

2011

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Recommended Citation

Kruse, Jerrid and Clough, Michael P. (2011) "Hot Conceptual Change - You've Got to Have Faith," *Iowa Science Teachers Journal*: Vol. 38: No. 1, Article 2.

Available at: <https://scholarworks.uni.edu/istj/vol38/iss1/2>

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Hot Conceptual Change - You've Got to Have Faith

Dr. Jerrid Kruse and Dr. Michael P. Clough

In the last editorial (Kruse and Clough, [2010](#)), we addressed some common concerns educators raise when considering inquiry-based instruction. Addressing such concerns is of utmost importance to address the plausibility, intelligibility and fruitfulness of inquiry-based teaching. Unfortunately, such issues are not all that affect willingness to enact inquiry-based teaching. More personal and contextual factors also play a part in all learning, including learning how to teach more effectively.

Pintrich et al. (1993) provide a framework for understanding these more personal and contextual factors in their additions to conceptual change theory called "hot conceptual change theory". This framework focuses on how goal orientation, value, self-efficacy, and control beliefs impact learning. While many of these constructs have been implicitly addressed in our previous editorials (Clough and Kruse, [2010a](#) & [2010b](#); Kruse and Clough, [2010](#)), we address these constructs more explicitly below. Unfortunately, we cannot provide magic strategies to become the teachers we all want to be. Effort, perseverance, and a bit of faith are required.

Goal Orientation

Few deny the benefits of inquiry-based instruction. This minds-on approach can help us achieve many of the goals we have for students including: critical thought, creativity, effective communication, collaboration, responsibility, independence, and, of course, deep learning of science content (Clough, [2006a](#)). However, if educators' enacted goal orientation is more aligned with memorization of science trivia, inquiry makes little sense.

Value

While our goals for students are so very important, educators must see the value of inquiry-based teaching. If we are to invest the necessary effort required to implement inquiry-based instruction, we must acknowledge the extensive evidence that supports more mentally engaging teaching through inquiry, proceed through the difficulties that arise, and maintain faith that with effort, reflection and time, we will be successful at teaching science through inquiry. If we don't earnestly accept that teaching science through inquiry is more effective at engaging students in truly understanding science concepts and processes, then we will easily cave to the current political climate focused on high-stakes testing and simple acquisition of facts. That is, the difficulties of inquiry-based teaching mean we must have faith that teaching through inquiry is a better way to teach. Without this faith, we easily give up and resort to traditional teaching methods.

When first struggling to implement inquiry-based instruction many teachers give up too quickly when they don't see immediate results. Unfortunately, many of these teachers

give up not because inquiry-based instruction doesn't work, but because inquiry-based instruction requires a complex skill set that must be used in concert. That is, to implement inquiry-based instruction teachers must do each of the following together:

- choose developmentally appropriate content
- use concrete representations for concepts
- ask thought-provoking questions
- use positive non-verbal to encourage student engagement
- manage the classroom for safety and off-task behaviors
- consider students' prior ideas
- keep students moving toward intended ideas

Effectively implementing each of these aspects of effective teaching collectively is difficult and most teachers do not succeed in their first attempts. Rather than thinking inquiry-based instruction does not work, having faith that inquiry-based instruction does work may help teachers persevere through initial struggles. Having faith in inquiry-based instruction may encourage teachers to wonder what they might do differently rather than dismiss the extensive research-base supporting inquiry-based instruction. Just as we continue taking antibiotics despite not feeling immediately better, we ought to continue implementing inquiry-based instruction even if we do not immediately see results. Often, the impact we have on students is not visible for years. Yet, having faith in inquiry-based instruction is not enough; we must also have faith in our own ability to implement inquiry-based instruction.

Self-efficacy

Teaching through inquiry is a daunting challenge. The inherent difficulties of highly effective instruction may prevent some teachers from taking on the challenge. To put more of the thinking in students' minds often requires the teacher's role to change (Clough, [2006b](#)). That is, the teacher becomes a questioner and encourager of thought rather than a bearer of all knowledge. When students take a more active role in the classroom there are clear learning benefits, but the ambiguity increases demands placed on teachers. Lack of self-efficacy, or lack of faith in one's ability to teach through inquiry may keep some teachers from even trying inquiry-based instruction, or may cause teachers to give up too quickly.

Self-efficacy concerns go beyond teaching strategies. Inquiry-based instruction requires that teachers understand content very deeply. However, many teachers have low confidence in their own understanding of the content. While understanding your content is of utmost importance, we want to discourage using lack of content knowledge as an

excuse to not engage students in inquiry. Some of our favorite lessons have been when we legitimately did not know the answer to a student's question. Rather than saying, "I don't know and I'll find out", we say, "I don't know, how could we (teacher and students) find out?" Notice, if our classes are consistently inquiry-based, asking students "how could we find out?" will not be an immediate indicator that you don't know the answer. If we consistently encourage student thinking rather than just providing answers, students don't realize when we don't know the answer! If we see ourselves as facilitators of student investigations rather than bearers of knowledge, we might be able to forgive ourselves more easily when we don't know the answers to student questions.

Some teachers worry about how much effort is required to implement inquiry-based instruction. I (Kruse) remember a colleague who expressed her concerns for me. She said, "I see you moving around the room talking to each group and having to mentally work to figure out what they are working on and I worry you're going to burn out." I won't deny the mental effort required during inquiry-based instruction and appreciated my colleague's concern. However, my faith in the benefits of inquiry for my students and my faith in my own ability to manage the difficulties helped me persevere.

Control Beliefs

Too often, teachers complain that they are powerless to change because of external pressures. This attitude clearly hinders progress. Indeed, most teachers would not accept such protests from their students. However, feeling as though they do not have control in a given situation prevents learners from venturing too far beyond what is deemed "safe".

If teachers are to abandon traditional teaching, having a more plausible/fruitful teaching method is not enough. Teachers must also authentically believe they have the autonomy to choose. When students feel education is done *to* them, they are likely to be less engaged than when education is done *with* them. This same idea applies to educators. Belief in one's own level of control is both a liberating and engaging feeling.

Some may want to use lack of control to rationalize their "inability" to implement inquiry-based instruction. These individuals might cite curricular, administrative, or standardized-testing constraints. Many of these issues were addressed in our last editorial (Kruse and Clough, 2010). Importantly, teachers do have control. We each faced these tremendous pressures when teaching kids, but our faith in ourselves and in inquiry-based instruction demanded we find ways around such constraints. For example, if an administrator demands homework each night, this does not mean each assignment must be graded or come from the textbook. If the curriculum seems

overwhelming, seek out the ways in which ideas are connected and focus on these big ideas. Have faith that you do have control over the decisions you make in your classroom. Research makes clear that the teacher is the most important factor in children's learning. We hope all teachers take that responsibility seriously and recognize they have choices to make despite steep institutional constraints.

Some Final Thoughts

In writing this piece, we realized that we must also have faith in our students. Oftentimes teachers give in to students' resistance or frustration. While we do not want students to feel overly frustrated and give up, we must have faith that they are capable of meeting our high expectations. Too often students are labeled as incapable or underprepared. Yet, how will spoon-feeding facts prepare them for anything other than trivial exams? In everything we do, we must carefully consider how our efforts will benefit our students.

While belief that inquiry does benefit students and belief in our ability to implement inquiry is necessary to overcome the activation energy required to become the teachers we want to be, we want to pass on some advice that was given to us. *Be gentle with yourself.* Teaching is not a destination, but a constant process. While we certainly get better with each passing year, our journey is never complete. Because teaching is a process of constant improvement, we do not need to have it all figured out on our first try. Each time we try to implement an inquiry experience for our students we learn – about our students, our content, ourselves, and about our teaching. If we are too hard on ourselves, burnout is inevitable. We must carefully balance our desire to improve with our vulnerability as caring human beings.

References

- Clough, M.P. (2006a). Why Inquiry? The Iowa Science Teachers Journal, 33(2), p. 2. <http://www.iacad.org/istj/33/2/editorial.pdf>
- Clough, M.P. (2006b). The Teacher's Crucial Role in Helping Students Learn through Inquiry. Iowa Science Teachers Journal, 33(3), p. 2. <http://www.iacad.org/istj/33/3/editorial.pdf>
- Clough, M. P. & Kruse, J. W. (2010a). Conceptual Change: It's Not Just for Teaching Science. *Iowa Science Teachers Journal*, Editorial, 37(1), 2-3. <http://www.iacad.org/istj/37/1/editorial.pdf>
- Clough, M.P. & Kruse, J. W. (2010b). When Dissatisfaction is a Good Thing. *Iowa Science Teachers Journal*, Editorial, 37(2), 2-3. <http://www.iacad.org/istj/37/2/editorial.pdf>
- Kruse, J.W. and Clough, M.P. (2010). Confronting Doubts about the Intelligibility, Plausibility and Fruitfulness of Inquiry-based Instruction. *Iowa Science Teachers Journal*, Editorial, 37(3), 2-5. <http://www.iacad.org/istj/37/3/editorial.pdf>
- Pintrich, P.R., Marx, R.W. & Boyle, R.A. (1993). Beyond Cold Conceptual Change: The Role of Motivational Beliefs and Classroom Contextual Factors in the Process of Conceptual Change. *Review of Educational Research*, 63(2), 167-199.