
Teaching Constructivism Constructively: What a Novel Idea!

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Abstract: *In the last 20 years, constructivism has been both a leading philosophical approach to learning and a tool for guiding instructional design. Thus, it is important that pre-service educators are properly trained on how to teach constructively. The purpose of this study was twofold: (1) to conduct a field experiment investigating the effect of teaching constructively in an educational psychology course, and (2) to develop and share a methodology for teaching future educators about constructivism. Over an 8-week period, 34 pre-service educators were taught constructivism through constructivist techniques and administered pre and two post measures of knowledge and perceptions of constructivist teaching methods. Results indicated that using a constructivist approach to teaching constructivism in educational psychology helped pre-service teachers to make significant gains in their academic and self-reported knowledge of constructivist theory. In addition, students reported that they enjoyed being taught constructively. The results imply that teaching constructivism constructively is educationally beneficial to educational psychology students.*

Keywords: *Constructivism, pre-service teaching, educational psychology*

In college, pre-service educators are taught that social and cognitive constructivism has an important role in the elementary school classroom (De Jager, Reezigt, & Creemers, 2002; DeVries & Kohlberg, 1990). Ironically, often this message is delivered via direct instruction (Richardson, 2003). Noel (2000) and Richardson (2003) suggest that to properly teach the importance of constructivist theory to future educators, instructors should teach in a constructivist way that pre-service students can experience and model. This study will describe and demonstrate how effective it is to teach constructivism in a constructivist way to pre-service educators.

Constructivism as both a philosophy of learning and an instructional technique has increased in popularity over the past few decades (Tobias & Duffy, 2009). In contrast to the empiricist and nativist approaches to learning, Piaget coined the term constructivism to describe how children learn (Byrnes, 2007). He suggested that children are not given knowledge (empiricist approach), nor are they born with knowledge (nativist approach) but instead construct their own knowledge by integrating new material with previously learned material (Powell & Kalina, 2009). Vygotsky and Piaget have slightly different perceptions of constructivism. Vygotsky's social constructivism stresses the importance of collaborative learning, discussions, and reciprocal teaching (Vygotsky, 1978). In contrast Piaget's cognitive constructivism stresses the importance of individual

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engagement with course materials through active learning, problem-based learning, and making lessons developmentally appropriate (Piaget, 1970).

Both forms of constructivism stress that students are in charge of constructing their own knowledge. They both also see the teacher's role as that of a facilitator who creates learning opportunities and scaffolds each student's learning as they actively engage in the material (DeVries & Kohlberg, 1987/1990). Among leading elementary and early childhood educators, constructivism is both admired and advocated as an effective instructional model (De Jager, Reezigt, & Creemers, 2002; DeVries & Kohlberg, 1990; McDavitt, 1994; Plourde & Alawiye, 2003). As a result of the important role constructivism has in the elementary classroom, we sought to assess the effectiveness of teaching constructivism, constructively, to pre-service educators.

Despite the demonstrated effectiveness constructivism has had in the K-12 classroom, constructivism is not without its critics. Some feel that constructivism is better as an epistemology than as an instructional design (Tobias & Duffy, 2009). Constructivism was defined by Piaget and Vygotsky as a theory of learning but it has been used to inform different teaching methods such as active learning, inquiry learning, discovery learning, collaborative learning, and problem-based learning. The teaching methodology that is most closely associated with constructivism is that of assisted discovery and many studies have found assisted discovery to be an effective tool for learning (e.g., Dođru & Kalender, 2007; Kim, 2005). However, critics feel that constructivism taxes student's working memory as they are asked to do too much "unassisted" and independent learning (Kirschner, Sweller, & Clark, 2006). Over taxed working memory can be an issue in *unassisted* discovery learning which is more in line with Piaget's approach to constructivism (Gresalfi & Lester, 2009). However, using Vygotsky's social constructivist view suggests that learning should involve assisted discovery where teachers and students help each other to solve a novel problem. Research examining the efficacy of assisted discovery has found quite favorable results (e.g., Dođru & Kalender, 2007; Kim, 2005; Sommerfeld Gresalfi & Lester, 2009).

Teaching methods based on constructivism are effective because the active learning style helps engage students and increase their intrinsic motivation (DeVries & Kohlberg, 1990). When using methods such as active learning, inquiry learning, discovery learning, assisted discovery, collaborative learning, and problem based learning, students are more likely to remember course material because of their active engagement and unique learning experiences (Harton, Richardson, Barerras, Rockloff, & Latane, 2002; Poirer & Fledman, 2007; Warren, 2006). Furthermore, students have a deeper conceptual understanding of class material, which helps to facilitate better transfer of material to real life circumstances (Byrnes, 2007). Students are also more likely to use and develop higher-order thinking skills by being asked to problem solve and actively experiment on their own (Richmond & Hagan, 2011). As such, in this article, we explore how best to teach pre-service educators about the epistemology of constructivism and the teaching methods that stem from such a philosophy. We chose to teach pre-service students from an educational psychology course in an effort to encourage them to teach in a constructivist manner in their own future classrooms.

Although professors understand the importance of constructivism for early childhood and elementary classrooms, they often teach these methods using direct instruction (Richardson, 2003). It is not uncommon to hear students say they learned how to actively engage their classrooms through a lecture. The manner in which future educators will teach depends largely upon their own post-secondary educational

experiences (Kroll, 2004). As a result, students might be more inclined or comfortable using a more direct style of teaching because of their limited exposure to constructivist classrooms. Noel (2000) suggests "If students have no past experiences of social constructivist classrooms, they are likely to have difficulty understanding what such classrooms might look like, and may not even attempt such models of teaching and learning." (p. 184) Thus, it is important for college instructors to teach constructivism in a constructivist way (Noel, 2000 & Richardson, 2003).

Teaching constructivism using discussion, active learning, inquiry based learning, and assisted discover does not come easily especially considering that the majority of secondary and higher education is taught in a direct or lecture based format (Noel, 2000; Powell & Kalina, 2009). Thus, it is vitally important to train pre-service educators to be fluent in the epistemology of constructivism and how that learning theory translates into best teaching practices. This begs the question, what is the best way for teacher educators to train pre-service educators about constructivism? We attempt to provide practical suggestions on how to teach constructivism in a constructivist way in order to model this teaching method.

One of the first courses students learn about constructivism is in an educational psychology course. Thus, we developed a methodology for teaching future teachers about constructivism in an educational psychology course. We then conducted a field experiment to investigate the effectiveness of our methods on student's understanding of constructivism and their self-reported perceptions about the elements of teaching constructively. We questioned: (1) Do pre-service educators gain knowledge of constructivist theory by being taught constructively? and (2) What elements of teaching constructively do pre-service educators find of value?

METHOD

PARTICIPANTS

Participants included 34 junior and senior level students enrolled in one of two sections of a cognitive development psychology class. This psychology course is specifically designed for early childhood and elementary pre-service educators. Ninety four percent of this sample was female and 6% was male. We did not directly measure ethnicity of the participants, however, at this university students typically consist of 1.2% American Indian, 2.7% Asian or Pacific Islander, 5.3% African American, 13.2% Hispanic, 70.8% White, and 6.1% declaring other.

MEASURES

There were four measures developed for this study. Two measures assessed students' knowledge of constructivism. The Constructivist Knowledge quantitative measure contained 17 multiple-choice questions that assessed student's knowledge and application of constructivist theory. A sample question from the multiple-choice test was:

In a constructivist classroom, the teacher feels that they are a(n):

- a. Expert in the field and the teacher can get the answers from them.
- b. Facilitator. The teachers' role is to create situations where students can create their own knowledge. (*Correct Answer)
- c. Communicator. The teacher's role is to communicate knowledge to the students.

d. Both A and C

The second measure of constructivist knowledge was a qualitative measure that comprised of a 3-item short answer question assessing student’s knowledge and application of constructivist theory. For this qualitative measure, answers were scored by two independent raters (average inter-rater agreement was 90%). A sample qualitative question was “How might you create a lesson that uses Constructivist Theory?” These two measures of constructivist knowledge were administered during a pre-test, before the semester began, a post-test, 4-weeks into the semester, and a second post-test, during the cumulative final.

The last two measures were administered only during the post-test periods. The third measure was a 12-item 7-point Likert scale self-report survey, which assessed students’ perceptions of their knowledge of cognitive developmental theories. The final measure was a 6-item 7-point Likert scale self-report survey, which assessed whether students valued the constructivist components of instruction incorporated into the course (see Table 3). This measure had an internal consistency of Cronbach $\alpha = .632$.

Table 1. Timeline of Constructivist Assignments for a 16-week and 8-week Course.

Constructivist Assignments	16-Week Course	8-Week Course
Instructor modeled constructivist lesson.	Week 5	Week 2
Creating and leading a group constructivist teaching mini-lesson.	Week 7-15*	Week 4-7*
Evaluation and critique of constructivist mini-lessons.	Week 7-15*	Week 4-7*
Individual reflection paper identifying how their mini lesson used constructivism.	Week 7-15*	Week 4-7*
A self-critique paper about the pros/cons of constructivist theory based on personal experience.	Week 16*	Week 8*

Note. (*) One student group presented their 30-minute constructivist lesson a week. Students turned in their constructivist theory paper on the day they taught their mini-lesson to the class. Assignments are presented in both an 8 and 16-week schedule to illustrate how each class delivered course material.

PROCEDURE AND DESIGN

This study was a within-subject longitudinal design investigating gains over an 8-week period. On the first day of class, all students filled out the multiple-choice test, essay test, and the self-report of knowledge gained measures. During week 2 of the course, the instructor modeled a 45-minute constructivist lesson for the class and then engaged the class in an evaluation and discussion of how the lesson was constructivist. Four weeks later (post-test 1) students filled-out the same three measures completed on the first day of class. Between weeks 4-7 of the course, one student group a week was asked to teach a 20 minute constructivist mini-lesson to the class. On the day that the group taught their lesson, they also had to turn in a research paper detailing how their lesson plan incorporated cognitive and social constructivism. After each student group’s mini-lesson, there was a 20-30 minute class evaluation and discussion about the lesson. On the last day of class, during week 8, students turned in a final reflection paper and also filled out the same three original measures. In an attempt to eliminate practice effects, students did not receive any feedback on their performance on these assessment measures during the 8-week period. See Table 1 for a complete time-line of constructivist assignments. At the end of the semester, students also filled out a measure

of the degree to which they felt each of the five steps in teaching constructivist theory were helpful and effective. The five methods used to teach constructivism were as follows:

Modeled constructivist class. After a brief introduction to constructivism, we gave a 45- mini-sample lesson that was taught in a purely constructivist manner. We asked the class to pretend they were 6th grade students as we taught them about the scientific method via active experimentation. Based on the suggestions of O'Neill and McMahon (2005), students were given an activity with very little direct instruction on how to find the answer within that activity. The instructor then served as a guide and assisted each student group to scaffold their work by giving them subtle suggestions or asking pertinent questions. This scaffolding helped students to process the material for themselves at a deeper level of conceptual understanding. After the sample lesson, the last 30 minutes of class time was used for students to reflect and identify how the lesson was constructivist in nature. Students identified how Piaget's cognitive constructivism and Vygotsky's social constructivism was implemented, how it could have been implemented further, and what were the pros and cons of using this method.

Constructivist teaching mini-lesson. Constructivist theory posits that we learn best by actively engaging with the material (Byrnes, 2007). Consequently, students were asked to plan and teach a team-taught (group of 3-5), 30-minute constructivist lesson on a K-6th topic of their choice. While the student group was teaching, the rest of the class role-played the age of child that the lesson targeted. For example, one group taught a mini-lesson geared towards second grade students' knowledge of parts of speech (e.g., verb, noun, and adverb). The student teachers organized students in small groups and gave each student in the group one word that they then wore around their necks as necklaces for other students to see. Then, students were asked to line up in different orders to create sentences with their words. Each part of speech was color-coded (e.g., verbs in yellow, nouns in blue). Thus, students began to observe different patterns of speech through the color combinations as they created their sentences. The pre-service teachers then facilitated the discussion of speech patterns. This lesson was constructivist because students were not given any direct instruction on speech patterns and parts of speech. Instead, through a guided activity, students discovered on their own that certain speech patterns exist. Thus, the pre-service teachers scaffold the discovery to explore those patterns.

Evaluating constructivist mini-lessons. To ensure that all students were engaged during each mini-lesson, students were asked to "evaluate" each constructivist mini-lesson during the last 20 minutes of class after the lesson. Students first individually evaluated the lesson, via a written reflection, and then further evaluated the lesson in the form of class-discussion. These evaluations involved students describing how the mini-lesson used a constructivist methodology, the role of the teacher and students in the lesson, the engagement level of students, the strengths and weaknesses of the lesson, and how constructivism could have been implemented further.

Constructivist theory paper. To further ensure that students were processing constructivism at a deeper-level, we asked students to write a theory paper explaining how each part of their lesson incorporated social or cognitive constructivism. We also asked students to define constructivism and state why it was an effective method for teaching in the early childhood and elementary classroom. Through this assignment, we were better able to assess student's mastery of constructivism and their knowledge of how it should be implemented in the classroom.

Reflection paper. Lastly, students were required to turn in a short reflection paper (based on their observations of their own constructivist lesson) that describes the pros and cons of using constructivism in the classroom. The purpose of this paper was to help students to reflect upon constructivist pedagogy and the potential strengths and weaknesses of using this method of teaching. Students were also asked to state which aspects of constructivist methodology they planned to use in their own classroom.

RESULTS

RESEARCH QUESTION 1

In order to evaluate whether students gained knowledge of constructivist theory by being taught constructively, we analyzed the data using three repeated measures Analysis of Variance (ANOVAs). The ANOVAs examine the degree to which student's knowledge of constructivism improved over the course of the semester as measured by the multiple-choice test, essay test, and self-report measure of knowledge gained. For the multiple-choice test the ANOVA revealed a significant effect $F(2, 66) = 116.89, p < .001$, partial eta squared (η_p^2) = .78, see Table 2 for descriptive statistics. For the 3-item essay test, the ANOVA revealed a significant effect $F(2, 66) = 244.54, p < .001, \eta_p^2 = .88$, and for the self-report of knowledge gained measure, the ANOVA revealed a significant effect $F(2, 66) = 24.59, p < .001, \eta_p^2 = .43$, see Table 2 for descriptive statistics. Using dependent *t*-tests, post-hoc analyses were conducted on all three ANOVAs to determine differences between testing periods. Results indicate that there were significant differences between all three testing periods in that students demonstrated significant gains on each measurement over the course of 8-weeks ($ps < .001$ see Table 2).

Table 2. Paired Samples *t*-test Summary

	Mean Difference	<i>t</i> (<i>d</i>)
Multiple-Choice Test		
Pre-test - Post 1*	13.85	8.81(1.51)
Pre-test -- Post 2*	22.23	14.89(2.55)
Post 1 -- Post 2*	8.38	6.30(1.08)
Essay Test		
Pre-test - Post 1*	2.46	6.80(1.67)
Pre-test -- Post 2*	9.07	21.93(3.76)
Post 1 -- Post *	6.61	13.54(2.32)
Self-Report of Knowledge Gained		
Pre-test - Post 1*	2.50	3.96(0.68)
Pre-test -- Post 2*	3.90	6.12(1.05)
Post 1 -- Post 2*	1.40	3.69(0.63)

Note. (*) = $p < .001$. There was a total of 34 students and the degrees of freedom = 33. Alpha slippage was controlled for using the Holms-Bonferroni Correction (see Green, Salkind, & Akey, 2000). *d* = Cohen's *d* effect size. Cohen's *d* (Cohen, 1988; 1992) is an effect size for paired-samples *t*-test and Green et al. (2000) suggest that *d* of .2 are small, .5 are medium, and .8 or more are considered large effects.

RESEARCH QUESTION 2

To analyze students’ perceived value of the different methods of teaching constructivism constructively, we collapsed scores and conducted five one-sample *t*-tests. Scores were compared to the median score of the scale (i.e., 3.5) or hypothetical mean. As illustrated in Table 3, all *t*-tests were significant and had extremely large effect sizes. Students rated on a 7-point Likert scale, the effectiveness of five different ways to teach constructivism: modeled constructivist class, mini-constructivist. On average, students reported that each constructivist teaching element were highly valued ($M > 5.5$). Furthermore, students reported creating their own lesson using constructivist theory to be the most valuable way to learn about constructivist pedagogy ($M = 6.67$).

Table 3. One-Sample *t*-tests Evaluating Which Segments of the Course Students Valued Most

Statements About Constructivist Elements That Were Useful ($n = 34$)	<i>M</i> (<i>SD</i>)	<i>t</i> (<i>d</i>)
Creating and teaching a constructivist lesson.	6.23(0.80)*	19.80(3.40)
Identifying and discussing the constructivist elements of student mini-lessons.	6.10(0.90)*	16.85(2.89)
Participating in an instructor facilitated constructivist lesson.	5.90(1.03)*	13.65(2.34)
A self-critique paper about the pros/cons of constructivist theory based on personal experience.	5.73(0.81)*	16.00(2.74)
Individual student papers identifying how their mini lesson was constructivist.	5.57(1.20)*	10.06(1.73)

Note. (*) = $p < .001$. Each of these questions was based on a 7-point Likert scale ranging from 1 (Not at all helpful) to 7 (Very Helpful). Alpha slippage was controlled for using the Holms-Bonferroni Correction (see Green et al., 2000).

DISCUSSION

Research studies have found many benefits to teaching in a constructivist manner for K-12 students, including increased conceptual understanding, better grades, and higher motivation for learning (DeVries & Kohlberg, 1987/1990; Poirer & Fledman, 2007; Warren, 2006). Thus, we need to instruct our future educators on how to teach in a constructivist way. To address this need, we taught pre-service educators in an educational psychology course how to teach constructively by engaging in a five-step system.

The quantitative measures of knowledge gained and a self-report of knowledge gained showed that students’ understanding of constructivism improved throughout the semester. While students’ initial level of understanding and confidence in using constructivism increased after the sample constructivist lesson (post-test 1), students’ understanding and confidence increased even further after their own implementation and evaluation of constructivist mini-lessons (post-test 2).

Students reported enjoying the course and felt that each of these five activities helped their understanding of constructivism. They reported getting the most benefit from creating and teaching their own mini-lesson using constructivist principles. The teaching method that gave them the second most benefit was identifying how other groups incorporated constructivist principles into their mini-lesson. Students reported getting

the least benefit from the papers they had to write although they still reported that the papers helped them understand constructivist theory.

We found that students' understanding and confidence in using constructivism in the classroom increased throughout the semester. We believe that this speaks to the power of teaching in a constructivist way. Constructivist theory posits that students learn by authentically engaging with material and by uniquely combining new material with previous understanding (DeVries & Kohlberg, 1990; Powell & Kalina, 2009). In contrast, direct instruction does not give students firsthand experience on what constructivism looks like in the classroom and how and why they should use this approach. We believe our students increased their understanding and use of constructivism because they had the opportunity to teach constructively which allowed them to create their own deeper understanding of constructivism through personal experience. Furthermore, students reported that they did not fully understand how to teach in a constructivist way until they actually created and taught a constructivist lesson.

INSTRUCTIONAL IMPLICATIONS

Instructors can use all five of these techniques to teach constructivism or only one or two depending on the class time available and the degree of importance understanding of constructivism is to the course. Based on the results of this study, having students create their own mini-constructivist assignment is critical in their understanding and confidence in using constructivism in the classroom. Although this method of teaching constructivism was used in an educational psychology course, we feel that this method can be used in a variety of educational and psychology courses that cover different teaching methods and/or learning theories. For example, if your course covers additional learning theories like ours does, then you can also have students identify how the student's mini-lessons integrates other learning or educational theories such as information processing theory, schema theory, or behaviorist theory.

LIMITATIONS AND FUTURE RESEARCH

Although the main purpose of this article was to study an implementation of constructivist theory into an educational psychology course – which as the data suggests was successful – there are a few limitations that future researchers should address. First and foremost, we created most of our measures without the ability to evaluate whether they had reliability or validity. However, the measures do seem to have face validity. Future researchers should replicate and advance this study by using more reliable and valid measures. Second, this study employed a repeated measures design without random selection and a control group. Thus, it is difficult to assess whether the students increased their knowledge purely as a result of the instruction and assignments or would they have gained the knowledge regardless of instructional type? Obviously this is a considerable limitation, however, Richmond and Hagan (2011) used a similar instructional format and employed a pre/post experimental/control group design and found similar results (i.e., constructivist instruction increased knowledge over that of direct instruction specifically on higher-level thinking assessments). Based on these findings, we believe it is safe to suggest that teaching constructivism constructively is a beneficial method for pre-service educators. Finally, we did not measure whether the constructivist knowledge our students gained transfers to their use in the classroom. This was not our focus, yet is an exceedingly important issue. Future researchers should track students in this fashion.

We hope that using all (or some) of the five suggested methods of teaching pre-service educators constructivism will prove beneficial to giving students the experience and confidence necessary to teach in a constructivist way. In true constructivist fashion, we feel that one cannot understand the mechanics of teaching constructively, in addition to the benefits of constructivism without experiencing constructivism first hand through participating in a constructivist classroom and creating one's own constructivist lessons.

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