructivism and Social Cognition, we must first come to realize what they can offer to the education process and some of their main aspects. Each of these theories has many great ideas to offer to teachers and education in general, while they also have some downfalls that could present challenges. Both of these theories have been developed by many theories and are still being researched today in order to determine how we as teachers can best reach our students.

The constructivist theory has been formulated by a number of theorists namely Piaget and Vygotsky, but many others have contributed to the shift from teacher-centered learning to the now student-centered learning that is present. “Vygotsky considered the social environment to be critical for learning and thought that social interactions transformed learning experiences” (Schunk, 2008). He went on to state that learning is constructed between two or more people that is critical to learning. One key part of Vygotsky’s theory is the Zone of Proximal Development. “The ZPD is the difference between what children can do on their own and what they can do with assistance from others” (Schunk 2008). These interactions between adults and children in their Zones of Proximal Development can be influential to their cognitive development.

Vygotsky went on to state that direct teaching has not shown to be completely useful. “A teacher who tries to do this usually accomplishes nothing but empty verbalism, a parrot like repetition of words by the child…” (Vygotsky & Kozulin, 1986). Constructivism can offer many great principles that can be used by teachers to enhance the learning experience for our students.

Originally called the social learning theory, social cognitive theory has challenged preconceived notions of how children learn and act since Albert Bandura introduced the theory with his famous “Bobo Doll” experiment and publication of “Transmission of Aggression
Through Imitation of Aggressive Models” in 1961 (Artino, 2007). This groundbreaking study took place in 1961 at Stanford University, and was conducted by Albert Bandura, Dorothea Ross, and Sheila A. Ross. The subjects in the study were 36 boys and 36 girls who were enrolled in the Stanford University Nursery School and ranged in age from 37 to 69 months. The role models in this experiment were two adults, a male and female, and one female experimenter who served as the conductor for the study of all 72 children. In the study, the subjects were divided into eight experimental groups; half of the experimental subjects were exposed to aggressive role models and half were exposed to “models that were subdued and nonaggressive in their behavior” (Bandura et. al., 1961). In the study, Bandura and his colleagues hypothesized that they children who were exposed to the models that exhibited aggressive behavior would imitate that behavior and react aggressively.

The results from the study confirmed their hypothesis. They found that the children who were exposed to the aggressive and violent models were most definitely more likely to mimic the same type of behavior. “The prediction that exposure of subjects to aggressive models increases the probability of aggressive behavior is clearly confirmed” (Bandura et. al., 1961). The children in the aggressive group were much more likely to act aggressively by kicking, punching, and yelling at the Bobo Doll. At the same time children who were exposed to the nonaggressive and subdued model mimicked the same behavior and were much less likely to treat the Bobo Doll in an aggressive manner. The findings of this study changed the way that people thought about how children learned. These groundbreaking results led to the basis of the social cognitive theory which has been debated and researched since the “Bobo Doll” experiment results were released.

Social cognitive theory can be broken down into five different assumptions: people can learn by observing others; learning is an internal process that may or may not lead to a behavior
change; people and their environments mutually influence each other; behavior is directed
toward particular goals; and behavior becomes increasingly self-regulated (Ormrod, 2008). The
basic idea behind this study is that children learn by watching and observing others. Social
cognitive theorists believe that one way children learn is by watching a model complete an
activity. This can be either a negative or positive model as well. For example, a student can learn
to talk back and be insubordinate in class by watching a negative role model and also can learn
how to conduct themselves in an appropriate manner in a classroom by mimicking the behavior
of a positive role model (Ormrod, 2008). However, learning is more complicated than just
watching someone and mimicking their behavior. That is why there are many positives and
negatives to social cognitive behavior.

**Rationale**

**Constructivism**

The Constructivist theory offers many benefits to the learning experience, such as
developing thinking skills, developing communication and social skills, helping students to
transfer skills to the real world and promoting intrinsic motivation to learn. “Constructivism is
premised on the belief that learners actively create, interpret, and reorganize knowledge in
individual ways” (Windschitl, 1999). To utilize this theory in a classroom, it is essential that the
teacher allow for other influences other than that of formal instruction. Problem-based learning,
inquiry activities, discussions between peers and teachers fostering understanding of subject
matter, utilizing multiple sources of information, and providing opportunities for students to
express their understanding in a variety of ways are all activities which support the constructivist
views. Constructivism presents “teachers as mediators of students and environments, not simply
as givers of information and managers of behavior” (Brooks & Brooks, 1999). Constructivist
teachers must employ strategies such as scaffolding, modeling, and coaching in order to support individual students.

**Social Cognitive Theory**

The school setting is a very social place. Teachers interact with teachers, students interact with students, and teachers interact with students. Bandura believes that human functioning is viewed as a series of interactions among personal factors, behaviors, and environmental events. Social cognitive theory studies the individual within a social or cultural context, and focuses on how people perceive and interpret information they generate themselves (intrapersonal) and from others (interpersonal) (Sternberg, 1994).

Many teachers believe that behaviors occur because of reinforced practice, but the social cognitive theory is based on the premise that cognitive processes guide a learner’s behavior instead. Learning occurs actively through actual performances, observing models, listening to instructions, and engaging with a variety of materials. Many ideas in social cognitive theory lend themselves well to instruction and student learning. Particularly important are applications involving models, self-efficacy, and self-regulation (Schunk, 2008). Teachers should be aware of this theory and its findings so they can obtain a better understanding of their students’ behavior and motivation.

**Pros and Cons of Implementing the Theories**

**Constructivism**

The constructivist theory has many positive aspects that can have a great impact on the field of education. “The benefits of constructivist-based educational settings for learners’ academic, social, and affective growth have been widely documented” (Kaufman, 2004). This immense amount of documentation has allowed educators to really come to understand this approach and how it can better their students if used in the classroom. Through its student-
centered approach, teachers put the ideas of and from the students in the forefront and let them make their own decisions. Constructivism allows students to become responsible for their own learning. They are guided by their own ideas and thinking, and are informed by the ideas of others. (Brooks & Brooks, 1999) Students taught through this approach are more in touch with their own understanding of the curriculum and are able to really explain that understanding to others instead of directly repeating phrases back to a teacher.

A key point in constructivism is modeling and scaffolding to help students learn material that they might not have been able to learn otherwise. “Vygotsky’s perspective, which involves teacher modeling followed by student practice and gradual independence, can provide a framework for intervention for students to develop control of their thinking processes” (Green & Gredler, 2002). Through the use of modeling students can become familiar with concepts and then with practice they can become comfortable with the content and construct their own understanding of what the content really means. The learner’s Zone of Proximal Development and their resulting potential for learning will lead a teacher to determine what level of scaffolding to provide to each individual learner or a group of learners. Kaufman (2004) states that “active engagement, pursuit of diverse paths to discovery, concept acquisition, and external and internal scaffolding are central to the learning process.” All of these methods are crucial to the theory of constructivism and require learners to think for themselves. “External scaffolding supports learners’ acquisition of knowledge by breaking down tasks into comprehensible components, modeling, coaching, providing feedback, and appropriating responsibility for learning to learners” (Kaufman, 2004). These elements allow the learners to experiment with others and learn content through their own devices. Whether a group of students are working together or a teacher and a student are working together, no matter what the key to this theory is
for the learners to be in control of their own learning. Internal scaffolding on the other hand
“engages the learner in reflection and self-monitoring to enhance acquisition of concepts”
(Kaufman, 2004) through allowing students to look into themselves and decide on an individual
basis what the content means to them and how they can better their learning experience. This
type of scaffolding encourages the students to work through their own emotions and feelings
about their learning and discover what works best for them when they are trying to learn a new
topic.

Another important aspect of the constructivist theory focuses on assessment. In much of
the research in this field, constructivists believe that assessment should occur during learning and
should not be seen as a strictly separate entity. This belief is consistent with many teachers as
well as other professionals in the school setting such as school psychologists. According to
Green and Gredler (2002), “the constructivist assumption that assessment must incorporate
observation during the course of typical classroom activities is consistent with problem-solving
approaches promoted by a number of school psychologists.” School psychologists and teachers
can use the information achieved from these types of meaningful assessments to help determine
special education eligibility from a new perspective. Teachers who wish to use this theory in
their classroom must try and focus on how to determine the level of content learned by their
students without adversely effecting their motivation to learn. Constructivists believe strongly in
the need to address and highlight students’ strengths, interests, and needs as a basis for tying
assessment to intervention. (Green & Gredler, 2002) These beliefs may allow for more accurate
interventions and better plans for change because they dig deep into what the strengths and needs
of each individual student are.
A couple of more strengths of this method have to do with the ideas of group work, and critical thinking by the students. Teachers should not simply teach the content to the students they should ask difficult questions and encourage students to explore and determine the answer to those questions independent of the teacher if possible. “Complex, thoughtful questions challenge students to look beyond the apparent, to delve into issues deeply and broadly, and to form their own understandings of events and phenomena” (Brooks & Brooks, 1999) These types of questions if they are too challenging for students to complete independently could be accomplished in a group setting, which is also an important aspect of constructivism. “Having the opportunity to present one’s own ideas, as well as being permitted to hear and reflect on the ideas of others, is an empowering experience” (Brooks & Brooks, 1999). Learning from others can be a challenging experience for some, but the benefits outweigh any difficulties that may arise. Being able to discuss with peers a new concept, share ideas, and come to an understanding of the content with the help of others is the key to success.

Lastly one of the other benefits of using this method in the classroom is that it allows for the use of a variety of resources, which aids both the teacher and the students. Having the ability to use a variety of resources allows teachers to become more creative and allows students to learn how to use a number of different resources. Teachers using this method can use “raw data and primary sources, along with manipulative, interactive and physical materials” (Brooks & Brooks, 1999). Students might learn from graphs and charts of facts from the U.S. Census or they might read historical letters from the Civil War, in order to gain knowledge about history all without a bit of direct teaching. Learning from real-world material and dealing with real-world situations allows students to discover on their own what the value of what they are learning really is to them and the world around them. Only after students have acquired some knowledge
about the content being discussed will the teacher make any type of communication of textbook content. Teaching from a textbook is not allowed, teachers instead should foster creativity and risk taking in their students when it comes to learning. Students should be encouraged to discover on their own things like what the effects were of the Civil War or what is the best way to arrive a solving a word problem.

In contrast to the great number of positives that accompany this theory there are also a number of negatives both for teachers and students when it comes to utilizing constructivism. Researchers vary on the specific reasons about why there are difficulties using this approach. Brooks and Brooks (1999) suggested in their book that there are three main reasons why teachers resist using this approach including “commitment to their present instructional approach, concern about student learning, or concern about classroom control.” Others feel as though it can be detrimental to students, especially those who are lower level learners and those with learning disabilities.

One of the reasons that teachers might hesitate in using this theory is the high demands that are placed on them while they are trying to use it. Teachers attempting to use this theory especially those using design tasks or problem solving require that teacher’s have a tremendous amount of subject matter understanding. “The teacher must not only be familiar with the principles underlying a topic of study, but must also be prepared for the variety of ways these principles can be explored” (Windschitl, 1999). Being able to understand the topic being taught and the effective ways to teach it to our students’ places a lot of pressure on the teacher, which makes some teachers hesitate right in the beginning and causes them to not even attempt to use this method in their classrooms.
Another major component in the constructivist theory focuses on working with others. Since collaboration is a key element of the constructivist view, students will witness and participate in the thinking of others. “Learners are exposed to the clear, cogent thinking of some peers as well as the inevitable meandering, unreflective thought of others” (Windschitl, 1999). Therefore students and teachers should be taught effective ways to deal with others in group settings so that everyone is prepared to fully participate and add to the educational experience of each other. This may sound like an easy task, but being about to work effectively in groups with others are actions that have to be learned and will take yet even more time away from content learning time for students. On top of this amount of time for needed for training to work in groups for both students and teachers, lessons take more time as well for teachers to construct. Constructivist lessons take more time than allotted in most traditional classrooms, thus major changes need to be made in both curriculum and in scheduling. According to Windschitl (1999), these changes in curriculum and scheduling allow for the students to engage in activities that enable them to build a more complex and elaborate understanding of the material. As teachers we want our students to have a complete understanding of what we are teaching and constructivist lessons offer a good deal in allowing for this understanding, but they also take more time than most teachers want to put in for each individual lesson. As it is now teachers put a great deal of time and effort into creating lessons and any more time seems rather daunting to most of them even though there may be substantial effects of their efforts.

Teachers also seem to hesitate at using the constructivist theory in their classrooms because to the nature of the assignments, assessments are more complex. Instead of simple paper and pencil assessments things like, research reports, models, artistic representations, or even performances require well-designed and flexible rubrics for grading purposes. Windschitl
(1999) suggests that students should be involved in the designing the rubrics because it helps to build agreement in the purpose, and meaningful criteria for the projects. For students to really gain the most from this experience they need to be involved in not only their learning, but also in their evaluations and this takes yet more time that there isn’t to spare in many classrooms.

In addition to all of these issues for teachers there are also many issues for students when it comes to the constructivist approach. Low-level learners and those with learning difficulties can present a challenge in a constructivist classroom. When using this theory, learners construct their own meaning in authentic contexts, develop approaches to understanding, and draw connections for generalization. “These tasks can be very difficult for low-ability learners because they tend to focus on details and do not see connections that allow for elaboration into personally meaningful ideas” (Green & Gredler, 2002). Due to the tremendous amount of time placed in discovering their own understanding of the content, students who are struggling will fall farther and farther behind because they simply do not see the big picture.

There is also a strong pull for individual exploration in the constructivist classroom. In this type of classroom students spend a good deal of time reading books of their choosing and writing on topics of personal interest. According to Green and Gredler (2002), these types of activities can lead to difficulties because of a lack of self-regulation and skill of some students. Students in a constructivist classroom need to be able to examine their own learning and determine what works best for them. If students lack these self-regulation skills, then they will continually think that they understand the material when in fact they do not understand it at all and are falling farther behind the other students, who have a better understanding of the content and have the skills to self-regulate.
Finally due to the wide range of diversity that is present in our classrooms today, teachers must try and account for all of the differences that play a role in our students, their interactions, and their learning. “A major ethical implication raised by two constructivist researchers is that students who cannot participate in the construction of meaning through dialogue are unable to be members of the classroom community” (Green & Gredler, 2002). Students with disabilities or those who don’t speak the same language spoken in the class will ultimately feel left out and their learning will suffer. Also students from different backgrounds will come to class offering a range of experiences to offer to classroom discussions. Some might be from higher economic backgrounds and have gone on trips to other countries or states, and therefore have a wider range of knowledge to pull from, while other students might never have traveled anywhere. According to Green and Gredler (2002), “diverse learners from minority cultures or lower socioeconomic groups may be shut out of environments that appear to be egalitarian because the students lack the knowledge and skills to participate.” These students will become withdrawn from the group and will not feel welcomed to share their experiences because they will not feel as though they are valued as much as their peers. It is essential that we make sure that all of our students feel welcome in the classroom and feel as though they are part of the classroom community.

**Social Cognitive Theory**

Implementing social cognitive theory can have both pros and cons. One of the most obvious pros of this theory is that when a student observes a positive model, they will imitate that positive behavior which will lead to a healthy classroom environment. This is evident in certain situations when students want to help each other succeed. For example, if a teacher sets up a lesson where students will be evaluated as a group and not an individual, the students in the group are more likely to help one another and affect each other positively (Crockenberg et. al.,
When students realize that they are going to be evaluated as a group and not just individually, their goals become interdependent. This can serve as a great tool for modeling. In this case it is important to set up groups of students with different abilities. Because the students are going to be evaluated as a group, they will be more likely to exhibit positive and desirable traits so that they will not be seen as someone who is going to hurt the group. If students understand that if they do not behave and work hard for the benefit of the other students in their group, then they are more likely to behave appropriately and work hard themselves.

Going along with this idea of modeling, students who observe a teacher as a model can also benefit greatly. Research has shown that students who observe adults (such as teachers) engaging in helpful and encouraging behaviors are more likely to engage in the same type of behavior (Crockenberg et. al., 1973). This supports the ideas that Bandura, Ross, and Ross found in their experiments with the Bobo Doll. In their experiment, the children were observing adult behavior and not behaviors of their peers. This is where teachers have to be careful in the way they act in the classroom. If teachers have a negative attitude about something, then the students will see this and will most likely also have a negative attitude about it. For example, if a teacher refuses to help a student or is demeaning to a certain student on a consistent basis, then the students in class will most likely “ape” that behavior and pick on that same student (Crockenberg et. al., 1973). This is where social cognition can be a con in the classroom as well. Teachers are not with their students twenty four hours a day and normally only spend one school year with them. Students can come into their classroom with a negative outlook on school that they have learned that from outside factors. Parents, the media, and peers can not only affect how a student is going to behave in class and how they are going to view school; according to social cognitive theory, students are not only affected by people they view, but also their environment. Social
theorists use the term “reciprocal causation” to explain how there is a constant interaction between a person, their environment, and their behavior (Ormrod, 2008).

Other theorists believe that teachers and adults do not always serve as great models for students and do not have the biggest impact on children when it comes to the social cognitive theory. This is where Bandura, Ross, and Ross seem to have gaps in their theories. In their original study, the children were observing adults only and not peers that are of the same age. It has been proven that just by watching and observing their teachers, students do not always imitate the positive behaviors exhibited. One of the reasons being is that teachers serve as mastery models for students and is this is not always beneficial for the social cognitive theory. Students learn better and are more apt to imitate the behavior of a coping model because they see that person as someone who is struggling to obtain a goal just like they are (Schunk, 2008). Using coping models is also a great for students to raise their self-efficacy. Students with low efficacy do not believe that they can solve certain problems or succeed in school so they are more likely to just not try. However, if students see that it is possible to succeed by observing one of their peers, they will take that behavior and use it help themselves succeed. This can be a priceless task for students because when most students come to a challenge, they will either not do the work or not care whether what they are doing is right or wrong. However, the modeling must be done carefully so that it is done correctly.

One way that social cognitive theory can be implemented in the classroom is by setting up activities where students see their peers exhibiting positive and healthy behaviors. In activities like this it is important that numerous factors be taken into account, even the seating arrangements of students in the classroom. Students should be arranged in a way that induces interaction with each other face to face. If students can see the positive cues given by other
students in the class then they are more likely to take these cues and emulate them (Crockenberg et al., 1973). With this in mind, it is important when doing activities using coping models, to arrange the classroom so that it is conducive to these types of activities. It would not make much sense for students working with each other to still be in rows and facing the front of the room. Also, the desks or tables in the room must be arranged in a way that teachers can easily get to each and every student. This is important for teacher-student communication (Ormrod, 2008).

When pursuing social cognitive theory in the classroom, it is easy for the situation to turn from a positive into a negative. The teacher must be able to quickly have access to all students in the class so that negative behaviors are not imitated, keeping the peer models positive.

When crafting an effective coping model activity for the social cognitive theory, the participants in the group must also be carefully selected and the activity must have certain guidelines. Dale Schunk (2008) gives an example of a great activity to use in a classroom setting. The activity is set up carefully. The groups that participate in the activity would have to be selected to represent a range from low level students to high level students. Also, the jobs that each student has should be clearly defined so that students do not drift off task. “Successful groups are those in which each member has some responsibility and members share rewards based on their collective performance” (Schunk, 2008). Each student in the group would have to have a specific job. The student who has the best grasp on the material being learned would be the facilitator and also serve as the peer-model. This student could help the other students in the group with the challenging tasks. This would help the other students in the group with their self-efficacy because they would be learning from one of their peers and not from a master-model like a teacher who has already mastered the material. Other jobs that students in the group could have are researchers, recorders, and presenter. The researchers would be students who have a
decent grasp of the material. The recorder could be a student who is struggling with the information and would benefit by learning from a peer-model. The presenter would be a student who is confident in front of the class and can convey information effectively. By presenting the information to the rest of the class, the class’s self-efficacy will be boosted because they are not learning from a mastery-model but a peer-model. This example of a peer-model versus a mastery-model is an example of where other theorists differ from Bandura, Ross, and Ross.

Teachers and staff in schools do not always know how to effectively make students into positive models so that the social cognitive learning process is positive. This is most evident when it comes to discipline in schools. Often, schools spend an immense amount of money on training teachers and staff on how to deal with students’ behavior problems. However, this may not be the most effective method because it empowers the adults rather than the students. If students are educated in how to resolve conflicts themselves, then teachers will be able to focus on actually teaching without worrying as much about classroom management and discipline (Johnson et. al., 1992). When a program like this is implemented and teachers and students are trained to deal with discipline, it will build a healthier school environment.

Instead of teachers and administrators dealing with discipline issues first and foremost, the students would deal with it themselves. If students learn that they can settle conflicts themselves in a healthy matter then they will spread that throughout the rest of the school. While it will most likely not squelch all problems, the environment of the school will be much different which will in turn affect the students in a different manner. If students know that they are responsible for their own actions and the teachers and administrators are not the first steps in discipline, then they are more likely not to partake in behavior that is detrimental to the school environment (Johnson et. al., 1992).
Examples of Lessons and Exercises

Plan for Learning – Constructivism

“Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological).” (Vygotsky, 1978)

Constructivists, as the name implies, believe that all knowledge takes place as people construct their own meaning from their own experiences, backgrounds, and attitudes. Clearly, then, constructivism is an outgrowth of earlier theories such as discovery learning. Constructivists believe that their approach makes learning more relevant to students by imbedding it in real, "authentic" situations, helping them learn to solve problems, think critically, and learn how to learn. Emphasis is on the process of learning, rather than searching for the answer. “Constructivist teachers design lessons that address students’ suppositions. This design process is informed and enhanced by an understanding of the cognitive demands implied by certain curricular tasks” (Brooks & Brooks, 1999).

A constructivist design, then, would (1) focus on learning through posing problems, (2) be concerned with large goals such as problem solving and learning skills, rather than specific objectives, (3) stress group work such as cooperative learning, and (4) use alternative assessment methods, such as student portfolios, evaluation of product, use of open-ended questions, and teacher observation.

Learning something new, or attempting to understand something familiar in greater depth, is not a linear process. In trying to make sense of things we use both our prior experience and the first-hand knowledge gained from new explorations. (Gardner, 1991) It is up to the teacher to facilitate the constructivist learning process. The structure of the learning environment should promote opportunities and events that encourage and support the building of understanding.

In this lesson process we have employed the Seven “E”s:

The seven E's are Expectation, Enticement, Engagement, Explanation, Exploration, Extension, and Evidence (Burton, 1997). Perhaps the most significant part of this approach is that students have freedom of choice and connect science with their lives (Burton, 1997).

Expectation – goal or main idea of the lesson or unit

Enticement – is the activity motivational and inviting the students to learn

Engagement - Here they make connections between past and present learning experiences, lay the organizational ground work for the activities ahead and stimulate their involvement in the anticipation of these activities.
Explanation - Looks at the reasoning and underlying concepts of the expectations. (Teacher-Guided discussions)

The learner begins to put the abstract experience through which she/he has gone into a communicable form. Language provides motivation for sequencing events into a logical format. Communication occurs between peers, the facilitator, or within the learner himself. Working in groups, learners support each other's understanding as they articulate their observations, ideas, questions and hypotheses.

Exploration - In the Exploration stage the students have the opportunity to get directly involved with phenomena and materials. Involving themselves in these activities they develop a grounding of experience with the phenomenon. As they work together in teams, students build a base of common experience which assists them in the process of sharing and communicating.

Extension - the students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them.

Evidence - the process that allows the teacher to determine if the learner has attained understanding of concepts and knowledge. Evaluation and assessment can occur at all points along the continuum of the instructional process. Some of the tools that assist in this diagnostic process are: rubrics, teacher observation structured by checklists, student interviews, and project and problem-based learning product outcomes.

Example Lesson Plan

Science Lesson Design
Acid & Base - Cleaning Pennies – Acid Rain

★ Exploration
➢ Cleaning Pennies

Does an acid or a base clean a penny better? Students clean pennies with acidic and basic solutions to determine which cleans copper better.

Materials:

1 qt. water & baking soda, ½ qt lemon juice, 1 qt water & Lava soap shaving,
1 qt vinegar, 4-8 oz cups for each group, 100 dirty pennies
What to Do

**DIVIDE** the class into groups of four students with the following roles:

- **Materials Handler**: Distributes materials.
- **Equipment Handler**: Manipulates materials.
- **Recorder**: Records results.
- **Speaker**: Shares results with the class.

**Materials Handlers** PASS OUT the following to each group: 8 oz. cup of baking soda solution; 8 oz. cup of vinegar solution; 8 oz. cup of lemon juice; 8 oz. cup of Lava soap solution; 4 dirty pennies.

**Equipment Handlers** CLASSIFY the substances into acids and bases. Lemon juice and vinegar are acids; Lava soap and baking soda are bases.

**Equipment Handlers** PLACE a penny into each solution. Recorders WRITE whether or not each solution cleaned the dirty penny.

★ **Explanation**

**Speakers** report their findings to the class. Did acids or bases clean the pennies better?

★ **Extension**

**What the student does**:

- Applies new labels, definitions, explanations and skills in new, yet similar situations.
- Uses previous information to ask questions, propose solutions, make decisions, and design experiments.
- Draws reasonable conclusions from evidence.
- Records observations and explanations.
- Checks for peer understanding.
Acid Rain: What is the pH of rain in your area?

What is the pH of rain in your area? Students take pH measurements for rain in their neighborhood and compare it with other students' findings. This activity is best when conducted over several weeks during a rainy time of year.

Materials:

pH test strips – (5 per student)

1 plastic 1-oz. cup for each student

What to Do

Distribute one cup and five test strips per student. Students take cups home. Each time it rains, students collect rain water in their cups. They test the water with one strip of pH paper, and bring the pH paper to class.

Draw a map of the neighborhood on a wall chart. Students pin their paper on the map in the location where they collected the rain water. On successive rainy days, students pin additional papers to the right of previous ones.

As a class, discuss the pH of water in the neighborhood. Did the pH change over time? Was the pH different in different areas? What are some possible reasons for this?

★ Evidence . . . the student understands.

What the student does:

- Answers open-ended questions by using observations, evidence, and previously accepted explanations.
- Demonstrates an understanding or knowledge of the concept or skill.
- Evaluates his or her own progress and knowledge.
- Uses alternative assessments to demonstrate their understanding of the concept/topic.
What the teacher does:

- Observes the students as they apply new concepts and skills.
- Assesses students' knowledge and/or skills.
- Looks for evidence that the students have changed their thinking or behaviors.
- Allows students to assess their own learning and group-process skills.
- Asks open-ended questions like:
  - Why do you think . . . ?
  - What evidence do you have?
  - What do you know about . . . ?
  - How would you explain . . . ?

Plan for Learning – Social Cognitive Theory

Math Lesson Plan
Related Problems- Oldest Animals

Objective: Students will create a number line to solve a related word problem with accuracy.

Materials: Oldest Animal related problems worksheet, overhead projector, markers

Plan
1. Start off the lesson explaining to students the will be learning how to solve related problems. Give them an example of what a related problem is (comparing length, height, amount, etc).
2. Introduce a number line and review what a friendly number is (a number that ends in 0).
3. Pass out the worksheets to the students containing the graph with information on animals that have lived a record number of years and the word problems they will have to answer using a number line and graph.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Record Ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parrot</td>
<td>35 years</td>
</tr>
<tr>
<td>Monkey</td>
<td>53 years</td>
</tr>
<tr>
<td>Alligator</td>
<td>66 years</td>
</tr>
<tr>
<td>Eel</td>
<td>88 years</td>
</tr>
</tbody>
</table>

Oldest Animals
1. How many more years did the oldest monkey live than the oldest parrot?
2. How many more years did the oldest eel live than the oldest alligator?
3. How many more years would the alligator have to have lived to be as old as the oldest eel?
4. A monkey is 9 years old. How many more years will it have to live in order to tie record for the oldest eel?
5. How much longer did the oldest eel live than the oldest parrot?
4. Using the overhead projector, do the first problem together explaining how you would solve the problem and your way of thinking. Have students follow on their worksheets as you go.

   a. “First I am going to read the whole word problem. Then, I am going to read it again and circle the information that will help me solve the problem.”

      i. How many more years did the oldest monkey live than the oldest parrot?

   b. “Now I need to know how many years the oldest monkey and oldest parrot lived, so I am going to find the information on the graph. I see that the oldest monkey lived 53 years, and the oldest parrot lived 35 years. Now that I have that information, I can make a number line to help me find the answer. Since 35 is the smaller number, I am going to start my number line with 35. Since 53 is the bigger number, I am going to end my number line with 53.”

      i. 35 53

   c. “I am going to put my finger on the 35. The closest friendly number to 35 is 40. So my first jump is going to be to 40. To get to 40 from 35 I need to add 5. To help me remember how much I jumped, I think it would be a good idea to write it above my jump. So above my first jump I am going to write 5.”

      i. 35 40 53 5

   d. “I am at 40 now and I need to get to 53. I think I can jump to another friendly number without going past 53. Yes, I can jump to 50. If I am at 40, I need to add 10 to get to 50. Above my second jump I need to write 10.”

      i. 35 40 50 53 5 10
e. “Now I am at 50 and I need to get to 53. I know I need to add 3. Above my last jump I am going to write 3.”

f. “Now that I am at 53, I need to figure out how many numbers I moved in all. To do this I am going to have to add all my jumps up. I know $5 + 3 = 8$, so now I need to add $10 + 8$. $10 + 8 = 18$. The oldest monkey lived 18 years longer than the oldest parrot. Now I need to answer the question using a complete sentence.”

i. The oldest monkey lived 18 years longer than the oldest parrot.

g. Self-regulation- “Now I am going to make sure I did what I was supposed to. Did I use the correct animals? Yes. Did I use a number line? Yes. Did I use friendly numbers to help me get my answer? Yes. Did I answer the question in complete sentences? Yes. Now I’m ready to move on to question number 2.”

5. After the first problem is done. Have students complete the worksheet independently. The class goal will be to finish the problems and go over it together as a class before lunch. As students are working, walk around the classroom providing assistance to any students that need it. When students are finished, have them stand in front of the class to show how they used a number line and friendly numbers to answer questions 2-5. Make sure they explained each step they took and the reasons they took those steps.

Assessment
At the end of the lesson the students should be able to:
★ Identify information in a word problem needed to solve a problem.
★ Read a graph to obtain information they need to solve a problem.
★ Create a number line using appropriate numbers and “jumps”.
★ Use a number line to help them solve word problems.
★ Answer the question in a complete sentence.

Conclusion
Each theory has its pros and cons. While learning about a theory, one can think that it would work perfectly in practice. However, this is not always the case. As teachers take the theories that are learned in teacher education programs out into the field, many realize that the theories may not work in all settings. Whether or not a theory works depends on many different variables. A teacher must address the setting in which they work, the age of the students that are
being taught, the different abilities of the students, the content that is being taught, and also a myriad amount of other variables. Each theory fits into some sort of educational setting but it is up to the particular teacher to test different theories and find out which one fits their situation.
References


