

CAN INTEGRATED INSTRUCTION REALLY LEAD TO ‘KARATE KID LEARNING’?

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One of the memorable scenes from the film *The Karate Kid* occurred when Daniel accused Mr. Miagi of using him to complete arduous tasks but not fulfilling his commitment to teach Daniel karate. Mr. Miagi responded by asking Daniel to show him the “sand the floor”, “wax on, wax off” and “painting” motions he had taught Daniel. Mr. Miagi made slight adjustments to the movements, then, while Daniel again showed him the motions, Mr. Miagi directed punches and kicks at Daniel. To his great surprise, Daniel found that the actions Mr. Miagi had taught him could be used to ward off the attacks. Thus, Mr. Miagi had taught and Daniel had learned some karate without realizing he had done so. The process of using activities from seemingly unrelated contexts to teach karate can be viewed as an instance of *integrated instruction*.

Integrated instruction or curriculum integration is the interweaving of the content or methodology of multiple disciplines, often through realistic, contextualized problems, in an effort to help learners build understanding of each discipline by constructing interrelationships between them or between topics within them (Beane, 1997). Personal experiences have led me to question whether or not integrated instruction, particularly in its extreme form, is a theoretically sound teaching method.

The preceding definition of integrated instruction characterizes a moderate version of the teaching strategy. I have heard a few teacher educators define integrated instruction as an effort to teach multiple disciplines simultaneously, in a manner that does not distinguish between when one discipline is being taught and when another is being taught. I shall term this form *extreme integration*. I find the failure to distinguish between disciplines problematic. For the moment, I will highlight the purported benefits of integrated instruction, one of which is also a source of perturbation for me.

One of the primary benefits of integrated instruction is that it helps learners construct relationships between or within disciplines as well as between realistic contexts and the concepts and procedures taught in school. The building of these links leads in turn to better recall of knowledge, as well as deeper understanding and enhanced skill, by providing more contexts in which knowledge can be applied (Beane, 1997; Lipson, Valencia, Wixson and Peters, 1993). Additional potential benefits that may arise from integrated instruction include enhanced appreciation of and motivation to learn subject matter and enhanced interpersonal relationships (Vars, 1993).

All of the above are desirable benefits and goals with which I do not take issue. However, I do take issue with the

claim that a benefit of teaching through an integrated approach is that learners may learn about mathematics or any discipline without realizing they are doing so. I shall playfully term this type of learning *Karate Kid [1] learning*.

The sources of my perturbation

One source that focused my perturbation with regard to the issue of integrated instruction was a conference presentation by Pournara [2]. Therein, he explored the practicality of integrated instruction and asserted that, while the method is theoretically feasible, his data indicated that mathematics could be completely integrated with other disciplines only if extensive teacher support was continually provided.

Of course, the difficulties noted by Pournara could be unique to the pre-service teachers involved in his study. Likewise, the difficulties could arise from an incompatibility in the instructional methods employed and the theoretical foundations of integrated instruction. However, Pournara’s work, in conjunction with an experience I had with some pre-service teachers who were enrolled in an integrated block of courses, has led me to believe that there is a conceptual problem with extreme integration and a potential methodological problem with integrated instruction in general.

I had the opportunity to interact with some pre-service teachers who were enrolled in an integrated block of courses. I was also able to observe several of those classes. The teacher educator used a variety of methods and engaged the pre-service teachers in activities through which they could learn instructional, managerial, and motivational strategies. Nevertheless, discussions with the pre-service teachers revealed that while they believed themselves to be learning about instructional methods, they were concerned that they were not learning much about managerial techniques. I have found this concern to be common among pre-service teachers. Even so, it appeared to me that the pre-service teachers had not noticed several of the concepts, processes and strategies that the instructor strove to teach. This in turn led me to question the effectiveness of integrated instruction in its extreme form.

A problem in concept

I have a problem with how extreme integration is defined. The source of this problem stems from the fact that under extreme integration no distinctions are made between when each discipline is being taught. The problem with this practice is that different disciplines are exactly that, different. While there are interrelationships and similarities, there are also significant differences in purpose, methodology and

emphasis. Moreover, the deepest levels of understanding of a topic or discipline are reached only after the learner understands how it is different from, as well as how it relates to, other topics or disciplines. Accordingly, quality instruction must emphasize the differences as well as similarities and interrelationships between disciplines and topics.

A questionable benefit

My second point of contention concerns the claim that integrated instruction allows people to learn without being aware of doing so. I use the term awareness like its common usage (Hewitt, 2001; Gattegno, 1981). Hewitt (2001) described the term and its various levels:

So, awareness is present at the level of my senses, at a meta-level through conscious cognitive analysis, and also at the level of carrying out automated processes (which may at one time in the past have required both awareness at the level of my senses and awareness at the meta-level of analysis in order for them to become automated). (p. 39)

Can people learn without being aware of it? A solution can be ‘stumbled across’ or constructed when its synthesis was initially not a goal of the learner. A learner may also have an AHA! sensation when she or he recognizes that a link between experiences can be made or that a solution to a problem has been constructed. Nevertheless, solutions and relationships must be recognized as such, and recognition requires some level of awareness. Any accompanying alteration to the learner’s model of reality is also a mental action of which the learner is aware, quite likely at the meta-level of awareness. This follows from the fact that such alterations are the result of accommodation, which is a meta-analytical process and, therefore, occurs at the meta-level of awareness. The fact that the circumstances in which the link or solution was recognized may have arisen accidentally bears no relevance to the learner being aware of the cognitive link being established. Hence, the claim that integrated instruction allows learners to learn without knowing that they are doing so is erroneous.

The dubiousness of the claim that people learn without being aware of doing so can also be highlighted through an exploration of how people make sense of their experiences. Learners not only use but select schemas and interpretive frameworks to give meaning to experiences, and selection would again necessitate some level of awareness on the part of the learner. Further, those schemas and frameworks and all knowledge are grounded in and abstracted from our experience, including and largely determined through our interactions with others. To know is to be able to operate effectively in the world in which we live, and such knowledge is inexorably related to the context in which the knowledge was constructed or is used (Maturana and Varela, 1992).

Since people select and use schemas to make sense of experiences, when mental links between experiences or phenomena are constructed, the links are created with respect to the relevant schema or interpretive framework. When constructing interrelationships between schemas as a part of the accommodation cycle, learners’ awareness reaches the

meta-level. That is, it is when our mental models of the world fail that we become aware at the meta-level of how we are making sense of the relevant experiences and engage in the process of accommodation (possibly with others) to try to modify our models to account for the perturbing experience (von Glasersfeld, 1991). Even so, the selection of a schema is frequently not conducted at the meta-level of awareness (Claxton, 1999), although the learner would be aware of it on some level.

Even if it were possible to learn mathematics or anything without realizing it, transfer of that knowledge to other contexts would be impossible since the learner would be unaware of what he or she knows. Further, of what use is it to a knower to know something that he or she is unaware of knowing? Thus, even if it were possible to learn without realizing it, the knowledge would be useless, since it could not be used until the knower became aware that he or she possessed said knowledge. Moreover, such a lack of utility would contradict the purpose of learning which is to allow learners to impose a repeatable structure on their experiences, *i.e.*, to predict, interpret, and to some extent control future experiences (von Glasersfeld, 1991).

An assumption of transference of knowledge

The claim that people can learn without being aware of doing so is rooted in the beliefs that people can and will transfer knowledge from one field of experience to another when provided with an opportunity to do so and that they may be unaware of the transfer. While the possibility of such transfer is under debate, I accept that people can transfer knowledge, but I assert that they would be aware of such a transfer on some level. I also maintain that the first few times a learner makes what is for her or him a novel transference of knowledge across contexts, the process reaches the meta-level of awareness. However, simply because people can transfer knowledge does not mean that they will (Claxton, 1981). Unfortunately, under an integrated approach, “it is usually left up to the student to do the integrating” (Tinker [3], p. 49), which may necessitate a transference of knowledge. While it ultimately is the students who must “educate their own awareness” (Hewitt, 2001, p. 39), a teacher can facilitate the process. Moreover, it is the teacher’s responsibility to foster the process. Thus, to leave it entirely to the pupils to transfer knowledge across contexts or to construct interrelationships would be irresponsible. So, how do educators help their students construct interrelationships and transfer knowledge from one context to another?

Helping the Karate Kid

Many students think mathematics is abstract and irrelevant to their experiences. Further, many pupils may not notice the relevance of knowledge to a context to which they have not linked that knowledge (Claxton, 1999). In such situations, novices may need more advanced others to help them select frames of reference or schemas to use to interpret a given experience.

Among other things, Hewitt (2001) alluded to the importance of helping students to select an interpretive framework:

Memorising only takes us somewhere, it is by educating awareness that we can have the means to take things further on our own accord and not be limited to reproducing only those things which we have been told. (p. 38)

He further stated that

[...] although teachers cannot directly work with someone else's awareness, they can make decisions which are sensitive and relate to that awareness (2001, p. 40).

I argue that through discourse and questioning, an instructor can take actions that are both sensitive to her or his students' awareness and educate their awareness by helping them to select and use an interpretive lens to given meaning to experiences. Hewitt (2001) asserts that

[a]wareness is revealed not through actions themselves but through making explicit what is guiding those actions (p. 41)

and that

[d]rawing attention to something can be a tool for a teacher and what attention is drawn to, and when, are pedagogic decisions. (p. 44)

That is, to facilitate learning, teachers need to help their pupils bring the choice of both interpretive lenses and solution strategies to the meta-level of awareness. Of course, it is not enough to stop with fostering a choice of interpretive framework. Additional investigation and discourse is needed to facilitate the construction of knowledge through experience.

Once a frame of reference has been selected, learners are ready to recognize and establish links for themselves, or to be oriented toward links that could be established through the interactions with more advanced others. Establishing such links will deepen the learner's understanding of the experience being investigated, and since much of the meaning that people give to experience is socially negotiated (Vygotsky, 1978), the teacher can and should contribute to that interaction.

When integration of disciplines or integration of mathematics and the 'real-world' is an instructional goal, I recommend that an instructor make his or her students aware of the interpretive lens being used to make sense of the phenomena under investigation. A teacher can help her or his pupils select a frame of reference or begin to understand what interpretive lens the instructor is using simply by stating, "Let's explore the experience from a mathematical perspective." This can also be accomplished by asking, "What mathematics did we use or what mathematics do we need to solve this problem or achieve our goal?" Of course, more specific questions or statements can be used to facilitate the choice of a useful interpretive framework. For example, "Does the path that the ball travels when thrown approximate the shape of the graph of any mathematical functions?" or the follow-up statement of "Let's try to relate what we know about quadratic functions to our ball-throwing activity."

Such questions help students activate their mathematical knowledge and use that knowledge as an interpretive tool. Likewise, the students will be less likely to feel disoriented

and unsure of the realms of experience to which they are expected to relate the current situation. Thus, they will be in a better position to construct new knowledge and relationships. Further, once students are aware that they are interpreting an experience from a mathematical perspective, they will be better oriented toward relating their mathematical knowledge to a broader context, while still being afforded the opportunity to construct knowledge through their investigations.

I want to make it clear that I am not arguing for an abandonment of efforts to integrate disciplines or to integrate disciplines and out-of-school experiences. I am not arguing that experience is composed of neat little packages that are easily labeled with distinct schemas. However, I am arguing that instructors should take time to help their students select a lens through which they can interpret the topics explored in class. Had the pre-service teachers who contributed to my perturbation concerning the effectiveness of extreme integration been aware of the interpretive frameworks their instructor intended for them to bring to bear on their in-class experiences, and had they interpreted class activities via each of the relevant frameworks, the pre-service teachers may not have missed so much of what their instructor strove to teach.

Getting students into the mind gym

Recently, Claxton (2004) raised issues that he believes mathematics educators need to address in order to justify the inclusion of mathematics as a whole or some mathematical topics in the curriculum. Among those challenges, Claxton highlighted a need for demonstrating the utility of mathematical topics before they are included in schools' subject matter content.

I believe that integrated instruction, when it includes highlighting the interpretive frameworks being used to make sense of a situation or activity, has promise for meeting the challenge of helping pupils come to view mathematics as practically useful. The reason for this is that integrated instruction stresses building relationships between disciplines, between topics within disciplines, and between concepts and processes taught in school and relevant, realistic contexts. Unfortunately, neither the construction of such links nor the transference of knowledge is a trivial endeavour, so in order for integrated instruction to be successful, teachers must establish conditions under which it is favourable for students to make such constructions. Therefore, instructors need to help their pupils select and use interpretive frameworks that are conducive both to the transference of knowledge across contexts and to the construction of interrelationships.

Claxton also asserted that

it is not clear that mathematics is the new Latin - in the sense of providing any kind of effective, generic 'training of the mind'. (2004, p. 27)

However, assisting students in selecting schema could improve their ability to reason. Interpreting an experience from a variety of perspectives and interacting with a more advanced other who verbalizes how he or she is interpreting an experience and reasoning through a solution process

builds the less advanced individuals' ability to independently engage in similar actions (Vygotsky, 1978). Such expansion in students' ability also relates to Claxton's point that "Piaget's (1959) definition of intelligence as 'knowing what to do when you don't know what to do' is being revived" (Piaget in Claxton, 2004, p. 28). Specifically, discourse concerning the selection of interpretive frameworks is one method of modeling what to do in the face of uncertainty and of orchestrating "learning contexts and activities, and the kinds of conversations *about* learning which they encourage" (Claxton, 2004, p. 29) in a manner that helps students learn how to learn. So again, the form of integrated instruction endorsed herein has the potential to help address challenges currently facing mathematics education.

In addition to challenges facing mathematics education, Claxton presented a mental gymnasium model of education. Within that model, he highlighted emotional, attentional, cognitive, reflective, and social components of 'mental fitness' or 'learning power' that educators should address to help their students build such power (Claxton, 2004). Discourse concerning interpretive frameworks can help pupils develop the emotional, cognitive, reflective and social components of 'learning power' by helping them learn how to deal with uncertainty, how to interpret experiences from multiple perspectives, and how to learn cooperatively.

Claxton (2004) also noted several implications that the mental gym metaphor had for educators. Among these, he noted a need for direction from a teacher or "learning coach" (p. 30) concerning how to use a novel learning apparatus at an appropriate difficulty level as well as a need to encourage pupils to coach or direct their own learning. Discourse concerning interpretive frameworks is one method of providing such advice and is most useful when the context, topic or perspective is unfamiliar to the learners. As previously stated, the advice concerning methods of giving meaning to an experience will help pupils construct interrelationships between experiences and will help their critical thinking skills, which builds their ability to direct their own learning. This in turn supports students as they strive to attain the goals set for them and can help them set and attain learning goals for themselves, which is another of the roles of the "learning coach" that stems from the mind gym metaphor (Claxton, 2004).

Despite the points of convergence between the mind-gym metaphor and the use of discourse to help pupils select useful interpretive frameworks, there are two points of divergence between my own position and a component of the epistemological movement that in part prompted Claxton's (2004) recent article. Claxton notes that currently there is an emphasis on contextualizing and interrelating disciplines, and well there should be. However, he also states (Claxton, 2004),

[i]n this creative, situated world, the boundaries between the traditional 'disciplines' become increasingly permeable, and even irrelevant. Mathematics becomes a tool, usually enshrined in a computer programme, that people need to know how and when to use, but not how to derive or justify. (p. 28)

The first point of divergence concerns the claim that boundaries between disciplines are irrelevant. With respect to

drawing on one another to resolve problems, yes they are. But, as I argued earlier in this paper, the differences in disciplines must not be neglected because the deepest understandings and appreciations of a discipline are only reached when a learner is aware of how it differs from as well as relates to other disciplines. Its idiosyncrasies compose much of a discipline's beauty and are therefore, essential to explore in order to develop appreciation and understanding of the discipline.

Moreover, pupils not only need to know when and how to use a solution strategy, but they also need to know how to justify the use of that strategy in order to be able to convince themselves or others that a solution has been obtained. Further, justifying solutions enhances learners' communication skills, retention and understanding as well as their preparedness to direct their own learning by providing them with challenging exercise on some of the most beneficial equipment in the mind gym.

Summary

I wrote this article because some perturbing experiences led me to ponder whether integrated instruction, particularly its extreme form, is an effective instructional strategy. I am not arguing that integrated instruction is an inherently undesirable practice. I am arguing that in its application, instructors too often expect students to abstract relevant mathematics or to construct links between experiences or topics without establishing conditions that are favourable for such abstractions and constructions.

Even the Karate Kid failed to construct links between the sanding, waxing and painting activities in which Mr. Miagi engaged him and his goal of learning karate. It was not until Mr. Miagi helped Daniel interpret his prior experience from a martial-arts perspective and apply that experience in such a setting that he was able to transfer his knowledge from one domain of experience to another. Moreover, when Daniel constructed the links, he was very much aware of both the process and product of his learning. Thus, *Karate Kid learning* is actually a misnomer for the process of learning without being aware of doing so.

Instructors who want to help their students build interrelationships across contexts must keep in mind that the construction of such links is neither automatic nor accidental (Claxton, 1981). Accordingly, educators should teach in ways that help learners

maintain contact with awareness of our (the learners') mental powers that translate themselves into our (the learners') growth. (Gattegno, 1981 p. 7)

Further,

[t]he nature of mathematics is such that a student does not always have the awareness necessary to see, on their own, the consequences of what they are doing. (Hewitt, 2001, p. 43)

While it is only an initial step, using carefully selected statements or questions is one method of helping students select an interpretive framework with which to give meaning to an experience and thereby, of helping students to construct the intended understandings.

Notes

[1] The title of the film *The Karate Kid* formed the basis of the term *Karate Kid learning* because, during the film, the character named Daniel learns karate largely through seemingly unrelated tasks that are set in contexts outside what would normally be considered the practice of karate.

[2] Pournara, C. (2000) 'Mathematics and integration: thorny rose or rosy thorn?', *Proceedings of the Sixth National Congress of the Association for Mathematics Education of South Africa*, Bloemfontein, South Africa, pp. 346-353.

[3] Tinker, R. (1994) 'Integrating mathematics and science', *Proceedings of the NSF/SSMA Wingspread Conference*, 49-52.

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Architecture

Most of us are so accustomed to living in a rectilinear environment that is difficult for us to imagine different surroundings. Our furniture and accessories are designed to fit along straight walls and into right-angled corners. Yet, people of other cultures would be just as uncomfortable if they had to give up their circular houses for our rectangles. The Native peoples of the Great Plains (northcentral U.S.) traditionally lived in conical *tipis*, portable tents made of animal skins and decorated with meaningful symbols – a dwelling appropriate to the life style of the people. Early in this century, Black Elk, one of their leaders, lamented:

We made these little gray houses of logs that you see, and they are square. It is a bad way to live, for there can be no power in a square. You have noticed that everything an Indian does is in a circle, and that is because the Power of the World always works in circles and everything tries to be round.

Why has the round house been traditional in some societies? One must consider the available materials and technology, as well as the way the society makes its living. A settled agriculturalist builds for the future, while a pastoral nomad may abandon a shelter after a few months, or pack it up and move on. Consider this aspect, too: a family that builds its own home, using hard-to-find materials, wants to achieve the largest possible floor space for a given quantity of materials for the walls. In other words, maximize the area for a given perimeter. The circle is the answer.

(Claudia Zaslavsky (1991) 'World cultures in the mathematics class',
FLM **11**(2), p. 33.)
