An Introduction to Constructivism: Its Theoretical Roots and Impact on Contemporary Education

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With roots in Piaget, Kant, Dewey, Freire and others, constructivism has had a large influence on teaching and learning design over the past three decades. Broadly defined, constructivism is the idea that learners make meaning and construct knowledge by reflecting on and interpreting their own and others’ experiences. In contrast to constructivism, transmissive or traditional learning is one in which a teacher transmits facts to passive students who are later asked to recall the information through quizzes and tests. On the other hand, constructivism leads to transformative learning. Knowledge is not received but created by the learners, as they continually interpret and act on their experiences. Constructivism emerged in part from the belief that education cannot be separated from the realities of society and that learners are only transformed when active assimilation is embedded in the learning process. Critics hold that constructivism creates a risk that learners will create their own realities separate from objective truths. Advocates state that this approach leads to more engaged students and better student outcomes. In recent years, the influence of constructivism continues to be seen in teaching pedagogy, classroom layout and educational technology design. Constructivism has contributed to the increasing emphasis on student-centered learning, active learning, experiential learning and holistic student success.

Keywords: constructivism; transformative learning; student-centered learning; active learning; experiential learning; student success; learning design and leadership; general education

Constructivism learning theory holds that learners construct knowledge as they reflect on and interpret their own experiences. The influence of constructivism is seen in educational practices and policies today throughout primary and secondary education. Schrader (2015) stated that “Constructivism as a meaning-making philosophy that informs pedagogical practices dominated the past several decades of educational practice” (p. 1). According to Krahenbuhl (2016), “Constructivism is undoubtedly one of the most influential philosophies in education in the twenty-first century” (p. 1). If these statements are true, then this theory does indeed warrant a closer look. This literature review seeks to define constructivism, trace its roots, and highlight evidence of constructivist pedagogy in the classroom today. This literature review will also highlight critiques and shortcomings of constructivism theory.

What is Constructivism?

According to Krahenbuhl (2016), constructivism “is an epistemological view of knowledge, arguing that knowledge is derived in a meaning-making process through which learners construct individual interpretations of their experiences and thus, construct meaning in their minds” (p. 4). Tomljenovic and Tatalovic Vorkapic (2020) contrast the “transmissive” or “traditional” approach to learning, which involves students passively receiving facts presented by their teacher, with
"transformational" learning built on cognitivist and constructivist theories, which promote "the student’s active participation through exploratory, problem-based learning" (p. 13). Jones and Brader-Araje (2002) share that across the many definitions of constructivism, the common aspect is that constructivism emphasizes that the learner is actively involved in meaning-making. It is a shift from “knowledge as a product to knowledge as a process” where “knowledge isn’t something that exists outside the learner” (p. 3).

**Tracing the Roots of Constructivism**

While Tomljenovic and Tatalovic Vorkapic (2020) refer to constructivist theory as contemporary, elements of this theory are found in the work of psychologists and researchers from the early, mid and late 20th century. According to Bufkin and Bryde (1996), constructivism has roots in Piaget’s beliefs in how children learn. Piaget (1964) stated that "Knowledge is not a copy of reality. To know an object, to know an event, is not simply to look at it and make a mental copy or image of it. To know an object is to act on it. To know is to modify, to transform the object, and to understand the process of transformation, and as a consequence to understand the way the object is constructed" (p. 176). Similarly, Phillips (1995) emphasized that knowledge is neither wholly innate nor wholly acquired “through some sort of direct perception or absorption” (p. 5). Phillips argues that knowledge, by and large, is constructed. Even the way knowledge is obtained is due to how it has been constructed by others into categories such as biology, physics and sociology – labels and constructs that were determined by people, not categories that were already in our heads at birth.

Through his research, Piaget (1964) found that experiencing and acting upon objects and physical reality (Figure 1) are factors in developing cognitive structures. He connected active learning, that is - acting on objects and realities - with learning and knowing. He stated that "Learning is possible only when there is active assimilation" and "...without this activity there is no possible didactic or pedagogy which significantly transforms the subject" (Piaget, 1964, p. 185).

**Figure 1. Children Learning Through a Hands-on Activity**

https://jmcinset.com/active-learning-classroom
Constructivism also traces its origins to Paulo Freire. In his work, Pedagogy of the Oppressed, Freire (1970) criticizes educators who feel their role is to fill students with information that is “detached from reality” and “completely alien to the existential experience of the students” (p. 71). Freire (1970) believed education and learning are inseparable from the learner’s realities and life context. He emphasized that educators and learners should be transformed together through mutual learning and discovery (Freire, 1970). Another early influencer on constructivism, Maria Montessori, came to conclusions about education from her work observing children. She stated, “The child has shown us the basic principle underlying the process of education, which he has expressed in the words “Teach me to do things by myself!” (Montessori, 2007, p. 17). Montessori emphasized the need for children to learn on their own, through play and autonomy (Montessori, 2007).

Constructivism Framework

Kanuka and Anderson (1999) conducted a review of the literature related to educational technology and constructivism. They developed a framework to represent the “epistemological constructivism positions” (Figure 2). Their intent was "to bring order out of the chaos - and often conflicting information - in the literature on constructivism learning theories" (p. 13). Their framework involves four positions and two dimensions on constructivism. The first dimension considers to what extent reality is objective and separate from the learner or to what extent it is subjective and based on the learners’ realities. The second dimension identifies to what extent knowledge is constructed from social, cultural or contextual sources or to what extent it is constructed individually. The four positions include cognitive constructivism, radical constructivism, situated constructivism and co-constructivism.

While existing literature reveals different positions on constructivist theory (Figure 2), Western Governor's University (2020) summarizes the general idea of constructivism with this explanation: “Constructivism is based on the idea that people actively construct or make their own knowledge, and that reality is determined by your experiences as a learner. Basically, learners use their previous knowledge as a foundation and build on it with new things that they learn. So everyone's individual experiences make their learning unique to them” (para. 1).

Figure 2. Constructivism Dimensions and Positions: Epistemological Constructivism Positions

Kanuka & Anderson, 1999
Influence of Constructivism on Teaching and Learning

According to Krahenbuhl (2016), “Constructivism is the dominant pedagogical theory in contemporary educational circles” (2016, p. 2). Similarly, Schrader (2015) stated that “Constructivism as a meaning-making philosophy that informs pedagogical practices dominated the past several decades of educational practice” (p. 1). Phillips (1995) reinforces this idea stating, “I hold that there is a very broad and loose sense in which all of us these days are constructivists” (p. 5). Jones and Brader-Araje (2002) posit that constructivism, with its emphasis on social context and a community of learners was a major shift away from individual learning and foreshadow that “this legacy of constructivism will likely prove to be a lasting and meaningful shift in the structure of schooling” (p. 7). Since that time, the usage of active learning – an umbrella term with roots in constructivism theory (Lombardi et al., 2021) – has continued to grow. Manduca et al. (2017) conducted a national survey with geoscience faculty in 2004, 2009 and 2012 and supplemented the survey with classroom observations. The results of this study revealed a movement away from lecture-style teaching and an increase in teaching that involved active learning (Manduca, 2017). As Lombardi et al. state, the “construct of active learning permeates undergraduate education in science, technology, engineering, and mathematics” (p. 8).

The influence of constructivism on the modern classroom is evidenced today in at least two key areas, as revealed by the literature reviewed: (1) teaching and learning practices commonly used today and, (2) the growth and usage of educational technologies that facilitate constructivist pedagogy.

Teaching and Learning Practices

Phillips (1995) emphasizes the need for knowledge to be constructed, for educators to find ways to help learners gain their own knowledge and for education to happen in social settings. Bufkin and Bryde (1996) refer to constructivism as “active learning” (p. 58). They emphasize that the constructivist approach to education promotes "choicemaking, use of a student driven curriculum to meet individual needs, development of critical thinking skills, incorporation of active learning, and alternative forms of evaluation" (Bufkin & Bryde, 1996, p. 59).

The University at Buffalo contrasts teaching practices from the “traditional” classroom with teaching practices evident in a constructivist classroom (Table 1).

Table 1. Contrast Between the Traditional and the Constructivist Classroom

<table>
<thead>
<tr>
<th>Traditional Classroom</th>
<th>Constructivist Classroom</th>
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<tbody>
<tr>
<td>Curriculum begins with the parts of the whole. Emphasizes basic skills.</td>
<td>Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts.</td>
</tr>
<tr>
<td>Strict adherence to fixed curriculum is highly valued.</td>
<td>Pursuit of student questions and interests is valued.</td>
</tr>
<tr>
<td>Materials are primarily textbooks and workbooks.</td>
<td>Materials include primary sources of material 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>Teacher’s role is directive, rooted in authority.</td>
<td>Teacher’s role is interactive, rooted in negotiation.</td>
</tr>
<tr>
<td>Assessment is through testing and correct answers.</td>
<td>Assessment includes student works, observations and points of view, as well as tests. Process is as important as product.</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>
</tr>
</tbody>
</table>

University at Buffalo, 2022
In conjunction with teaching practices are that of assessments. Liang and Akiba (2015) posit one reason teaching practices are incorporating more constructivist pedagogy may be because teacher assessment policy influences them to do so. Specifically, they stated that, “Standards-based reforms also require teachers to make a transition from traditional teacher-centered didactic instruction to student-centered constructivist instruction” (p. 382). They found evidence of a positive correlation between constructivist-based teaching and improved student achievement in math. They also highlight a case in the state of Missouri where teachers were explicitly evaluated based on several types of constructivist learning activities employed in their classroom.

Related to teaching practices is the physical structure of classrooms and learning spaces. Jones and Brader-Araje (2002) report that social constructivism has led to the change in classroom layout, from the individual study carrels to group learning spaces, flexible seating arrangements, science stations and mathematics centers. More recently, Rands and Gansemer-Topf (2017) connected the concept of classroom design with student engagement. In their study, they found that the active learning classroom (ALC), featuring a more flexible, open classroom design where seating is not fixed and tables and workspaces are not stationary, led to increased student engagement (Rands & Gansemer-Topf, 2017). Specifically, they found that with this design, students felt more connected with their instructor and peers and experienced a greater feeling of community. This design “made students feel valued as co-constructors of knowledge” and they saw the professor as a facilitator of learning (Rands & Gansemer-Topf, 2017, p. 29). As highlighted throughout this paper, co-construction of knowledge and the teacher as a facilitator are both key tenets of constructivism. In their study of the active learning classroom, Cotner et al. (2013) found similar results to Rands and Gansemer-Topf. They compared student performance between two groups of students – one group that took class in a traditional classroom and the other that took class in an active learning classroom. Both student groups took the same biology course, using the same syllabus, exams and instructor. They used student ACT scores to set a baseline for predicted student performance and found that students in the classroom with the active learning layout performed better than expected and those in the traditional classroom underperformed compared to expectations (Cotner et al., 2013). The active learning classroom used in this study included features such as round tables instead of individual desks, laptop connections at the tables, whiteboard space, several microphones and a large overhead projector. In addition to increased student performance, Cotner et al. (2013) found that students in the active learning classroom felt more engagement and felt better alignment between the classroom and the course.

Education Technology

The availability and usage of educational technologies has grown significantly over the past several years. According to Fortune Business Insights, the edtech market has grown and is projected to continue to grow tremendously (Global Newswire, 2022) (Figure 3).
Even more relevant for this literature review than the growth of the edtech market is the nature of these new technologies and their purpose in the classroom. Education technologies today have the potential to improve student engagement and learning by enabling constructivist pedagogy, particularly in the areas of active learning, social learning, knowledge creation and student meaning-making. Zhai et al. (2019) examined the application of a constructivist learning solution leveraging mobile technology. Specifically, this study aimed to determine the frequency of and functions (Table 2) accessed on the mobile devices of 803 10th grade physics students. In addition to system data, pre and post-surveys and tests associated with their interest in physics and their achievement outcomes were conducted, and Zhai found a positive correlation between using technology that promoted constructivist pedagogy and student achievement. Student achievement increased as students used technologies that promoted student agency in initiating and leading learning.

Table 2. Mobile Technology Functions and Uses in the Classroom

<table>
<thead>
<tr>
<th>Functions</th>
<th>Mobile technology-supported instruction</th>
<th>S-T</th>
</tr>
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<tbody>
<tr>
<td>Screen broadcast</td>
<td>Students watch slides or other material offered by teachers from mobile device screens. They take screenshots and store the content in their own files</td>
<td>C</td>
</tr>
<tr>
<td>Picture uploading</td>
<td>When teachers assign subjective work to students, they require students to upload pictures that are taken of student work, tests, or drawings to teachers immediately during class</td>
<td>T</td>
</tr>
<tr>
<td>Doodling</td>
<td>When teachers broadcast screens or assign subjective work, students are required to write or draw directly on the screen and store or submit</td>
<td>T</td>
</tr>
<tr>
<td>Clicker</td>
<td>When teachers have formative questions, quick tests, or votes for students to monitor or adjust the instructions, they will ask students to respond by using clickers</td>
<td>T</td>
</tr>
<tr>
<td>Class test</td>
<td>When teachers want to monitor students’ learning outcomes during class or at the end of the class, they will issue a class test to students. Teachers can retrieve statistical results immediately</td>
<td>T</td>
</tr>
<tr>
<td>Screen display</td>
<td>Teachers display a student’s screen onto the whiteboard to show the student’s work or drawing. Students can explain their work at the same time under requirements</td>
<td>T</td>
</tr>
<tr>
<td>Use learning guide</td>
<td>Students can watch guided resources (pictures, videos, simulation experiments, etc.) once they need help. Teachers can check the statistical report and adjust their instruction</td>
<td>C</td>
</tr>
<tr>
<td>Preview learning guide</td>
<td>Students use the resources in the learning guide (texts, pictures, videos, simulation experiments, etc., provided by teachers for class usage) to prepare for class</td>
<td>C</td>
</tr>
<tr>
<td>Review learning guide</td>
<td>Students use resources in learning guide (texts, pictures, videos, simulation experiments, etc. which may be used in class) to review the academic content. Teachers can check the statistical report and adjust their instruction</td>
<td>C</td>
</tr>
<tr>
<td>My homework</td>
<td>If the homework consists of objective multiple-choice items, student answers can be statistically summarized for teachers automatically. If the homework consists of subjective items, students can complete them on paper and upload them by taking pictures. Teachers correct or give comments on them directly. Students can also add items to the incorrect items set or check the homework guide</td>
<td>C</td>
</tr>
<tr>
<td>My textbook</td>
<td>Students use the textbook for preparation, review, and searching or as a tool for learning. It is easy to insert tags, highlighit, etc.</td>
<td>S</td>
</tr>
<tr>
<td>Mindmap</td>
<td>Students use this function especially at the end of a chapter for building knowledge structure. It can also be used to make notes</td>
<td>S</td>
</tr>
<tr>
<td>Class notes</td>
<td>Students review class notes after class, which can be easily modified, reorganized, tagged, searched, etc.</td>
<td>S</td>
</tr>
<tr>
<td>Build incorrect items set</td>
<td>Students add items to the incorrect items set and add tags or notes to them</td>
<td>S</td>
</tr>
<tr>
<td>Use incorrect items set</td>
<td>Students review or manage the incorrect items set in the device, such as highlighting, marking, searching, and indexing</td>
<td>S</td>
</tr>
</tbody>
</table>

Zhai et al., 2019
As revealed by the literature reviewed, examples of educational technologies that promote constructivist pedagogy include Google Jamboard (Ahshan, 2022), Yellowdig (Martin et al., 2017), and Kahoot! (Wang & Tahir, 2020). Google Jamboard is an online collaborative space where students can create and share information and annotate others’ work through text, images, video, and other media. In a study about active student engagement (ASE) techniques used in the classroom, Ahshan (2022) examines the impact of educational technologies on the student experience. The study follows the instructor of an online class on Circuit Analysis over the course of three semesters. In the course, the instructor implemented several ASE techniques, which include interactive teaching and active learning strategies, student interaction, social presence, and a customized instructional design. The instructor also utilized various educational technologies, including Google Jamboard. In each semester, the instructor conducted several surveys to ascertain the students’ perception of the ASE techniques and the technologies utilized. In the results, the study found that students who used Google Jamboard in a virtual learning environment felt it was effective for interactive teaching and learning in online class sessions and that it improved their interactions and social presence.

Yellowdig is a platform that allows for one-to-one, one-to-many, and many-to-many conversations and peer learning through discussion boards and social media-like features. Students ask questions, teach each other, respond to prompts, and co-create knowledge together. Martin et al. (2017) conducted a study with students in four marketing courses and found that Yellowdig allows instructors to provide formative assessment and enables students to co-create content and benefit from social learning. They also found that the number of times students provided feedback to other students in the platform was a significant predictor of course grades (Martin et al., 2017).

Kahoot! is a game-based platform that allows teachers and students to create, share, and complete quizzes and learning games. Kahoot! is a popular platform, with 50 million monthly users. Wang and Tahir (2020) conducted a literature review of 93 studies about the Kahoot! platform. From their analysis, they found that Kahoot! can have a positive effect on learning in both K-12 and higher education. They concluded that the use of Kahoot! can improve teacher-student and student-student interactions and can make students more favorable to participate in class. Wang and Tahir observed in their review of the literature that Kahoot! can have a positive effect on student motivation, engagement, satisfaction, and confidence.

The findings from the three studies referred to in the preceding paragraphs resulted in several key student outcomes aligned with constructivist learning theory, including students becoming co-constructors of knowledge; learning was interactive between students and teachers and between students and students; students were actively participating in the learning process utilizing and sharing their knowledge with others; and the teacher was no longer the sole or even primary source of knowledge. According to Holmes (2019), the constructivist approach to learning emphasizes the need for the learner to be an active participant and to be actively responsible for constructing their knowledge. In addition, he claims the teacher acts as a “facilitator or guide and co-producer of meaning” (p. 8). The emergence of these and many other educational technologies that promote active learning, knowledge creation, and social learning provide evidence of the influence of constructivist learning theory on education and teaching practices today, as outlined in the literature reviewed.

Limitations and Critiques

As noted in this literature review, constructivism has greatly influenced modern educational practices, yet this approach is not without its critics and critiques. Constructivism isn’t the only, or always the best, approach to learning. For example, Simpson (2002) posits that constructivism is not the only
way to teach and educate learners and that learners have a diverse array of learning styles and preferences. “No single strategy exists that will achieve success with all students. If constructivism obscures this perspective, then the results for teaching and learning could be negative” (Simpson, 2002, p. 351). While constructivist proponents argue against using drill and incentives in the learning process, Matthews (2003) has demonstrated through research and experience that positive reinforcement, direct instructional models and decontextualized learning are effective, especially in certain circumstances and for certain types of learners.

Simpson (2002) claims that constructivist theory, with its emphasis on personal and individual realities, is incompatible with the concept of absolute and objective truths. Krahenbuhl (2016) claims constructivism, with a focus on learning from one’s own experience, can lead to the learner creating their own reality, rather than basing learning on standard or widely recognized truths. Additionally, he posits if the previous experience of the learner includes incorrect ideas and then a teacher creates an environment where students are asked to refer to previous experiences to learn, this teaching may only extend the learner’s incorrect ideas. Similarly, Phillips (1995) warns against leaning too much on constructivism, where it is possible to create knowledge outside of reality. He states that we “must recognize – and not just pay lip service to – the fact that nature exerts considerable constraint over our knowledge-constructing activities and allows us to detect (and eject) our errors about it” (Phillips, 1995, p. 12). Schauble (1997) points out that just because learning is not passive absorption does not necessarily mean that all learning should happen through discovery. Schauble states that this idea, “when taken to an extreme, seems to mean that the history of western civilization must be reinvented by each child anew in the course of education” (Schauble, 1997).

Clark and Mayer (2008) claim while learning can be fun and engaging, not all fun or engaging activities lead to learning. Specifically, they state,

Our message here is a simple one: physical activity does not equate to mental activity, and it is mental, not behavioral, activity that leads to learning. Specifically, engaging in online games, immersive simulations, or various forms of collaborative learning is not a guarantee of learning. Conversely, more passive environments, including text readings or lectures, do not preclude learning. Instead, it is the learner’s cognitive processing that leads to learning. (p. 5)

On a similar theme, Schauble (1997) argues that not all forms of engagement are valuable from a learning perspective. The assumption is made, but not necessarily confirmed, that because educational activities are “hands-on,” they are educationally fruitful (Schauble, 1997).

Conclusion

Constructivism has had a large influence on today’s teaching and learning practices. With roots in thinkers such as Piaget, Dewey, Kant and others, constructivism, with its emphasis on connecting learning to reality, learning from experience and constructing knowledge in concert with others has wide appeal among educators and learners.

Constructivist theory highlights the importance of providing learners with opportunities to co-create knowledge, use their agency and find ways to relate learning material to themselves. Constructivism has a basis in the now common notions of student-centered learning and active learning (Holmes, 2019), as well as in experiential learning and student engagement. Constructivism is not the only or always the best approach to learning, especially if it promotes student discovery without being...
grounded in truth. But constructivism has the potential to increase student motivation, deepen the learning and lead to transformation of the learner.

The educator’s role then, is to ensure students are grounded in theory and then help them compare their personal experience to the theory to construct new knowledge. This new knowledge might include learning how to apply the theory in real-world scenarios or it might include evolving the theory to better explain the students' experiences. Helping students navigate the dissonance between theory and application and then constructing new knowledge based on that navigation, is at the heart of effective education.

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