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Solving Social Problems through Science: Creative Thinking Workshops

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Abstract

Innovative approaches to teaching science and inventive problem solving come in many forms, many of them solely based within the subject matter. While the students learn content and perform experiments, the applicability of their knowledge is often limited to within the walls of the classroom. Instead of projects that hone specifically on science, a multidisciplinary approach to teaching science and its application can come through teaching students to solve social problems with science and collaboration. Science can solve problems, and students work together in creative thinking workshops to solve those problems. In fact, the necessity of group work for creative thinking is clear because, as DeHaan (2009) suggests, "When an individual experiences an aha moment that feels like a singular creative act, it may rather have resulted from a multicomponent process, under the influence of group interactions and social context" [2]. This presentation will provide a description of how such group work can be incorporated into classrooms and demonstrate how, in immersive and interactive workshops, students work in teams to find a social problem and then take on the task of solving it through science. Examples of such problem solving are tasking students to employ their understanding of biology to solve a problem with food availability or physics to build something sustainable. Through creative thinking workshops, students in schools will be challenged to apply science to solve social problems in their communities, in their towns, and maybe in the world.

Keywords: *Creative thinking, engaged pedagogy, science, social problems, workshops*

1. Introduction

One thing is true—students want to make a difference in their worlds, and education can be the tool to help their ideas come to fruition. The image of students' minds being filled with information is often how we see classrooms. We imagine students listening to lectures or doing experiments, often learning in a vacuum. Research has shown that applying what has been learned is the key to motivating students to stay engaged in class. Ideas like the flipped classroom and the workshop model are not new to science education, but a new approach to enhancing student engagement and employing critical thinking skills is by developing cross-disciplinary workshops that invite students to solve social problems by using what they learn in science classrooms. Through merging science and social issues together, this interdisciplinary lens allows students to make connections, ask questions, and solve problems in novel and hands-on ways [4]. Exploration, inquiry, and engaged pedagogy invite students to use problem-solving techniques to put science into action, a term coined as socioscientifics [3]. In creative thinking workshops that blend the two, the teacher becomes the facilitator and the student works with others to solve "wicked problems" [5]. In all grades, students have the knowledge of such problems, but many have yet been given the opportunity to solve them. Therefore, problem driven creative thinking workshops invite students to solve social problems by using their science knowledge in a meaningful way [6]. As a means of fostering and nurturing more inquisitive and problem-solving student minds, schools should develop creative thinking workshops that mimic those ones that have been adopted by businesses and industries. [1].

2. Theoretical

The term "wicked problems" comes from design thinking, a method famously taught in IDEO and the d.School at Stanford University. These wicked problems are multi-faceted and contingent, so not easily solvable [5]. Because most social problems are systemic and not easily solvable, science (using the broad term) is certainly a tool that can be used to solve such problems. In fact, it should be used. Although it could be argued that students don't have enough knowledge of science to work on such problems, adaptive expertise allows students to apply the principles they do have, even if they are somewhat limited, to solve challenging problems, which supports such coursework [2].

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For these reasons, science classrooms can incorporate engaged pedagogy and problem-solving skills in meaningful ways through incorporating creative thinking workshops. Broadly defined, the art of creating thinking is “a meaningful response to any situation which calls for finding a problem and solving it in one’s own way” [6]. While it is clear that people imagine the arts as the home of creative thinking, all subjects should, and can, support creative thinking [6]. Clearly, creative thinking is a broad approach to teaching students how to think. Creative thinking suspends the correct answer, if there is one, and instead of immediately searching for the right answer when given a problem, students withhold their desire to be right. Divergent and convergent thinking drive creative thinking. Divergent thinking invites students to solve problems and challenges by ensuring that students think as widely as possible and suspend judgment all throughout the process [1]. Divergent thinking is truly thinking outside of the box. In convergent thinking, the students look at the information they have and apply logic and analysis to find suitable solutions [1].
Creative thinking workshops foster problem solving through ideation and brainstorming, which allows students to work with open problems, ones that do not have an easy solution and problems that invite students to look for all possible solutions rather than the right answers [7]. The answers are quite often more scattered, so they can invite students to address complexity beyond the page of a text or within a lab [3]. By combining real world issues with science teaching, the workshops can improve content knowledge [3], and immersing students in active-learning promotes critical thinking and transfer of knowledge. Ultimately, workshops that deliver engaged pedagogy may decrease failure rates [6].

3. Implementation

In creative thinking workshops, students are provided with both the context of a social problem and the opportunity to work in teams. As DeHaan suggests, the “aha moments” happen in light of interaction with others and within specific contexts [2]. Working together to solve a social problem invites such interaction. The social problem should be one that the students have access to or they can interview each other in scenarios. Once the issue has been developed, teams work together for a class session, a module, or even a semester to find a creative solution to a wicked problem.
The learning objectives for creative thinking workshop include the following:

- Use empathy to understand problem
- Brainstorm solutions
- Investigate the problem
- Prototype and test solutions
- Reflect

A suggested workshop that includes both the science and the social aspect is to have students consider how to provide shelter for a homeless person. In all classrooms, groups of four diverse (gender, interests, academic strengths) should be provided with a table, a flipchart, post it notes, and multiple pens.
First, the students need to be provided with the exigency. A scenario could be as follows:

> *Imagine you have met a woman who lives primarily outside. She has no shelter for most nights and spends many of them in doorways or under bridges. You are challenged with creating something to help her. How can you help the woman protect herself from the elements?*

The individual elements of the workshop should have time limits. The constraint of time pushes the students to act quickly and purposely, and it also moves the group to work together.

3.1 Empathy

Empathy drives the workshops and drives the way the students approach the situation. In fact, without empathy, the workshop product is meaningless. During this session, which could be extended depending on the time allowance for the project, students need to develop their understanding of both the woman’s plight and the challenge. By brainstorming questions, the group will develop empathy for the woman and will be able to discover what she needs. Students are allowed to interview the subject (teacher can be actor) for the time allotted.

3.2 Brainstorm

In groups, they brainstorm to figure out how to create something to keep the woman warm at night. As students consider the situation and the conditions, they need to be provided with tools to generate ideas. At the end of the first part of the brainstorming, students must have a problem to solve.

Next, on the flipcharts, students come up with an A-Z of solutions. Students must be pushed to the limits of creativity at this stage. Then, provide Post-It notes and encourage the students to start writing down everything they think of as a means to solve the problem. Finally, students are given three extra tools that they can select, such as technolgy.

3.3 Investigate

During the investigation portion of the workshop, students are actively looking at weather, temperatures, materials, and landscape. Students use specified science skills to think about the most appropriate means of helping a person. At this point, facilitators can provide constraints, information, research directions, or handouts to frame the situation. Students will need to come up with as many answers as possible. While this portion of the workshop is running, students can be given outside constraints such as changing their concept of what it may cost, saying that they have a budget or that money is infinite, or by size, meaning the solution has to fit in a backpack or a bag.

3.4 Prototype and test

After students have agreed on a possible solution that solves the woman's need for protection from the elements, the students then draw and build a solution as a rough prototype. Materials such as cardboard, string, paper, wood, or other remnants are provided, and the students create, to scale if required, a solution.

Once they have created the artifact, then it should be tested. For example, if it is supposed to keep the woman dry, it is important that it is waterproof. However, if has been created to keep the woman warm, the students need to test for that by using a thermometer and placing the item in the refrigerator, for instance.

3.5 Reflect

The final and most important element in the workshop is reflection. At this point, students are asked to talk through or write about the experience. They need to address the positive and negative elements of the group and each part of the workshop. By reflecting, students are continuing the creative thinking process. One activity that can help develop reflection is "I think, I wish, I feel." Students are provided with notecards. On one, they write what they are thinking after the workshop. On the next they write I Wish and explain what they wish had happened or could happen. Finally, I feel asks them to reflect on their emotions. These postcards can anonymous and pinned to a board in the classroom, which encourages students honestly.

4. Conclusion

While creative thinking has been embraced in the arts and in the business world, it has been slow to be incorporated in many classrooms where memorization and practice often reign. Clearly, content matters. And without content, a vacuum will exist. However, the practical application of these projects takes what has been learned and applies it to humans and to life. Engaged pedagogy that teaches creative thinking invites students to foster creative thinking skills, encourages them to think beyond the walls of a classroom or the binding of a book, and ultimately provides them with the tools to engage in an increasingly challenging and collaborative workforce.

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