

GOODNESS IN TEACHING: A MATHEMATICAL PERSPECTIVE

John Grant McLoughlin, Professor

University of New Brunswick, Faculty of Education

The concept of the “public good” is open to interpretation. A public good could be thought of in contrast to a private good, thus, suggesting this topic is about things that could be public or private. Instead it is the idea of “goodness” that guides this author’s interpretation. One may wish to consider the principle of being guided by what one deems to be working out of a spirit of goodness. This suggests to me a striving that goes beyond meeting the requirements of a position to extend into practices and actions that are motivated by serving a greater capacity than one’s own. Perhaps it could be thought of as making a societal contribution that is well intentioned and meaningful beyond the immediacy of the situation in which it is offered.

The aforementioned introduction is personal. The definition of good work is contextually personal in this respect. My inclination to use the word *striving* articulates this perception as it is through striving that the goodness is achieved. Further it is not critical to my understanding of education for the public good that you necessarily agree with this perception. I would go as far as to say that this negotiation and reconfiguring of perceptions is essentially part of striving itself. Rigidity stands in the way of this development.

Mathematics (education) is the discipline in which my work is placed. Ironically it is the perceived clarity of the subject - right versus wrong, in particular - that opens it up for closer consideration. The richness of mathematical ideas can come through contradiction, paradox, and playfully juxtaposing ideas or assumptions that motivate thinking differently about the concepts at hand. In fact, a core principle may not even hold in such instances. Stephen Brown and Marion Walter (1970) articulated a strategy called *What-If-Not* as a means of problem posing. (See Brown and Walter, 2005, for more on the topic of problem posing.) The idea is to identify evident attributes of a familiar idea and then negate them to find fertile ground for exploration. Open-ended investigations can build on such principles.

An investigation by Karen, a student at Memorial University of Newfoundland (MUN) at the time, considered the idea of prime factorization with respect to different sets of numbers such as those defined as $1 \pmod{3}$ like 1, 4, 7, ... (These are the numbers that leave a remainder of 1 when divided by 3.) It is a core mathematical principle that in our standard number system there is only one way to express a number in terms of its prime factors. (e.g. $130 = 2 \times 5 \times 13$ or $72 = 2 \times 2 \times 2 \times 3 \times 3$). Karen found that uniqueness of prime factorization did not hold in the $1 \pmod{3}$ case.

Consider $100 = 4 \times 25$. Note that 4 and 25 are prime numbers in this system as the numbers 2 and 5 would not be in the set of numbers as they each do not leave a remainder of 1 when divided by 3. Therefore, 4×25 is a prime factorization of 100. But hold on a moment --- because $100 = 10 \times 10$ and likewise, 10 is a prime number. Hence, we have two distinct ways of expressing 100 as a product of prime factors. This revelation was made possible by playing with the way that mathematics is experienced in a course. Essentially it represents an effort to bring the doing of mathematics closer to the less polished ways of a mathematician. The openings for cognitive dissonance and disequilibrium offer potential richness.

Above I have articulated an example from mathematics that indeed depends upon mathematical language and concepts. The example is drawn from my experience as a teacher. My teaching is affected by a commitment to opening up such avenues, as reflected in the abstract of a presentation at the 2009 Society for Teaching and Learning in Higher Education (STLHE) Conference entitled *Confused? Good, now learning can begin*:

Clarity: “the quality or state of being clear”. That hardly sounds like a starting point for learning. Suppose you know clearly what you would gain from being at this session. It would make little sense to attend. Rather the intent is to provoke you to think about teaching and learning in some way that is not anticipated in advance... The session will primarily feature discussion on this dilemma between clarity and confusion. A framework will be offered through an opening presentation of examples that illustrate how my teaching works to acknowledge complexity and the place of “pedagogy of confusion” (Brown, 1993) as a starting point for learning. (Grant McLoughlin, 2009a)

Returning to the idea of goodness brings me back to pedagogy and what it is that one values in teaching. There are many facets to consider. Three are evident in each situation: the teacher, the students, and the discipline around which they have gathered. Much more is going on as the people live in context within life circumstances. The course itself operates within a broader context, as is strikingly evident when a significant external event shapes collective experiences during the time together. Meanwhile individual circumstances evolve as a course progresses. The significance of stories and acknowledging the personal mathematical experiences of others has shaped the outset of courses. Biography has become integral to this picture. (See Grant McLoughlin, 2009b for elaboration on this idea.)

Teaching and learning is tangled in paradoxical ways. Paraphrasing Parker Palmer (2008) it is enriching to write about those ideas that puzzle us. Striving for simplicity while consciously acknowledging and giving rise to complexity is illustrative of this reality. The greater good is served, in my opinion, by offering a safe space in which one grapples with confusion, messes with seemingly clear ideas, and widens the

lens for viewing. Mathematical beauty needs to be brought forth to shine in contrast with the deadening of a textbook image; people's stories and prior experiences with the discipline need to be acknowledged as part of what they bring forth; and the teacher needs to challenge one's self to meet new situations in new ways. This educator is muddling with these ideas at various levels in different contexts, so as to develop as a teacher and a person. Writing this piece contributes to that process and responses to this contribution would deepen this process.

In closing, it is the idea of "meeting" that has become central to my perception of goodness. How is it that we meet others? Opening multiple forms of entry into a course context creates an invitational space. Wendell Berry's (1989, p. 23) opening of the poem *Traveling at Home* may resonate with others teaching a familiar course again: "Even in a country you know by heart it's hard to go the same way twice. The life of the going changes." It is the surprises that lie ahead when one meets a collection of people in a familiar course that seemingly provide novel and enriching experiences, that bring us teachers back again to forge human relationships and continue learning in familiar yet changing contexts.

References

- Berry, W. (1989). *Traveling at Home*. San Francisco: North Point Press.
- Brown, S. I. (1993). Towards a pedagogy of confusion. In White, A. (Ed.), *Essays in Humanistic Mathematics*. Washington, D.C.: Mathematical Association of America, 1993, pp. 107-122.
- Brown, S.I. and Walter M.I. (1970). What-If-Not? An elaboration and second illustration. *Mathematics Teaching*, 51, 9-17.
- Brown, S.I. and Walter M.I. (2005). *The Art of Problem Posing (Third edition)*. Mahwah, NJ: Lawrence Erlbaum.
- Grant McLoughlin, J. (2009a). Confused? Good, now learning can begin! (Unpublished paper presented at the *Society for Teaching and Learning in Higher Education Conference*, Fredericton, NB, June 2009).
- Grant McLoughlin, J. (2009b). Biography: Meeting simply in complexity. In S. Bell, L. Best, D. Creelman, K. Craft, D. Roach, and D. Ross (Eds.), *Atlantic Universities Teaching Showcase Proceedings (Vol. XII)*, Oct. 24, 2008, Saint John, NB, pp.147-158.
- Palmer, P. (2008). *The Promise of Paradox*. San Francisco: Jossey-Bass.