Inviting Uncertainty into the Classroom

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Five strategies to help students respond well to uncertainty—and foster complex problem-solving skills.

What would happen if we invited uncertainty into our classrooms? If you're not sure how to answer this question, you're not alone. What makes this question difficult is that most of us don't like uncertainty. It's uncomfortable. We do our best to avoid uncertainty and if we experience it, we attempt to quickly resolve it.

In the context of classrooms, educators often replace uncertainty with overplanned learning experiences. We go to great lengths to clearly define the problems our students will solve, how they should solve them, and the desired outcomes. There are benefits in doing so beyond maintaining a sense of consistency, calm, and control; students can and do learn from routine problems and assignments (Lee & Anderson, 2013).

The key limitation to these types of learning experiences is that they don't give students opportunities to engage with uncertainty. Just as you can't learn to swim if you never get in the water, students won't learn how to respond productively to the unknown if we never give them opportunities to do so.

What if instead of trying to eliminate uncertainty, we welcomed it into our classrooms? Doing so requires a shift in how we think about uncertainty and its place in fostering problem solving. Five strategies can help us make that shift.

1. View (Good) Uncertainty as an Opportunity

If we view uncertainty as causing curricular chaos, then we're justified in attempting to eliminate it. Not all uncertainty, however, leads to chaos. One way to think about uncertainty in the context of classrooms is that there is *good uncertainty* and *bad uncertainty* (Beghetto, 2016a).

Bad uncertainty results from learning experiences that don't include necessary supports and structures. In such situations, students have no idea of what's expected of them. They also don't know whether, when, or how they will receive support when they need it. When structure and support are lacking, chaos is likely to ensue. If on top of this lack of supportive structure we ask students to tackle complex challenges or ill-defined problems, then we really are inviting chaos into our classroom, presenting them with a double whammy of uncertainty.

Good uncertainty, however, provides students opportunities to engage with the unknowns of a challenge in an otherwise supportive, well-structured environment. For example, when students are trying to come up with their own ways of solving a problem, teachers can let them know in advance about key constraints (such as time and materials), what's required for success, and how they can get additional assistance if they get stuck.

Although it may not be clear in advance how to best approach or solve a complex challenge, students still receive the guidance necessary to navigate the doubts and confusions connected to the problem they're attempting to solve.

This approach relates to why it's important to inject uncertainty into students' learning experiences. Put simply, uncertainty is what makes a problem a problem. If you already know how to move from A to Z, then you don't have a problem—yet our students *will* face problems in life. If we want to unleash student problem solving, we need to give them chances to respond well to uncertainty in the context of a supportive environment.

2. Try Lesson Unplanning

To invite uncertainty in their classrooms, teachers need to make room for it. They can do so by making slight adjustments to pre-existing lessons—what I call *lesson unplanning*. This refers to replacing some predetermined

element (such as the problem or process) with a to-be-determined (by the students) component. Doing so transforms a routine exercise into a more complex one (Beghetto, forthcoming).

Lesson unplanning can be used with any preplanned learning exercise or activity. You might start small by unplanning just one feature of an already planned lesson. Let's say your typical approach is to teach students how to use a procedure to solve math story problems, and then assign them a set of similar problems to solve using the just-taught procedure. This is a routine exercise because the features of the task are predetermined; there's a clearly defined problem, solution, and procedure for arriving at the solution.

You could transform this exercise into a more open-ended one by removing the requirement to solve it using the predetermined method and instead require students to come up with as many different ways of solving the problem as they can.

Niu & Zhou (2010) observed a 3rd grade math teacher in China who took a similar approach. As a result, her students generated more than a dozen unique, mathematically accurate procedures for solving one math story problem.

In such cases, students still have an opportunity to reinforce their understanding of the concepts just taught. But instead of being limited to solving a dozen practice problems one way, students can learn how to solve one problem a dozen or more ways. The key advantage of doing so is that students learn that even problems with fixed solutions can be approached in many different ways. So if students get stuck trying to solve a problem one way, they may realize that there are likely other ways to solve it—and persist or seek assistance rather than give up at the first sign of difficulty.

Although teachers may already include a few problems and activities that incorporate uncertainty in these ways, it's worth exploring what would happen if they used lesson unplanning systematically throughout their entire curriculum. The more opportunities students have to practice working through problems when things are less spelled out, the more likely they'll be able to take on increasingly complex challenges (Beghetto, forthcoming).

3. Assign Complex Challenges

Challenges can range in scope from modest "in-classroom" tasks (such as rewriting the ending of a short story, while adhering to the style of the narrative) to more complex projects (such as developing a gardening project to provide homeless families with fresh produce). The more uncertainty involved in a challenge, the more complex the challenge becomes.

If we want to prepare students to respond productively to uncertainty, we need to have them tackle a full range of challenges, including those addressing ill-defined problems and big issues—such as developing an inexpensive, accurate way to detect the Ebola virus or designing a robot that can clean trash from New York's subways (Stone, 2016). Such work invites students to engage in tasks, situations, or experiences that are filled with uncertainty. There are no sure-fire formulas or predetermined steps to solve a problem like how to address under-the-radar bullying. And the nature of such problems can change during the process of solving them.

Students need to learn how to sit with the uncertainty of a thorny challenge, take time to explore the features of the task or situation, generate possible ways to address it, and evaluate the viability of those possibilities. Finally, students need to take action by choosing initial steps, taking those steps, monitoring progress, and making adjustments along the way. Teachers can help students become more familiar with these principles by having students apply them in different learning situations and highlighting how they differ across disciplines (monitoring progress looks different when working on a chemistry problem than when addressing a problem in theater design). When students become skilled in these basic principles of complex problem solving, they can apply them to almost any ill-defined problem.

Although complex challenges are filled with uncertainty, educators can set them up so they also have a structure. Teachers should break such challenges down into smaller parts and provide guidelines, criteria, and supports for addressing them (Beghetto, forthcoming). Consider the challenge of developing a gardening project to provide fresh produce to homeless families. The teacher might break this challenge down into smaller subgoals (for example, learn about the nutritional benefits of fresh fruits and vegetables, determine what can be grown in our region, identify a

location for the garden, and so on). She can then help students develop specific agenda items (what must be done by when) to complete before moving on to the next sub-goal.

Working through complex challenges also requires students to put their knowledge to creative use, challenge their assumptions about the situation, seek out assistance from more knowledgeable people, persist through setbacks, and know when it's necessary to modify or even step away from a challenge (Beghetto, 2016a; 2016b; forthcoming).

4. Explore the Backstory of Famous Solutions

One way to help students learn to tackle complex challenges is to let them learn from models of successfully solved problems and accomplished problem solvers. Doing so requires students to go beyond the "what" of solved problems and learn about the *why, who, how, when*, and *where* of getting to that solution (Root-Bernstein & Root-Bernstein, 2017).

Much of what we teach in school involves solutions to complex challenges that have *already* been figured out (scientific laws, technological inventions, major social movements, and other solutions that have changed the course of history). Focusing only on tidy solutions, however, doesn't allow students to understand how or why those challenges were identified in the first place or reveal the behind-the-scenes messiness and productive struggle that went into resolving them.

One way to provide students with a behind-the-scenes look is to invite accomplished professionals from various disciplines into their classrooms (in person or through platforms like Skype) to describe the kinds of ill-defined challenges they face in their professional work and how they have addressed them (Beghetto, forthcoming). Alternatively, students might explore the story behind successfully solved challenges. Creativity researchers Root-Bernstein and Root-Bernstein (2017) assigned students in one course to choose an important discovery, figure out how the problem behind that discovery was initially identified, explore the approach used to address the challenge, find out how the problem solvers overcame obstacles along the way, and describe how the disciplinary community received the solution. Students then shared what they learned with the class. Such assignments can powerfully illustrate how accomplished problem solvers rely on both prior and new knowledge to structure the uncertainty they face.

5. Launch Never-Ending Projects

Projects provide great opportunities to address complex challenges. Unfortunately, most projects don't go far enough. Regardless of what form projects take, most are confined to the walls of the classroom and almost all have a predetermined end date. Once a project is over, it's over; the science fair trifold is recycled or stored in the basement, and the 3–D printed fidget spinners are shelved.

What if instead of limiting projects to the classroom and viewing them as coming to an end, we engaged students in projects that address authentic complex challenges and that make a lasting contribution beyond classroom walls, what I call *legacy challenges*? A legacy challenge represents an issue, problem, or situation that requires us to develop an ongoing solution and pass that solution on from one group of young people to the next (Beghetto, 2017; forthcoming).

For instance, suppose a group of bilingual high school students recognizes that non-English speaking members of their community aren't receiving important health, education, and other public information in Spanish, their native language. These students work with their school language department and local businesses, nonprofits, and community centers to develop a service that translates public information into Spanish and delivers it to people in the community. The service would be sustained as each incoming class of bilingual students helps translate and disseminate key information.

As this example illustrates, legacy projects are a way for students to respond productively to complicated challenges facing them, their school, or their community. Designing such a project starts with working through four deceptively simple design questions (Beghetto, 2017; forthcoming):

1. *What is the problem?* Identifying a problem that's relevant to students is the first step. Potential challenges or problems can emerge from what students are learning in class or what they're experiencing in their lives, schools, homes, or neighborhoods.

2. *Why does it matter?* Once students have identified a challenge, they need to understand why it needs to be addressed. This includes learning more about the challenge, obtaining feedback and perspectives from various stakeholders, and becoming able to articulate to others the importance of addressing this problem.

3. *What are we going to do about it?* Students must start developing a plan for addressing the problem by drawing on their existing relevant knowledge, identifying areas where they need additional information, establishing external partnerships, and identifying initial steps to take.

4. *What lasting legacy will our work addressing this problem leave?* This question distinguishes legacy challenges from other kinds of problem-solving efforts. It requires students to take a long view of the challenge and identify how their work will be sustained, curated, and passed on from one generation of students and project partners to the next.

These questions are filled with unknowns. The idea of inviting this much uncertainty into the classroom may initially seem terrifying. Again, the key is to invite students to take on these questions within a structured, supportive learning environment. Break down each question into smaller subgoals, distribute the work across teams of students, and guide teams to accomplish it over time.

By working in this way, we support learners in moving from an ill-defined starting point toward a more clearly defined resolution of the challenge. Such efforts can go a long way in helping students learn how, why, and when to unleash their problem-solving skills on complex challenges—and even when it's better not to do so.

The Beautiful Risk

Let's return to our opening question: What would happen if we invited uncertainty into our classrooms? I hope you now have some idea of the potential benefits of doing so, and understand that reaping those benefits requires a change in how we think about uncertainty. It also requires a shift in how we do things, including being willing to unplan our lessons, incorporate complex challenges into our curriculums, explore previously solved problems with students, and give students opportunities to respond to community needs through legacy projects.

Many other good things may come from welcoming uncertainty into our classrooms. But we will never realize these benefits unless we're willing to take the beautiful risk of allowing students to unleash their problem solving on complex challenges—inside and outside the classroom.

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