Classroom Constructivism Inventory: Informing Teaching Practices

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Abstract

This study addresses the need to assess critical thinking in P-12 teaching by developing the Classroom Constructivism Inventory (CCI), a tool designed to assess constructivist teaching practices. Constructivism, which emphasizes active student involvement and the construction of knowledge, has been linked to positive educational outcomes. Despite its benefits, the diverse implementation of constructivism complicates its evaluation. The CCI was created to provide a construct-valid and user-friendly instrument for assessing the presence and effectiveness of constructivist elements in classrooms.

Grounded in the theories of Piaget and Vygotsky, the CCI measures adherence to constructivist principles, such as student-centered activities, democracy in classroom interactions, professionalism, and the development of inquiry skills. The instrument was tested with two groups of teachers: one trained in constructivist methods and a control group with traditional training. Results demonstrated the CCI's subscales' reliabilities (pretest Cronbach's αs = .79 - .83), good test-retest reliability ($r_{Experimental}$ = .53; $r_{Control}$ = .70), and its ability to distinguish between the teaching practices of the two groups. Teachers trained in constructivist methods led more student-centered activities and encouraged greater use of inquiry skills.

The findings support that the CCI can validly measure constructivist teaching in real classroom settings, providing educators with a practical tool to enhance and evaluate constructivist teaching practices. Further validation with a broader range of school faculty is recommended.

Keywords: constructivism, instrument creation, reliability, validity, classroom observation

1. Introduction

1.1 Background

Critical thinking is important for quality education (Indrašienė et al., 2023; Lithoxoidou & Papadopoulou, 2024; Palavan, 2020). Yet, educators seldom delve into how students learn or how learning mechanisms should shape pedagogy (Butler, 2024; Liyanage, Walker, & Shokouhi, 2021). This gap has led educational theorists (e.g., Cannella & Reiff, 1994; DeJong & Groomos, 1996; Greene, 1996; Richardson, 1997; Savelova, 2022; Zulkarnaen, 2019) to advocate constructivist approaches. Greene (2000) contends that, despite empirical support for active learning and critical inquiry, educators lack the speculative engagement to apply these insights comprehensively.

Constructivism emphasizes active learning processes (Wang et al., 2024), being associated with positive learning attitudes (Ritcher & Tjosvold, 1980), increased student accountability (Wang & Stiles, 1976), and reduced anxiety (Cardozo et al., 2023). Its adaptability to diverse backgrounds (Greene, 1996; Newcomer et al., 2021; Nurpatri et al., 2021) also strengthens constructivism's value. Yet, this diversity complicates its assessment (Birdon, 2000). Identifying discrete components within constructivism (Hay & Barab, 2001) is essential for evaluating their unique impacts on learning outcomes.

1.2 Purpose

This study addressed these challenges by creating the Classroom Constructivism Inventory (CCI), an instrument that (a) measures constructivist teaching and (b) is easy to use. The instrument was designed so that school personnel could obtain valid assessments with minimal training and supervision.

The current study outlines the development and performance of an instrument that attempts to identify and measure the ability of various constructivist elements. Specifically, I measured the effect of constructivist practices on (a) teacher knowledge, (b) teacher leadership attitudes and behavior, and (c) the classroom behaviors of both the teachers and students.

1.3 Theoretical Framework

The CCI was designed to assess a classroom's alignment with key principles of constructivism. Given the diverse ways in which constructivism can be applied, it was important to establish a well-defined sample domain for the instrument. This theoretical framework used combines Piaget's (1967; 1952) psychological constructivism and Vygotsky's (1978) social constructivism. Central to constructivist theory is the assertion that "[t]he brain needs to experience the abstract through concrete experiences" (Barton, 2001, p. 28), advocating for classrooms that promote active engagement (Anderson, 2022; Richardson, 1997; Sioukas, 2023) rather than passive knowledge absorption (Anderson, 2022).

Constructivism considers each student's existing cognitive frameworks, guiding them to construct, expand, and integrate new knowledge into these pre-existing structures. This process encourages students to independently navigate challenges, fostering the development of interconnected knowledge through relationship-building (de Almeida et al., 2019). Additionally, constructivist classrooms prioritize student-centered activities that employ manipulatives to facilitate empirical learning (Goodwin, 2024; Uyandiran & Tarim, 2024). Consequently, constructivist-oriented teachers emphasize the cultivation of inquiry and critical thinking skills, actively guiding students in the application of these competencies (Anderson, 2022).

These attributes of constructivism guided the creation of an instrument, the CCI (Table 2). The CCI pilot version burrowed structural architecture from Bybee's "Five Es" and the Flanders Interactive Analysis Categories Systems (1967). The CCI sought to marry these perspectives into a conceptual framework for identifying the extent to which a classroom centers on activities that may foster intellectual growth and critical thinking. The validity of the CCI was studied in real classrooms to insure that it is easy to use, easy to understand, and demonstrated sufficient generalizability.

Table 1. Teacher Demographics

Group	*N*	*N* (%) Female	Mean (*SD*) Months Teaching
Experimental	24	18 (75)	50.83 (41.0)
Control	24	14 (58)	51.8 (36.8)

Table 2. Item-Subscore Correlations and Coefficient αs When Items Are Removed for the Classroom Constructivism Inventory's Four Subscales

Domain	Item Prompt	Coefficient α if Item Removed	Item Mean (SD)
Student-Centered Activities	1. Students actively participate in class discussions.	0.77	2.81 (0.807)
	2. Students have opportunities to choose their own learning activities.	0.77	3.10 (0.90)
	3. Classroom activities are designed to cater to diverse learning styles.	0.7	3.02 (1.04)
	4. Students are encouraged to collaborate on projects and assignments.	0.75	2.81 (0.94
	5. The teacher adjusts instruction based on student feedback and interests.	0.75	3.15 (1.07)
	6. Students have significant input in setting learning goals and objectives.	0.77	3.12 (1.00)
Democracy	7. Students participate in creating classroom rules and policies during class discussions or discussing whether observed actions are affected or guided by the rules.	0.75	2.64 (1.08)
	8. Lessons incorporate activities that reflect the interests and cultural backgrounds of students.	0.78	3.04 (0.85)

	9. Students actively voice their opinions and ideas during class discussions.	0.81	3.08 (1.93)
	10. The teacher visibly incorporates student suggestions into ongoing class activities.	0.8	3.17 (0.95)
	11. Students choose from a variety of options to demonstrate their learning during class.	0.85	2.92 (1.14)
	12. Classroom interactions show respect for diverse viewpoints and perspectives.	0.79	2.83 (1.00)
Professionalism	13. Class time is filled with structured activities that keep students engaged in learning.	0.75	2.75 (1.10)
	14. The teacher provides accurate and detailed explanations of the subject matter during class.	0.77	3.12 (1.20)
	15. Lessons are delivered in an organized manner with clear instructions and objectives.	0.8	2.79 (1.01)
	16. The teacher sets and communicates high expectations for student performance during lessons.	0.81	2.92 (0.99)
	17. The teacher gives timely and constructive feedback on student work during class.	0.79	2.77 (0.99)
	18. Professional development practices are evident in the teacher's instructional methods.	0.8	2.93 (1.37)
Inquiry Skills	19. Students frequently ask questions and explore answers independently during class activities.	0.8	2.85 (0.77)
	20. Students conduct experiments and research projects as part of the class curriculum.	0.77	3.06 (0.98)
	21. The teacher guides students in critically evaluating information and sources during lessons.	0.78	2.85 (1.13)
	22. Classroom activities involve students in problem-solving and analytical thinking tasks.	0.79	3.27 (0.79)
	23. Students participate in hands-on learning experiences regularly during class.	0.75	3.33 (0.88)
	24. Students use empirical evidence to support their conclusions in class discussions and activities.	0.84	3.02 (0.96)

2. Method

The domains from which the instrument items sampled were characteristics of constructivism; the items themselves were devised to assess situations, behaviors, and environmental classroom conditions evincing these constructivist domains.

The items that comprise the CCI is reproduced in Table 2. All items are rated on a 5-point Likert scale ranging from "Not Present" (1) to "Always Present" (5). Since the CCI was created with the evaluating administrator in mind, care was taken to insure the instrument remained "user-friendly" so that a non-scientist could rather quickly familiarize him or herself with the given instrument, and have little trouble interpreting the results. Interpretation was facilitated by instructions and step-by-step coverage of the preparation and analysis of the data.

2.1 Participants

The experimental and control groups each contained 24 teachers who had consented to participate in the study. Five of the experimental teachers and six of the control teachers taught at one school, the rest of the teachers taught at another.

The experimental group teachers—17 (71%) of whom self-identified as women—had been teaching a mean of 4.39 years (SD = 3.36). The control group, of whom 15 (62%) identified as women, averaged 4.11 years (SD = 3.12) of teaching experience. Neither gender ($t_{45.8}$ = -0.60, Cohen's d = 0.18 ± 0.56, p = .559) nor the number of years teaching ($t_{45.7}$ = -0.30, Cohen's d = 0.09 ± 0.55, p = .762) differed significantly between the two groups.

To assess the instrument's construct validity, i.e., how well it measures actual constructivist classroom practices, the

instrument was used with two groups of teachers to detect a difference in the teaching strategies. The experimental group had previously received extensive training in, and demonstrated an understanding of, constructivist methods during a professional development program. The control group of teachers had also received in-service in a series professional development programs, but these programs (and all of the teachers' previous training) included traditional, teacher-centered strategies and did not address constructivist methods or theory per se.

3. Results

3.1 Reliability

The CCI total score demonstrated moderate overall reliability (Cronbach's $\alpha = .60$). The item-total reliabilities for the entire reinstatement ranged from .58 to .62. The CCI, however, was designed to measure four, relatively discrete subscales: (1) student-centered activities, or the amount of student-engagement and student-directed learning, (2) democracy, the degree to which the interactions and classroom content are tailored to and decided by the abilities, needs, and interests of the students, (3) professionalism, the degree to which class time is used to advance student knowledge, and (4) inquiry skills, or the extent to which the students are able to learn, develop, and use empirical knowledge to guide their thinking. The reliabilities and item-subscore reliabilities. presented in Table 2, were acceptable or good (αs = .78 – .83).

3.2 Validity

The CCI revealed that teachers in the experimental group conducted significantly more student-centered activities ($t(48) = 2.51$, $p = .015$) and encouraged greater use of inquiry skills ($t(48) = 3.29$, $p = .002$) compared to the control group. However, there were no significant differences between the groups in fostering democratic practices or professionalism (both t-values ≤ 1.03, p-values $\geq .308$).

On average, students in the constructivist group guided classroom interactions during 59.7% of observed time intervals, while students in the traditional group guided interactions during only 31.2% of these intervals. This difference was statistically significant ($z = 2.80$, $p = .005$), indicating that teachers trained in constructivist strategies allowed for a greater degree of student contribution to classroom activities.

In terms of academic focus, the constructivist group spent 69.2% of time intervals centered on academic content, compared to 50.1% for the traditional group. This difference, however, was not statistically significant ($z = 1.91$, $p = .056$). While teachers in the constructivist group allowed students more opportunities to lead interactions, both groups devoted a similar majority of class time to teaching academic content.

4. Discussion

The CCI demonstrated evidence strong face validity and robust construct validity. Designed to accurately reflect constructivist practices through clear language and structure, the CCI serves as a tool for evaluators to assess the extent of constructivist alignment within classrooms.

To establish construct validity—how effectively the CCI measures constructivist practices—I examined its ability to differentiate instructional approaches across two teacher groups. The constructivist-trained group had completed extensive professional development in constructivist methods, showing a thorough understanding of these approaches. In contrast, the traditional group's training focused on conventional, teacher-centered methods with no exposure to constructivist theory or practices.

Constructivist teaching diverges significantly from traditional methods. In traditional classrooms, the teacher is the central authority, providing structured content, while students typically engage passively. For example, traditional instruction often relies on lectures with students taking notes and demonstrating understanding through tests or worksheets focused on factual recall.

By contrast, constructivist classrooms center on active student participation and inquiry. Teachers act as facilitators, guiding students through problem-solving and exploration rather than merely delivering information. For example, a constructivist science class might involve students conducting experiments to explore concepts like gravity or chemical reactions. Rather than explaining these upfront, the teacher provides materials for experimentation and encourages students to hypothesize, observe, and reach conclusions independently, fostering deeper understanding through hands-on learning.

The CCI's ability to validly measure its constructs was supported by its sensitivity to these nuanced instructional differences. With the experimental group's training effectively imparting constructivist principles (Reinhartz &

Samuels, 2003), the CCI accurately measured differences in approach. Evaluators—primarily university faculty and one teacher—found the instrument user-friendly; however, further evaluations by school faculty is necessary to ensure broad applicability.

Not all aspects of constructivism differed significantly between the groups. Constructivist methods did not markedly affect time allocation to academic instruction. Whether constructivist approaches lead to more substantial learning outcomes remains an open question, as this study focused on the CCI's ability to distinguish between teaching methods rather than on outcome efficacy.

The observed differences may reflect more than random error; the significant effects noted—despite small sample sizes—suggest that certain constructivist elements exert a stronger influence than others. These findings imply that constructivist teaching may better tailor learning experiences to individual needs, fostering deeper engagement with material.

Constructivism fundamentally emphasizes the active construction of knowledge through "the interaction of what [students] already know and believe" (Abdal-Haqq, 1998, p. 1). For example, in a constructivist history class, instead of presenting a narrative of historical events, a teacher might guide students in primary source analysis, prompting them to develop interpretations and debate their findings—a stark contrast to traditional methods where history is often delivered as a fixed narrative.

Constructivist educators, viewing themselves as guides rather than gatekeepers, seek to inspire curiosity and critical thinking, fostering lifelong learning. Classroom activities are designed to actively engage students through hands-on tasks, manipulatives, and guided exploration. For instance, a constructivist mathematics class might use physical objects to explore geometric concepts like area and volume, allowing students to understand these ideas through tangible problem-solving rather than solely through abstract formulas. Such methods enable students to form meaningful connections, deepening comprehension and supporting prediction and application (Anderson, 2022; Henessey, 1999; Sioukas, 2023).

5. Conclusions

The findings from this study affirm the practical value of the Classroom Constructivism Inventory (CCI) as a reliable tool for distinguishing between constructivist and traditional teaching practices. By capturing variations in instructional strategies—particularly those that foster student-centered activities and inquiry skills—the CCI proves useful for educators and administrators aiming to implement or evaluate constructivist methods. This distinction is meaningful, as constructivist approaches, through active engagement and experiential learning, have been shown to enhance critical thinking and promote long-term knowledge retention, unlike traditional methods that often emphasize passive learning.

The implications of this study extend beyond individual classrooms, suggesting that broader adoption of constructivist frameworks can better prepare students with critical thinking and problem-solving skills essential in an increasingly dynamic world. As 21st-century education places a premium on adaptability, innovation, and analytical skills, constructivist methods align closely with these societal priorities.

By introducing a validated tool for assessing constructivist principles in educational settings, this study contributes to the field's methodological rigor. Future research could expand upon these findings by exploring how constructivist practices affect student outcomes across various contexts and subjects. Additionally, examining the long-term cognitive and social impacts of constructivist learning could yield insights into the sustained benefits of these approaches.

In sum, the CCI represents a valuable advance in empirical research on constructivist education, providing a reliable means for researchers and practitioners to measure, analyze, and enhance constructivist practices. This advancement may foster greater consistency in constructivist research, contributing to a more profound understanding of how educational practices can adapt to meet the needs of modern learners.

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Authors contributions

Dr. Samuels descigned the study, recruited participants, conducted the study, collected and analyzed the data, and wrote the article. Dr. Samuels designed the instrument, which was inspired by a different one piloted by Dr. Reinhartz. The author read and approved the final manuscript.

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No additional data are available.