To be effective, a teacher must understand constructivist theories of learning. Discuss.

Ellen Crombie

Educators and theorists alike have extensively debated the impact of teachers' beliefs and values on effective teaching. Although there is no universal definition of effective teaching, many educational reforms now emphasize the importance of moving away from traditional teaching methods, such as lecturing and the prescription of textbook questions, and towards the facilitation of problem solving and reasoning (Wang & Lin, 2009). With themes focusing on enabling learners to construct their own knowledge, it seems that in many settings, effective teaching approaches are best understood under a constructivist perspective (Clements & Battista, 1990), which considers learning as a process of active discovery (Wray, 2014). However, when evaluating effectiveness, this essay will examine the nature of the students' mathematical learning outcomes incited by the teaching, within the socio-cultural context of the setting as suggested by Devine et al. (2013), and argues that the most important aspect of effective teaching is the cohesion of learning theory and practice within each classroom (Stipek et al., 2001).

Grand theories of learning such as constructivism do not offer direct instructions for effective teaching practices (Jaworski, 2006), however Pire and Kieren (1992) propose a constructivist environment where learners can interpret mathematical rules and procedures within their own conceptual frameworks, similar to Skovsmose's landscape of investigation (2001). In this context, teachers can facilitate Piaget's constructivist notion of discovery (Wray, 2014) by encouraging students to reinvent and investigate their own 'constructions', rather than solely answering textbook questions (Lerman, 1990, p.60). For instance, a teacher might explain the application of an algorithm, but also encourage students to investigate the method on the LOGO computer language.

Scholars such as Goldin (1990), Clements and Battista (1990) suggest that by creating constructivist environments, teachers can effectively encourage practical learning outcomes, such as students' improved ability to illustrate rules with patterns and explain their reasoning. These types of outcomes are also reflected within global educational reforms. For example, the Cockcroft report (1982) recommends creating opportunities for students to investigate and solve problems, while Hong Kong's Targets and Target-related Assessment (1992) advises effective teaching that enables students to actively construct their knowledge, a testament to the very definition of Pirie and Kieren's constructivist environment (1992). Boaler's (1998) comparative study of two British schools supports this, demonstrating that students who were encouraged to develop their own mathematical ideas (which pertains to elements of a constructivist environment) were more willing to 'interpret different situations' and develop meaning from them, compared to those taught with traditional textbook methods (p. 59). Jonassen (1991) and Cobb (1988) suggest that these abilities may foster a deeper understanding that lasts long after the period of instruction, consistent with Skemp's idea of relational learning (1987). Skemp values worthwhile teaching practices that might nurture students' understanding of both how and why one should do something, rather than solely teaching rules in an instructional manner. Therefore, creating a constructivist environment can be an effective teaching practice in some settings, such as the schools studied by Boaler (1998) in the United Kingdom.

However, considering the vast difference in social and cultural values across global classrooms, in many cases understanding constructivist theories of learning alone might not be sufficient or required for effective teaching. In fact, this essay argues that cohesion between teaching theory and practice within each socio-cultural context is most important in promoting student learning (Wray, 2014). This idea is best illustrated within East Asian countries and cultures. One study describes how two Korean teachers integrated traditional teaching approaches, which prioritise students listening in silence to teacher instruction, with their beliefs about constructivism (Lee & Sriraman, 2013). The teachers did not utilise scaffolding or group work as suggested by social constructivists such as Bruner (Love and Mason. 1992), because they viewed incomplete speech as inferior to silence, fearing that students would suffer embarrassment at making mistakes in public. Instead, they effectively facilitated knowledge construction using a range of techniques that aligned better with Confucian values of self-discipline, hierarchy and obedience. For example, they offered rich explanations and asked students to picture and evaluate concepts in their heads. While these approaches do not follow Western perspectives of constructivism, they align with the cultural community (Jaworski, 2006), illustrating the importance of choosing a teaching approach based on 'the content, students' needs, and teacher objectives', regardless of its consistency with constructivism (Simpson, 2002).

In the United Kingdom, Askew et al. (1997) conducted a study of 84 lessons, concluding that effective teaching was best demonstrated by teachers who exhibited strong coherence in their beliefs that students learned by being challenged to think, discuss and problem solve, and crucially, ensured all students were challenged accordingly. These beliefs display strong alignment with elements of constructivism, such as the concept of student discovery (Wray, 2014). In fact, Stipek et al. (2001) suggest a well-informed understanding of constructive environments contributes to higher self-confidence and efficacy, because teachers cannot rely solely on textbooks, and instead require a wider knowledge of how to diagnose students' misunderstood concepts and respond appropriately with scaffolding (Love & Mason, 1992). Furthermore, a metanalysis of 225 studies (Freeman et al., 2014) suggests that the promotion of active learning abilities correlated with improved exam results compared to lecture-based instruction, aligning with Boaler's findings (1998). However, in many settings teachers can also be effective without an understanding of constructivism.

A study conducted in 1997 determined that more than 70% of elementary Taiwanese school teachers were unfamiliar with the concept of constructivism (Hue 1997, as cited in Leu & Wu, 2006). Despite this, Chinese students consistently outperform Western students in mathematical achievement *and* understanding tests (OECD, 2004). Surprisingly, You (2020) attributes this with the influence of Confucianism and its emphasis on learning by rote, a concept often associated with behaviourist theory, which focuses on students' abilities to respond to stimuli rather than their deeper understanding (Jordan et al., 2008). You suggests Chinese learners stimulate higher cognitive processes by practicing memorization, enabling a form of active learning and sensemaking. Simpson agrees, suggesting that even during rote learning students will construct their own interpretations (2002), and explains how effective teachers often operate from several different philosophical positions to encourage learning. Indeed, the study by Leu and Wu (2006) describes a teacher influenced by Buddhist principles, who believed learning to depend on 'individual efforts and apprehension'. She aimed to broaden her students' mathematical awareness by improving their problem solving abilities, which resonates with constructivist values regarding knowledge construction yet exemplifies an alternative approach to promoting active learning.

A cohesive approach between theory and practice is particularly important when considering exam-oriented schooling across both the East and West (Li, 2006; National Council of Teachers of Mathematics, 2014). Ng and Rao's (2008) study of nine teachers in Hong Kong revealed their understanding of learning to be consistent with constructivist perspectives. However, the schools they taught in had large class sizes and used assessment formats such as computational-based worksheets that did not measure intuitive discussion or valuable peer collaboration. Consequently, the teachers often reverted to traditional approaches, such as drilling verbal counting skills, thereby failing to promote discovery-based reform proposals (Education Department, 1992). Skemp associates an instrumental understanding with computational efficiency (1987), and in a similar manner, the teachers taught students to quickly pick up the methods required for exams. In many cases, creating constructivist environments requires an awareness that students may progress at different rates, which may not align with exam-style assessments (Pirie & Kieren, 1992). Hence, although a teacher can understand constructivist theories, they may be most effective if they can integrate their views on learning with their teaching practices to promote the desired student learning outcomes, within the socio-cultural context of the classroom.

In conclusion, both understanding and implementing an appropriate constructive environment is one way of promoting active learning. However, this essay maintains that the most important element of effective teaching is achieving cohesion between theory, practice, and socio-cultural factors specific to each classroom.

References

Askew, M., Rhodes, V., Brown, M., & Wiliam, D., & Johnson, D. (1997). *Effective teachers of numeracy: final report.* King's College London School of Education.

Boaler, J. (1998). Open and Closed Mathematics: Student Experiences and Understandings. *Journal for Research in Mathematics Education*, *29*(1), 41–62. https://doi.org/10.2307/749717

Clements, D. H., & Battista, M. T. (1990). Constructivist Learning and Teaching. *The Arithmetic Teacher*, *38*(1), 34. https://www.proquest.com/scholarly-journals/constructivist-learning-teaching/docview/208779317/se-2

Cobb, P. (1988). The Tension Between Theories of Learning and Instruction in Mathematics Education. *Educational Psychologist*, *23*(2), 87–103. https://doi.org/10.1207/s15326985ep2302_2

Cockcroft, W. (1982). *Mathematics counts: Report of the Committee of Inquiry into the Teaching of Mathematics in Schools under the chairmanship of W.H. Cockcroft*. London: H.M.S.O. http://www.educationengland.org.uk/documents/cockcroft/cockcroft1982.html

Devine, D., Fahie, D., & McGillicuddy, D. (2013). What is "good" teaching? Teacher beliefs and practices about their teaching. *Irish Educational Studies*, *32*(1), 83–108. https://doi.org/10.1080/03323315.2013.773228

Education Department. (1992). General Introduction to Targets and Target-related Assessment. In Handbook on Educational Policy in Hong Kong (1965-1998) (pp. 7–44). Government Printer, Hong Kong https://www.eduhk.hk/cird/publications/edpolicy/15.pdf

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, *111*(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Goldin, G. A. (1990). Chapter 3: Epistemology, Constructivism, and Discovery Learning in Mathematics. *Journal for Research in Mathematics Education. Monograph*, 4, 31–210. https://doi.org/10.2307/749911

Jaworski, B. (2006). Theory and Practice in Mathematics Teaching Development: Critical Inquiry as a Mode of Learning in Teaching. *Journal of Mathematics Teacher Education*, *9*(2), 187–211. https://doi.org/10.1007/s10857-005-1223-z

Jonassen. (1991). Objectivism versus Constructivism: Do We Need a New Philosophical Paradigm? *Educational Technology Research and Development*, *39*(3), 5–14. https://doi.org/10.1007/BF02296434

Jordan, A., Carlile, O., & Stack, A. (2008). Chapter 2: Behaviourism. In *Approaches to Learning* (pp 21-35). Oxford University Press.

Lee, K., & Sriraman, B. (2013). An Eastern Learning Paradox: Paradoxes in Two Korean Mathematics Teachers' Pedagogy of Silence in the Classroom. *Interchange*, *43*(2), 147–166. https://doi.org/10.1007/s10780-013-9190-2

Lerman, S. (1990). Alternative Perspectives of the Nature of Mathematics and their Influence on the Teaching of Mathematics. *British Educational Research Journal*, *16*(1), 53–61. https://doi.org/10.1080/0141192900160105

Leu, Y. C., & Wu, C. J. (2006). The Origins of Pupils' Awareness of Teachers' Mathematics Pedagogical Values: Confucianism and Buddhism - Driven. In: Leung, F.K.S., Graf, KD., Lopez-Real, F.J. (Eds.), *Mathematics Education in Different Cultural Traditions-A Comparative Study of East Asia and the West* (9th ed., pp 139–152). New York: Springer. https://doi.org/10.1007/0-387-29723-5_9

Li, S. (2006). Practice makes perfect: A key belief in China. In F. K. S. Leung, K. D. Graf, & F. J. LopezReal (Eds.), *Mathematics Education in Different Cultural Traditions-A Comparative Study of East Asia and the West* (pp 129–138). New York: Springer. https://doi.org/10.1007/0-387-29723-5_8

Love, E. & Mason, J. (1992). Interlude: On readiness and fading. In *Teaching Mathematics: Action and Awareness* (pp. 54-58, 86-88). Milton Keynes: The Open University.

National Council of Teachers of Mathematics. (2014). Principles to Actions: Executive Summary. National Council of Teachers of Mathematics. https://www.nctm.org/PtA/

Ng, S. S. N., & Rao, N. (2008). Mathematics teaching during the early years in Hong Kong: a reflection of constructivism with Chinese characteristics? *Early Years*, *28*(2), 159–172. https://doi.org/10.1080/09575140802020917

OECD. (2004). *Learning for tomorrow's world: First results from PISA 2003*. https://www.oecd.org/education/school/programmeforinternationalstudentassessmentpisa/34002454.pdf

Pirie, S., & Kieren, T. (1992). Creating constructivist environments and constructing creative mathematics. *Educational Studies in Mathematics*, 23(5), 505–528. https://doi.org/10.1007/bf00571470

Simpson, T. L. (2002). Dare I Oppose Constructivist Theory? *The Educational Forum*, 66(4), 347–354. https://doi.org/10.1080/00131720208984854

Skemp, R. (1987). Chapter 12: Relational Understanding and Instrumental Understanding In: *The psychology of learning mathematics: Expanded American edition* (pp 152-163). Taylor and Francis Group.

Skovsmose, O. (2001). Landscapes of Investigation. *Zentralblatt Für Didaktik Der Mathematik*, 33(4), 123–132. https://doi.org/10.1007/bf02652747

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education*, 17(2), 213–226. https://doi.org/10.1016/S0742-051X(00)00052-4

Wang, J., & Lin, E. (2009). A meta-analysis of comparative studies on Chinese and US students' mathematics performance: Implications for mathematics education reform and research. *Educational Research Review*, *4*(3), 177–195. https://doi.org/10.1016/j.edurev.2009.06.003

Wray, David (2014). Looking at Learning. In T. Cremin & J. Arthur (Eds.). *Learning to teach in the primary school* (Unit 2.2, 3rd ed., pp 69-78). Routledge, Taylor and Francis Group.

You, Y. (2020). Learning Experience: An Alternative Understanding Inspired by Thinking Through Confucius. *ECNU Review of Education*, *3*(1), 66–87. https://doi.org/10.1177/2096531120904247