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A CRITICAL REVIEW OF HARVARD'S PROJECT ZERO

by

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Abstract: Project Zero, a research center at Harvard's Graduate School of Education, is impressive and far-reaching in its scope. It is a multifaceted research project that is commonly referred to as being interdisciplinary or as doing interdisciplinary work, and among other things performs research on the nature of interdisciplinary teaching and research. This paper critically reviews a segment of the Project's work and considers it in light of a definition of "interdisciplinarity" (Klein & Newell, 1997) around which a consensus is developing. The review provides a brief history of Project Zero, then focuses on the GoodWork® Project with further emphasis on the GoodWork® Interdisciplinary Studies Project. Both teaching and research reports are reviewed, noting those that are traditionally published and/or offer literature reviews. The role of in-house and popular press publication versus peer-reviewed publication is considered. This review concludes that Project Zero does *interdisciplinary-related* work, rather than *interdisciplinary* work. It is suggested that Project Zero could draw more heavily on the wider literature in its research reports as well as pursue an explicitly integrative process in its research.

Introduction

Project Zero in the Harvard Graduate School of Education is a multi-faceted research group that was formed in 1967 to conduct research on learning and assessment (http://www.pz.harvard.edu/). This review will address Project Zero's stated mission, its use of non-traditional methods of publishing its research findings, and the degree to which its work is interdisciplinary. First, the project as a whole is considered briefly, and then one major sub-project (the GoodWork® Project) is investigated. Finally, a further subdivision of

its work ("GoodWork® in Interdisciplinary Contexts") is studied in detail to ascertain whether it is interdisciplinary and to survey its insights with regard to teaching, research, and the nature of interdisciplinarity in general.

The name "Project Zero" harkens from the group's initial (1967), and still primary, research focus: As explained by founder, first director, and philosopher Nelson Goodman, "the state of general, communicable knowledge about arts education is zero. So we are Project Zero" (Perkins & Gardner, 1989, p. x). Forty years since its inception (28 of those years under the co-direction of Howard Gardner and David Perkins), its efforts to understand symbolic development in children in terms of language, writing, drawing, and gesture, and how those symbol systems relate to the nature of thinking, have taken the Project far from zero. One can peruse a list of its projects and papers and acknowledge that, while there will always be new questions to answer, Project Zero has accomplished much toward its initial mission "to examine the philosophy and psychology of the arts, with an eye to informing arts education" (Perkins & Gardner, 1989, p. vii).

The Project's portfolio of research projects is substantial and includes over 50 primary projects; many having multiple lines of sub-inquiry and dealing with different aspects of education from models for "Smart Schools" to studies of active learning, teaching for understanding, and assessment of learning. A number of the projects focus on the arts, and most consider some aspects of critical and creative thinking that cut across the disciplines. The notion of developing "thinking dispositions" figures prominently in its work (http://www.pz.harvard.edu/Research/Research.htm). The movement from a strict concern with arts education is reflected in its more recently stated official mission "to understand and enhance learning, thinking, and creativity in the arts, as well as humanistic and scientific disciplines, at the individual and institutional levels" as well as "to help create communities of reflective, independent learners; to enhance deep understanding within the disciplines; and to promote critical and creative thinking" (http://www.pz.harvard.edu/History/History.htm, 1).

Originally the founders agreed that, "much remains to be done, but when Project Zero turns to writing prescriptions and instruction books, when it becomes Project-How-To, it will have passed on to an unjust reward" (Goodman, 1989, p. 2). But now, interestingly enough, writing prescriptive how-to articles and books is just what the Project is doing by offering consulting, keynote speaking, and training to industry. Little of its work has appeared in traditional, peer-reviewed academic channels that would foster deeper shared analysis by its researchers and other scholars. While most of Project

Zero's work is classroom-related (e.g., its work on K-12 teaching), there is one major project that is not: the GoodWork® Project. Perhaps this project convinced the Principal Investigators of Project Zero to adopt a more educate-through-marketing/consulting/popular press-stance in regard to their findings (necessitating my use of the trademark symbol) and to practically eschew the academic input of scholars outside the Project Zero family.

The GoodWork® Project

In 1995, The GoodWork® Project was created and co-directed by psychologists Howard Gardner (of the theory of "Multiple Intelligences"), Mihaly Csikszentmihalyi (of *Flow*) of the Claremont Graduate University, and William Damon of Stanford University. In this context, "good work" captures two senses of the word "good": 1) high quality and innovative, and 2) socially responsible, especially in regard to influences of market competition and new technology. Gardner, Csikszentmihalyi and Damon (2000) provide indices of "goodness" though do not indicate from what, if any, disciplines or literature the indices are drawn. In 2006 they added a third dimension: meaningfulness (The GoodWork® Project Team, 2006). The GoodWork® Project receives funding from at least 23 different foundations, corporations, institutes, and individuals. The research agenda consists of several related lines of inquiry around the concept of good work, including its: origins, role in professional development, place in interdisciplinary contexts, relation to contemplative practices such as meditation, role in journalism, transmission through apprenticeship and mentoring, place in business, and comparative dimensions in other societies. These diverse lines of inquiry are pursued across a wide range of professions and other types of work. While it might be hoped that the insights from different studies would be integrated, this has not happened. Instead, the rich ingredients from each piece of research usually remain isolated.

For example, GoodWork® Project researchers started by interviewing journalists and then geneticists to find out what "good work," or impediments to it, existed in those professions. Their research methodology follows a consistent pattern: Pick an industry/profession of interest, read about it to be alert to the current milieu for that domain and to help find names of key informants and "exemplars" to interview. They conduct interviews (1.5 to 2 hours each), write a report for their website describing "good work" in that field, and engage in keynote speaking and consulting for the industry/profession based on the report. (Or, in this case, also based on the popular press book *Good Work: When Excellence and Ethics Meet* that discusses

journalists and geneticists in particular.) To date Project Zero researchers have interviewed actors, accountants, Albert Schweitzer Fellows, marketers, lawyers, physicians, basketball players, coaches, young social entrepreneurs, philanthropists, and more. They have conducted over 1,200 interviews (http://www.pz.harvard.edu/Research/GoodWork.htm). As mentioned, a report of their findings was posted at the completion of each set of interviews. These reports are not processed like papers submitted to a professional journal that sends submissions out to reviewers for comment. Rather one of their researchers serves as an in-house series editor, and they self-publish the papers on the website. Few of the reports offer the benefit of a literature review, and few have later appeared in peer-reviewed journals. The handful of reports that draw on more than one set of interviews (and thus must cite multiple reports) are rarely grounded in any *disciplinary* literature(s). Despite the occasional peer-reviewed article, there is much more emphasis on in-house publishing of reports for the public to find on a website for download or purchase. While in-house publishing provides practical advice for those within certain professions (if they know where to look), this approach has meant that the project is largely disconnected from the wider scholarly literature and unavailable through traditional library search tools. As a result, opportunities for integrating across scholarly disciplines, or even across the insights of different research reports, have been lost.

The goals of the GoodWork® Project include moving from investigation to understanding and then to developing recommendations to influence training and practice in the areas studied (Gardner, Csikszentmihalyi & Damon, 2000). While its dedication to enhancing good work in the world is admirable, these goals run counter to the original Project Zero mission statement of not becoming prescriptive or writing "how-to books." It is unclear why or how this change occurred. Perhaps it is because the primary source of funding shifted from scientific foundations in Project Zero's early years to more private funding (Gardner, Perkins, Quense, Seidel & Tishman, 2003). Yet private funding need not preclude peer-reviewed publication. Unfortunately, it appears the drive to achieve "the widest possible attention to our findings" excludes much of the academic world. The few peer-reviewed publications constitute a fraction of the project's overall portfolio. Few of the e-bookstore papers (http://www.pz.harvard.edu/ebookstore/index.cfm) are peer-reviewed, and those on the GoodWork® website that have been published are generally produced by popular or trade presses rather than by academic presses (http://www.goodworkproject.org/papers.htm).

Barring a reversal or expansion of this approach, we will likely see "re-

ports" and popular press books with catchy titles such as *Good Business: Leadership, Flow, and the Making of Meaning,* and *The Moral Advantage: How to Succeed in Business by Doing the Right Thing.* The latter book, for instance, tells what they learned from the journalism and geneticist interviews. In essence, they report what people in particular fields say "works" without subjecting this to much analysis that draws upon scholarly understanding of the various activities. It is likely that we will see more products and services like the GoodWork® Toolkit used in educational settings (http://www.goodworkproject.org/toolkit.htm) and the Journalism Traveling Curriculum about which they report, "To date we have conducted over 100 workshops and trained over 3,000 journalists in print, broadcast, and Internet newsrooms. We have visited the Chicago Tribune with a newsroom staff of 670, the Chico Enterprise Record with a staff of 18, and newsrooms of all sizes in between. Responses to anonymous course evaluations point to renewed passion and purpose in journalists' work" (http://www.pz.harvard.edu/Research/GoodWorkTCJ.htm). The products and services resulting from the GoodWork® Project, then, often bear a greater similarity to management consulting than to traditional academic work. Such work is no doubt of value to the participants and can, perhaps, be seen as contributing to the "literature" on the professions in a way that reflects a postmodern "rejection" of academic publishing power centers in favor of a popular approach aimed directly at their target audience. Nevertheless, this practice raises the question of whether this research could, at the same time, be used as a basis for scholarly reflection and publication.

The issue of target audience, if not marketing approach, of the GoodWork® Project is a point of departure from academic convention. The GoodWork® Project is today as much a commercial undertaking as an academic one—complete with registered trademark. In a time when universities increasingly urge a balance between academic and public dissemination of research, perhaps in part to help attract new sources of external funding, the GoodWork® Project is an example of how to communicate research to a larger audience and generate revenue in the process. Indeed, scholarly publication and the peer-review process can be tedious, time-consuming, and devoid of immediate reward. It is, perhaps, an encouraging reminder to the rest of us that if world-class scholars like Gardner, Csikszentmihalyi, and Damon can successfully pursue a popular or trade audience, perhaps so should we. Still, a balance would seem appropriate. Given what the GoodWork® Project has to offer the academy, it is regrettable that a greater effort has not been expended both to draw upon and inform the scholarly literature.

Is the GoodWork® Project Interdisciplinary?

The background provided thus far suggests that Project Zero work itself is not truly "interdisciplinary" even though, it could be argued, its insights would indeed be enhanced with a more interdisciplinary approach. The interdisciplinary potential has not been realized. Researchers from the GoodWork® Project have interviewed thousands of people from a wide range of fields and perspectives but not attempted in a sustained manner to integrate their insights on any given issue. Nor has there been any sustained effort to integrate their research findings with the scholarly literature, whether disciplinary or interdisciplinary.

It is useful to compare the practice of the GoodWork® Project with definitions of interdisciplinarity. Using the widely cited definition of interdisciplinary studies advanced by Klein and Newell (1997), Klein states that interdisciplinarity can be seen as the integration of "separate disciplinary data, methods, tools, concepts, and theories in order to create a holistic view or common understanding of a complex issue, question, or problem" (Klein, 2005, p. 55). The original definition puts that last phrase as "…a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession" (Klein & Newell, 1997, p. 393). In relation to the first part of the definition, the writers of the GoodWork® reports do not draw on theoretical underpinnings, they do not struggle with integrating disciplinary perspectives, nor do they use the tools or insights from multiple disciplines to guide their inquiry. The project is a series of explorations of the applied professions rather than an integrated attempt to understand their work practices. The original directors are psychologists, and yet even the wide range of psychological theories, models, and concepts that could be used in this project are not explored (they were, however, more present in the early years of the over-arching Project Zero). The directors do acknowledge that the good work issues can be approached in different ways: "Economists are concerned with the marketplace and its imperfections, philosophers with various competing sense of the good; sociologists with the institutional norms and incentives that encourage or discourage certain kinds of behaviors; anthropologists with the striking variations across institutions, cultures, and subcultures" (Gardner et al., 2000, p. 4). Despite this recognition that different disciplines have different perspectives on good work, there is little else said about disciplinary grounding or the use of either disciplines or interdisciplinary techniques in conducting or inter-

preting their research. If they did draw on any discipline, in any substantial way, they did not make that—or any interdisciplinary parts of their undertakings—salient.

In terms of the second part of the Klein & Newell definitions, creating "a holistic view or common understanding of a complex issue, question, or problem" (Klein, 2005, p. 55) "or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession" (Klein & Newell, 1997), scholars of interdisciplinarity disagree as to whether a subject needs to be complex in order to benefit from interdisciplinary analysis. It might be argued that "good work" is not a complex concept. However, there clearly are distinct disciplinary perspectives that could be drawn upon. Moreover, the different professions examined represent different "knowledge formations" and thus integration across reports could be counted as "integrative praxes" (Carp, 2001). This is done only to a very limited extent. For instance, Solomon, Feldman and LeLacheur (2000), and in later GoodWork® reports, list several domains of responsibility that they discerned from interviews of different groups: responsibility to self, others, workplace/institution, domain, society, and imputed responsibility. While they may have attempted to integrate across interviews here, the paper reads more as a standard analysis of interview data where one allows themes to emerge as opposed to something more innovatively or disciplinarily integrative.

We have seen, then, that while the GoodWork® Project *could* be a "fully interdisciplinary" project, this has not occurred. One report (The GoodWork® Team, 2006), an overview of the project looking back over the first 10 years, does offer a model of the influences on good work based on their 1,200 interviews. This provides a useful start but is not particularly comprehensive or integrative. It does not compare, for example, with the work of Julie Thompson Klein of whom Carolyn Haynes, in connection with Klein's 2005 book, comments, "Klein has undertaken an ambitious agenda: to construct a conceptual and historical framework for understanding, studying, and supporting interdisciplinary practices" (Haynes, 2005, p. 2). Were the GoodWork® team to take on a similar agenda their work would be an interdisciplinary undertaking. As it is now, the work is not a strong example of interdisciplinarity in that it meets few of the criteria present in most common interdisciplinary definitions. At most, one might consider the work as multidisciplinary as it sometimes juxtaposes professional perspectives—as it did with journalism and genetics—but, again, its consideration of those professions is not necessarily well-rooted in the literature or theory of those fields.

The GoodWork® Interdisciplinary Studies Project

While the GoodWork® Project as a whole has not explicitly pursued interdisciplinarity, there is one subproject that focuses specifically on interdisciplinarity, The GoodWork® Interdisciplinary Studies Project, which is also called "Good Work in Interdisciplinary Contexts" and "Interdisciplinary Work and the Future of Education." At this writing, this project is co-directed by Howard Gardner and Veronica Boix-Mansilla. In its effort to assess quality interdisciplinary work, this project uses the same interviewing methods as were used in the over-arching GoodWork® Project. Some reports also presented case studies of school or work sites. As with the over-arching project, the researchers chose to consider a few exemplars from pre-college, undergraduate college, graduate school, and functioning interdisciplinary labs inside and outside academic institutions. While there are studies pertaining to both interdisciplinary teaching and interdisciplinary research, it is not clear that the understanding of how interdisciplinary research is done informs the recommendations made regarding teaching. These two aspects of interdisciplinarity remain largely distinct in their writings.

This Project generally operates with the definition of interdisciplinarity provided on its website as "the ability to integrate knowledge from two or more disciplines to create products, solve problems, or produce explanations" (http://www.pz.harvard.edu/Research/GoodWorkIS.htm1). The expanded version states that interdisciplinary understanding is "the capacity to integrate knowledge and modes of thinking drawn from two or more disciplines to produce cognitive advancement—e.g., explaining a phenomenon, solving a problem, creating a product, raising a new question—in ways that would have been unlikely through single disciplinary means" and adding that "the integration of disciplinary perspectives is a means to an end, not an end in itself" (Boix-Mansilla, 2005, p. 16). This definition adds dimensions to Klein and Newell's (1997; Klein, 2005) with the "creating a product," with the "raising a question" (rather than a focus on answering them), by requiring no prerequisite for complexity, and in implying that an integrative process may be more important than a verifiably integrated *product.*

Interdisciplinary or Integrative Teaching?

To its credit, the GoodWork®'s "Interdisciplinary Studies Project" heeds the call of the Association of American Colleges and Universities (AAC&U) in 2002 for a New Academy that produces "intentional learners" who are

> integrative thinkers who can see connections in seemingly disparate information and draw on a wide range of knowledge to make decisions. They adapt the skills learned in one situation to problems encountered in another: in a classroom, the workplace, their communities, or their personal lives. As a result, intentional learners succeed even when instability is the only constant." (Association of American Colleges and Universities, 2002, chap. 3)

This highlights the importance of our teaching students to think not just interdisciplinarily but integratively (Newell, 1999) or "interperspectivally" (Newell, 2007) as well as using their critical thinking skills outside the classroom.

> For intentional learners, intellectual study connects to personal life, formal education to work, and knowledge to social responsibility. Through understanding the power and implications of education, learners who are intentional consciously choose to act in ethical and responsible ways. Able to place themselves in the context of a diverse world, these learners draw on difference and commonality to produce a deeper experience of community." (Association of American Colleges and Universities, 2002, chap. 3)

GoodWork®'s Interdisciplinary Studies Project echoes many of the hopes and concerns that arise in the pages of *Issues in Integrative Studies* and other traditional academic journals. There is common ground.

To illustrate the Project's contribution here, we consider Report 21 regarding "Three strategies for interdisciplinary math and science teaching" (Nikitina & Boix-Mansilla, 2003). This report draws attention to the difference between *internal* integration within a field (sometimes the sub-fields are as rigidly defined as entirely separate disciplines) and *external* integration, building cross-paradigmatic bridges between the ideas and tools of different areas (in this case, math and science). The authors emphasize that since specialization within fields is customary, internal integration should not be assumed and is not necessarily easily done (See Carp, 2001, on disciplines, and Szostak, 2002, on discipline sub-fields). Still, attempting integration within or between subfields, and thus identifying the concepts that unify one domain of knowledge, may be an important first step in increasing understanding and successfully effecting external integration. Indeed, many—especially undergraduates—do not muse about the complexities in their own "fields." Or, if they do muse

about internal integration, they may be at a more novice level of thinker, which is the first step in becoming an expert (Bransford, Brown & Cocking, 1999).

This report also discusses three integrative strategies—Essentializing, Contextualizing, and Problem-Centering—and considers the strengths and weaknesses of each. These strategies have parallels in the techniques of integration (*redefinition*, *extension*, *organization*, and *transformation*) proposed by Newell (2007) and extended by Repko (2008) for creating common ground in the interdisciplinary studies literature. The integrative strategies from Report 21 encourage students to think beyond facts within the subject area and may be used alone or in concert, depending on one's needs and motivation for curricular reform. Essentializing reduces content to core or unifying concepts that "have the potential to produce sharable tools and understandings" (Nikitina & Boix-Mansilla, 2003, p. 8) to get to real common denominators that provide pattern or coherence. *Linearity, change*, and *scale* are the examples the authors offer of such core constructs, and one can imagine how considering these concepts would encourage internal integration within mathematics. To increase interdisciplinary awareness or skill, they explain that one would extend consideration of linearity, change, and scale to algebra and geometry within mathematics, but also to physics, biology, geology, history, or psychology, engaging the vocabularies of the disciplines and helping with matters of translation as the core concepts are explored. This integrative strategy encourages transfer of learning within and between disciplines and provides a foundation for still greater later external connections as students see pattern and coherence where they previously saw unrelated facts and theories.

One could consider the functions of Essentializing as being performed or achieved mainly by the integrative techniques of redefinition, extension, and transformation. Redefinition involves redefining discipline-specific terms into language that is more easily translated into other disciplinary domains. If the concepts and assumptions of different disciplines are revealed to be different, then the integration technique of extension is used. This creates common ground by extending the meaning of concepts and assumptions beyond the domain of one discipline "into the domain of another discipline" (Newell, 2007, p. 258). Finally, if the concepts and assumptions of one discipline are found to be opposite to that of another, the integrative technique of transformation is used to resolve the differences by transforming dichotomous concepts or assumptions into a continuous variable (Newell, 2007, p. 259).

The next Report 21 strategy (Nikitina & Boix-Mansilla, 2003) is Contextualizing through integrative inquiry. It focuses on external integration

by considering the disciplinary concept in terms of philosophical, historical, cultural, and methodological foundations. Questions that might form the basis of a contextualizing class or course would be, for example, "Why did scientific thinking develop in Western Europe, and how was that related to Greek philosophy, revealed religion, political [*sic*] circumstances up until the 17-18th century? Why is it necessary to understand St. Augustine to understand Isaac Newton?" (Nikitina & Boix-Mansilla, 2003, p.12). This strategy, while not necessarily advancing a skill set within a particular discipline (for example, there is no emphasis on facts, proofs, techniques or practices), does provide a broader perspective for building bridges between disciplines and also humanizes material that may be dry and uninteresting in isolation. The authors point out that considering the ideas in the context of culture and time period potentially increases the personal relevance to the students.

The functions of Contextualizing are accomplished through all of the integrative techniques (redefinition, extension, transformation and organization) in the Newell (2007) scheme. Extension creates common boundaries by extending a concept or assumption "across the boundaries of cultures, races, ethnicities, genders, ideologies, nations, regions, classes or any other classification" (p. 259). Transformation accomplishes the same effect by transforming dichotomous concepts and assumptions into a continuous variable if the relationships are shown to be opposites. Organization is a higher-order integrative technique. Once concepts have been redefined, the technique of organization "organizes, arranges, or arrays the redefined insights or assumptions to bring out a relationship among them" (Newell, 2007, p. 259).

The third integrative strategy from Report 21 (Nikitina & Boix-Mansilla, 2003), Problem-Centering, invites students to consider the disciplinary entry points as they explore influences, and consider solutions, to a real-world problem or topic. This approach may motivate students to attend to disciplinary knowledge in a new way, especially if they consider the problem important and meaningful to themselves. It would be expected that attempts to integrate disciplines in the exploration of real-world problems would reveal relationships of all types (similar, different, opposite) between concepts and assumptions across disciplines. Therefore, as above, all integrative techniques in the Newell (2007) and Repko (2008) frameworks could and generally would be used to accomplish the tasks involved in the strategy of Problem-Centering.

The three strategies are not completely distinct, or would not have to be in a particular class or endeavor. They can be blended in practice. While Essentializing is about abstract conceptualizing of facts with an emphasis

on transfer, and Contextualizing is expansive and contemplative in nature, Problem-Centering is learning through deciding and doing, borrowing from disciplines in the service of solving or exploring. The problems could range, as the authors mention, from earth-bound environmental issues to considering the colonization of Mars. Since the focus is a narrow consideration of problem-related information, such borrowing, especially at an undergraduate level, does not necessarily require or imply that the student has a good foundation in the disciplines from which they borrow. Using any of these strategies could involve significant effort on the part of the teacher to build the links, potentially restructure the curriculum within or between classes, and use pedagogical tools to aid students in making these connections.

In two other papers Nikitina covers similar ground (Nikitina, 2002b, 2006). In the 2002 "Report" Nikitina (2002a) experiments with using some different terms for the same strategies and offers more examples that are outside the primarily math and science focus of Nikitina & Boix-Mansilla (2003). For instance, with Contextualizing she illustrates potential differences in that approach if teachers were to choose one unifying context: whether historical, philosophical, or epistemological. With Problem-Solving, Nikitina offers examples dealing with problems that are less thought experiments (like colonizing Mars would be), opting for something more immediate or proximal. She mentions topics from bioethics where, for example, students might spend the term considering what to do when a baby is born with anencephaly and end the class with an actual proposal for legislative change in how death is determined (as occurred in a class offered in the Center for Bioethics of the University of Pennsylvania). Other classes, this time at the graduate level, may focus on the design or construction of a physical object that helps encourage or solve a challenge, such as children learning music at an early age with the help of technology. For instance, classes have focused on issues such as "How can children exchange rhythmic signals on stage?" or "How do we translate graphics into harmonics?" (Nikitina, 2006, p. 264), as occurred with graduate students in MIT's Toy Symphony Project. Note the difference between the Problem-Solving strategy and those of the other integrative strategies that would, for example, place music in a historical context or engage in a discussion of the complexities of music theory and core concepts and determine if those patterns occur in other disciplines.

Unlike other writers of GoodWork® Project reports, Nikitina (2002a) provides a literature review of other academics' works regarding definitions of interdisciplinarity. She identifies Klein and Newell, as well as others who

have written on the topic, in setting up which definition or typology her work most closely resembles. In Nikitina's 2002 report version she says her approach most closely resembles Boix-Mansilla's, whose typology distinguishes between "conceptual bridging interdisciplinarity, comprehensive interdisciplinarity, problem solving interdisciplinarity, and interpretive interdisciplinarity" (Nikitina, 2002a, p. 3). Other papers that pertain to interdisciplinary teaching include "On Disciplinary Lenses and Interdisciplinary Work" (Boix-Mansilla, Miller & Gardner, 2000): This paper has a literature review relating to the content on obedience to authority and eugenics, two topics they detail as cases in teaching using an interdisciplinary approach but barely references any interdisciplinary literature. Nikitina (2002b) offers another look with a different set of topics using two Harvard classes—Music, Mind & Brain; and Waking, Sleeping, and Dreaming—as case studies on integrative teaching. This article reiterates with fresh examples key elements: Learn the disciplines, identify points of connection and disconnection, describe limits of the discipline, and attempt a synthesis.

Noting that we are often talking not just about interdisciplinary learning but integrative learning of which interdisciplinary studies is just one stripe, Newell (1999) acknowledges "full integrative learning requires inputs from a wider range of perspectives, nondisciplinary as well as disciplinary" (p. 19). In addition, in 2007, Newell pointed out "indeed, the term 'interdisciplinary' probably places too much emphasis on the disciplines and not enough on the other available sources of perspective" (p. 251). Miller and Boix-Mansilla's (2004) Report 27 on "Thinking Across Perspectives and Disciplines" offers insights including three "senses" of "perspective" (individual, role, and disciplinary), five "cognitive bridges" for making integration happen (reasoning through analogies, creating compound concepts, building complex and multi-causal explanations, advancing through checks and balances, and bridging the explanation-action gap), and four degrees of integration (mutual ignorance, stereotyping, perspective-taking, and merging).

While the GoodWork® Interdisciplinary Studies Project work just reviewed complements and extends ideas in the Association for Integrative Studies (AIS) literature, GoodWork® researchers might find it particularly useful to teach an interdisciplinary course rather than primarily focusing on studying and theorizing about them. Those who teach an interdisciplinary course can readily attest that there are myriad unexpected challenges that one does not confront in disciplinary teaching. It might be particularly useful in this respect to teach outside of elite colleges. Researchers could

then report on how useful they found both theoretical advice and the advice gleaned from their interviews (and ideally the integration of these).

Assessing Interdisciplinary Work

The GoodWork® Project has also addressed the challenge of assessing interdisciplinary teaching. There are two similar reports on this. The first is Boix-Mansilla's report on the GoodWork® website, "Assessing Student Work at Disciplinary Crossroads," (GoodWork® Project Report 33, 2004), that was subsequently published in 2005 in *Change* under the same title. The *Change* article, grounded in Boix-Mansilla's interviews, is devoid of reference to any literature (interdisciplinary or not). In contrast, the Boix-Mansilla and Dawes (2004) report does reference literature. In particular it provides reference to Klein, Newell, Stowe, Haynes, and Seabury, among others associated with AIS. The two articles walk through different examples of student work, but they offer the same "take-home points": that students should be using or demonstrating thinking with knowledge, rather than simply possessing it, and that students should reach beyond common-sense applications to show purposeful integration, leveraging understanding of one discipline with another as opposed to simple juxtaposition. That they offer these insights—especially with the 2005 *Change* article being in such a prominent magazine rather than a self-published report—is a contribution to the field. It could be argued that the Boix-Mansilla and Dawes (2004) report, however, is as much or more a contribution. Beyond providing the literature review, including a look at authentic assessment literature, it offers more examples for each step in the proposed three-part framework of *disciplinary grounding, integrative leverage,* and *critical awareness* with criteria for assessing students' knowledge bases and integration skills.

As mentioned earlier Boix-Mansilla defines interdisciplinary understanding "as the capacity to integrate knowledge and modes of thinking in two or more disciplines to produce a cognitive advancement—e.g., explaining a phenomenon, solving a problem, creating a product, raising a new question in ways that would have been unlikely through single disciplinary means" (2004, p. 4; see also Boix-Mansilla, 2005). Yet though the challenge of interdisciplinary assessment can and has been addressed from many perspectives, much of her work neither engages the literature in order to convey that deeply informed expertise nor wrestles with or benefits from overt integration. She says quality interdisciplinary work involves "redefining problems, exchanging methods, translating categories, and testing outcomes against

multiple and often conflicting standards of quality" (Boix-Mansilla, 2004, p. 13, 2005, p. 20). She agrees that interdisciplinary work be "highly 'disciplined'—that is, deeply informed by disciplinary expertise" (2005, p. 17) and that "it involved the *integration* of disciplinary views" (2005, p. 17). Yet her published research on assessment only rarely engages the wider literature.

Boix-Mansilla reports that many interdisciplinary teachers' assignments or assessment techniques lack substance or are too generic. Yet her own framework, while prescriptively toned as complete, leaves substantial room for interpreting how to assess and what qualifies as good student interdisciplinary work. Of course, leaving room for interpretation is appropriate, if only because some element of subjectivity will always remain, and perhaps there cannot, or should not, be iron-fisted techniques as each program, teacher, assignment, and student will interact in unpredictable ways. In sum, on this topic, the Boix-Mansilla (2004, 2005) article and the Boix-Mansilla and Dawes (2004) report on assessing student work are worth reading, especially for those new to interdisciplinary teaching, who recognize gaps in or want to improve their assessment skills. Or to help make salient some things one may be doing intuitively in student assessment but for which there is no clear label. However, they may find the guidelines too open to interpretation. They would benefit from also reviewing the important insights of Wolfe and Haynes (2003) on interdisciplinary writing assessment for the additional structure they offer with their thoughtful rubric.

Interdisciplinary Research and Institutions

Beyond considering interdisciplinary teaching, Project Zero's GoodWork® Interdisciplinary Studies Project considers interdisciplinary research and institutions. Those engaging in interdisciplinary research or who have read *Facilitating Interdisciplinary Research* (The National Academies, 2005), will find that there are additional potential comparisons that can be made about the challenges and opportunities of interdisciplinary research at the institutional and personal level. This is true in regard to Dillon (2001a)—the focus of this review—and other articles in the series that investigate the Santa Fe Institute (Dillon, 2001b) and the Center for Integration of Medicine and Innovative Technology (Cambridge, Massachusetts) (Dillon, 2001c). Dillon's (2001a) goal was "to investigate a few key questions with regard to the interdisciplinary nature of the [MIT Media] Lab, questions whose

answers can provide insight into the basic challenges associated with an interdisciplinary institution" (p. 15). Dillon (2001a) reports on the highly successful MIT Media Lab where faculty and graduate students pursued the bridge between the computer, broadcasting, and publishing industries with at least 32 projects like Affective Computing, Tangible Media, Opera of the Future, or the Future of Learning. (See http://www.media.mit.edu/.) The MIT Media Lab is organized around research groups that focus on unique ideas in an open environment where students move freely from group to group to glean new ideas and share information. This is quite unlike "working as an individual to push the boundaries of a single scientific area" (Dillon, 2001a, p. 12). No timid incrementalist researchers here, these bold thinkers are ready to combine or recombine existing knowledge in inventive ways. They consider lateral thinking and collegiality to be premium skills in terms of sharing information and achieving positive research results.

Tying obliquely to the parent GoodWork® Project's interest in the market model, corporate sponsorship is integral to the Lab's functioning in terms of locating problems on which they will conduct their research and in terms of funding. Interestingly, proprietary concerns and competitiveness do not decrease the free flow of people and information between products at this lab. Perhaps this is due to a bold, unifying stroke where the Lab's founder decreed that corporate monies were not to be earmarked for a specific project but shared. The corporate component encourages a focus on applied work. The lab faculty report pride in their work not being "irrelevant" or strictly "academic" but, rather, that it "tackles problems that cross several disciplinary boundaries" where they "develop topics as a result of conversations they have with corporate sponsors—an additional source of intellectual input absent in most disciplinary settings" (p. 14). This contributes to their emphasis on synthetic, practical work aimed at solving problems that may be shared by many.

Characteristics. Faculty in the MIT Media Lab come from different disciplines and, while talented and intelligent, were often considered misfits in their home disciplines (a sentiment mentioned in other project reports as well) but feel "normal" with the Media Lab as their full-time academic home. Graduate students come from a variety of disciplines. However, as Dillon observes, "At the Media Lab, faculty and students are expected to do more than simply mix and match ideas—they are expected to produce objects which embody those ideas" (2001a, p. 23). This can lead to an overrepresentation of engineering perspectives as "the Media Lab is bound up in creating physical objects" (p. 23). For those interested in the individual

characteristics that interdisciplinarians often possess, compare Klein's list (1990) which includes, among others, "reliability, flexibility, patience, resilience, sensitivity to others, risk-taking, a thick skin, and a preference for diversity and new social roles" (p. 183) with what was gleaned from the various comments of the Media Lab faculty about themselves and their students. Different people mentioned different qualities they found important including intelligence, extroversion, broad-mindedness, open-mindedness, willingness to take intellectual risks, passion, curious thinker, original thinker, lateral thinker, a "doer," sense of perspective, flexibility, ability to work in teams, and an entrepreneurial spirit. While some of those phrases echo Klein's list, others bear a closer resemblance to Petrie's assertion that interdisciplinarians be secure in their endeavors, "competent in their own fields … have a taste for adventure into the unknown and unfamiliar ... their interests must be fairly broad," have a need for achievement and be able to work in groups (1976, pp. 32-34). In sum, professors in the MIT Media Lab believe that success depends "more on personality and cognitive style than on a specific area of interest or even a unique technical ability" (p. 11) or an interdisciplinary background. A number of these qualities are echoed in the other individual reports in the series.

Breadth versus Depth. The Dillon (2001a) article highlights an issue examined in the AIS literature in the context of education: the concern with breadth versus depth (Benson, 1982; Newell, 1983). The Media Lab is a functional lab that is also responsible for educating graduate students. The Media Lab environment encourages such rampant boundary crossing that often depth is sacrificed; faculty report that graduate students do not necessarily appreciate key tenets of their disciplines and thus are unaware of when they are even crossing a boundary. More troubling, they do not know how to go deeper. Dillon (2001a) reports mixed opinions among faculty, but some feel a solid undergraduate understanding in a discipline is enough for success at the Media Lab. Others indicated a more advanced grounding in "the classics" would enhance creativity. And another, commenting in regard to the students' demonstration projects, felt "many students do not take the time to evaluate its strengths and weaknesses thoroughly in an attempt to improve the work" (2001a, p. 29). There was a trend to move on too quickly from one project to another project, resulting in the products failing to reach the high quality and potential they could. In this case hasty lateral thinking (breadth at the expense of depth) hampered development. With these issues in mind, the general view of Media Lab faculty is that they should continue providing research opportunities to the occasional undergraduate but should

not offer an undergraduate degree themselves as their methods of operation would not provide a sufficient grounding in any particular discipline: The researchers "do not probe the same areas with enough consistency for a sustained program of undergraduate education" (p. 28). This conclusion is at odds with much of the AIS literature that advocates providing an interdisciplinary undergraduate education. The interviewer might usefully have drawn on that literature in order to probe this issue more deeply.

Assessment. Breadth versus depth also came up briefly in terms of the assessment of student and faculty work. The Media Lab faculty members do not face many of the challenges of doing interdisciplinary work because their particular configuration of institutional support leads to fewer worries about funding, and creates a cross-fertilizing physical and social environment. Still, the issues of faculty work assessment remain—especially when the person whose work needs to be assessed is, perhaps, the only person who has done research across the combinative disciplines and can thus appreciate how it all works. As well, with their emphasis on creativity and innovation, Dillon (2001a) reports Media Lab faculty are more future-oriented than their discipline-focused peers who tend to emphasize disciplinary history and the incremental refining of work products. Thus the standards applied to assessment may be seen differently. The founder, architect Nicholas Negroponte, says that "the prerequisite for advancement as a Media Lab professor is world fame" (Dillon, 2001a, p. 32). While media attention is important, one might hope that assessment of "fame" would include the respect of academics and industry leaders. However, as with others who endeavor in interdisciplinary projects, it is sometimes difficult to find people with just the right backgrounds to assess the work.

In terms of standards and assessment of graduate student research, they offer an illustrative example of a student who had trouble in his oral exams because he made unsupported claims. His advisor worried, "I haven't trained him right. I haven't taught him what a standard of evidence is…. Can I train them in every field? Am I training them for any field" (p. 31)? His response was to make "a concerted effort to spend time teaching students about metascience, the overarching ideas that form the basis for sound experimentation and scientific practice" (p. 32). Other professors expect their grad students to complete their work in the various ways that meet the standards of each discipline from which they draw. The rule of thumb used by one professor requires three different standards of evidence: He tells his students "that the key to useful creativity is to look at how three disciplines have approached a problem, determine what has been missed, and then use some combination

of the three disciplines to fill in the gaps" (2001a, p. 22). Another adds, "that finding students who are willing and able to mix disciplines is difficult" (p. 37), blaming a rutted discipline-based education he believes is incapable of producing DaVinci-like thinkers. These remarks contrast with the support shown for disciplinary undergraduate education above, but the interviewer did not attempt to integrate across these viewpoints. It appears that Media Lab professors have not consciously reached out to students in *interdisciplinary* undergraduate programs. Interdisciplinary students might well be advised to seek them out: Both the lab and the students would benefit.

Integrating. How is integration achieved in practice in the Media Lab? Dillon observes that the MIT Media Lab "seems to be rather unreflective regarding the disciplinary boundaries being crossed in particular pieces of work" (2001a, p. 39). They assume that simply putting smart, inquisitive people together will result in interdisciplinary work. Yet, true interdisciplinary work requires more than that: It requires consciously drawing on the different perspectives, methods, and questions of the disciplines. Thoughtfully done, interdisciplinary work may lead to shifting the insights in the contributing disciplines or even to the creation one day of a new interdiscipline. One researcher commented that it takes "willingness to spend lots of time working with materials and notions that are initially foreign. A great deal of skill and thought is required to bring separate disciplines together effectively" (p. 35). That said, the level at which Media Lab faculty members generally do their integration is short-term borrowing in the service of a particular creative product. While successful in generating new products, this research strategy does not generate deeper understandings of disciplinary differences that might provide grounding for more sustained and revolutionary insights.

The process of integration—in this case, how the "underlying intellectual tensions between disciplines are addressed"—is left unexamined in part because, Dillon acknowledges, he did not ask directly enough about it (2001a, p. 39). Had Dillon's own research been soundly grounded in the interdisciplinary studies literature, questioning about the process of integration would have been salient and may have been probed further. As it is, Dillon speculates, "that Media Lab researchers have been combining disciplines for so long that they no longer think much of it—they are beyond considering the differences between areas of inquiry" (2001a, p. 36). He adds, however, that it is still important to research this process "because the degree to which the compatibility of two disciplines has been thought through is likely to determine the value of the resulting interdisciplinary work" (p. 37).

The 13-person MIT Media Lab group was not conscious of, or at least

did not report, specific steps they took to facilitate integration or study a problem from multiple disciplines. This was not unique. Apparently nothing along the lines of a distinct, thoughtful set of steps was revealed in the 48-plus interviews the GoodWork® Interdisciplinary Studies Project conducted with interdisciplinary researchers. And there is little or no description of steps approximating the interdisciplinary integrative process such as we find in Klein (1990), Newell (2001), Szostak (2002), or Repko (2008). Admittedly only Klein's integrative process was in the literature well before these interviews were performed. As suggested above, familiarity with certain interdisciplinary best practices might allow an even more successful interdisciplinary research effort. While intuition is an important component of interdisciplinary research, it has been well-argued that interdisciplinary research is best informed by a rational research strategy (Szostak, 2002).

Klein (1990) discusses the importance of integrating interdisciplinary theory and practice:

> Though it is a rather slim genre, the interdisciplinary autobiographies and biographies that have been published demonstrate the value of compiling and studying narratives of actual interdisciplinary work. They temper abstract theory in the forge of experience, as the complex actuality of doing interdisciplinary work is brought along side theory. Neither is sufficient by itself. (p. 184)

Newell (2001) and Szostak (2002) call for doing more empirical research on interdisciplinarity. The research provided by GoodWork® provides useful data for theorizing, but could be even more useful if it were itself more solidly grounded in the theoretical literature. In any case, it would seem from the GoodWork® Interdisciplinary Studies Project reports that the act of doing integrative work—if not interdisciplinary work—is much more fluid than we academics might imagine. It is based a great deal on informal conversation and open-minded questioning with lots of smart, interested and interesting, people batting around ideas and noticing mysteries or gaps as opposed to solitary scholarly work doing literature reviews of "relevant" disciplines or pondering in isolation over solutions to problems. It seems that Mackey's (2002) argument that interdisciplinary work may be more intuitive than consciously rule- or step-based is descriptive of, at least, the Media Lab project. This does not detract from the fact that the more delineated, and still iterative, processes of Klein, Newell, Szostak, and Repko have heuristic merit and may, as Mackey points out, be the preferred method for some (and also

that those who prefer the intuitive approach may still find the steps useful on a post hoc basis). Alternatively, and certainly, those in applied interdisciplinary settings (like the Media Lab) may benefit from consciously taking a more rational approach from the start, still leaving room for intuition.

This body of work by Dillon, Boix-Mansilla, and others on the GoodWork® Interdisciplinary Studies team reveals fewer connections made to existing conceptualizations of process and vocabulary than one would hope. The Santa Fe Institute report (Dillon, 2001b) is only marginally more descriptive on how interdisciplinarity is advanced or integration accomplished than the MIT Media Lab report. For instance, it discusses the pros and cons of "becoming a hybrid" (learning two disciplines) or the importance of choosing the right people when "collaborating." In the Center for Integration of Medicine and Innovative Technology piece (Dillon, 2001c), the researchers clearly prefer a collaborative model, but there is still no indication that these physicians and engineers engage in a particular process. Since the necessary questions were not asked, however, we cannot be entirely sure whether this result reflects the behavior of the interdisciplinary researchers or their interviewers.

One report begins to address how integration is done in interdisciplinary research settings (Boix-Mansilla, Dillon & Middlebrooks, 2000). Here, the authors begin to look for patterns across the interviews they conducted with the five research labs; the MIT Media Lab just discussed, as well as Santa Fe Institute, Research in Experimental Designs group (a now defunct unit of Xerox in Palo Alto, California), the Arts and Science Laboratory (in New Mexico), and the Center for Integration of Medicine and Innovative Technology (Cambridge, Massachusetts). In addition to discussing organizational/institutional, and individual qualities (some of which were discussed in reviewing the Media Lab report), three epistemological strategies were identified regarding how their subjects drew from different disciplines: *seamless* or *fluid integration, translation,* and *explicit integration.* These in turn reflect skill with analogical thinking, common language, and metadisciplinary views. (See McCormack, 2005, for related considerations). While they thus take first steps toward identifying integrative processes, they list in their areas for future study the need to examine "(a) the process of borrowing across disciplinary boundaries; (b) the integration of knowledge, and (c) the definition of standards of acceptability" (Boix-Mansilla et al, 2000, p. 67).

Related, though from a different angle, Boix-Mansilla and Gardner

(2003) address integration in terms of assessment, drawing on the interviews at the same five organizations. They propose that the "three core epistemic 'symptoms' of quality interdisciplinary work" are *consistency, balance,* and *effectiveness.* In this same article, they:

> view interdisciplinary work as a purposeful means to reach a cognitive or practical goal (e.g., understanding, solving a problem) as opposed to an end it itself. Our definition stipulates that disciplinary lenses be integrated in mutually informative networks of relationships rather than simply juxtaposed. By focusing on disciplinary integration—as opposed to the integration of multiple perspectives, disciplinary or not—our focus is more stringent that the "transdisciplinary" one presented earlier in this forum and in the literature. (Boix-Mansilla & Gardner, 2003, p. 3)

This paper extends their definition via the discussion of the framework they propose for assessment, positing that work:

> can be assessed on three fundamental grounds: 1) the way in which the work stands vis à vis what researchers know and find tenable in the disciplines involved *(consistency with multiple separate disciplinary antecedents),* 2) the way in which the work stands together as a generative and coherent whole *(balance in weaving together perspectives),* 3) the way in which the integration advances the goals that researchers set for their pursuits and the methods they use *(effectiveness in advancing understanding).* (p. 5)

The second of these is largely uncontroversial: An interdisciplinary conclusion must be internally consistent. The first needs to be probed further: How does one decide which disciplinary insights can be overturned? The third is notable for stressing that interdisciplinary research be judged not just by results, but also by the process of achieving those. This standard suggests that researchers should indeed be more self-conscious about how they integrate.

Does One Have To Be Interdisciplinary in Studying Interdisciplinarity?

The GoodWork® Interdisciplinary Studies Project is clearly less "commercial" and more interdisciplinary than the parent GoodWork® Project. Still, while there is an interdisciplinary focus and discussions regarding in-

tegration, the project reviewed in this paper did not fully meet any number of definitions of interdisciplinarity, including that of GoodWork® principal investigator Veronica Boix-Mansilla. In her noteworthy *Change* article (2004, 2005), she asks "What does it mean to deeply understand an issue in an interdisciplinary way?" (p. 16) and answers that it requires using knowledge (not just accumulating it) in novel situations, being "deeply informed by disciplinary expertise (most of GoodWork®'s publications do not draw substantively upon or review disciplinary literatures) such that it can survive "the scrutiny of expert communities" (relatively little of GoodWork®'s publications is subjected to peer review outside their own research team), differs from common sense "precisely in its ability to draw on disciplinary insights," and it "involves the integration of disciplinary views … not merely juxtaposed … thereby leveraging understanding" (p. 17). The disciplinary ground, integrative leverage, and critical stance she requires to call something "interdisciplinary" in assessing student work are rarely present in the GoodWork® Project offerings. She emphasizes that integration is not the goal as much as to "produce a cognitive advancement that uses both disciplines and integration as its tools" (p. 20). While the GoodWork® Project has certainly produced advancements in understanding by interviewing teachers and researchers from many fields and disciplines, it would be, by Boix-Mansilla's own arguments, a more meaningful advancement had the project consciously pursued an interdisciplinary approach. While the sub-project "GoodWork® Interdisciplinary Studies Project" does review literature in a couple of the reflective articles, it is still not generally grounded in one or more disciplines or in the literature on interdisciplinarity. Neither their process of doing research nor their product reflects using multiple methods, concepts, theories, or needing to attend to different disciplinary standards. And their weaving together of some insights offered by individual researchers or teachers does not equal an invocation of antecedent disciplinary knowledge or an integration of different epistemic bases. In a more recent refereed article (Boix-Mansilla, 2006, that was not published at the time this review was originally submitted), Boix-Mansilla does engage the academic community and offers more grounding in the literature than most previous reports. Still, the overall approach in the paper, as in the over-arching project, is not to draw on multiple methods or theory and reflects a standard technique for evaluating interview data more than interdisciplinary analysis. There is no mutual disciplinary revision going on (a most extreme definition of interdisciplinarity) but neither is there simple borrowing. Like the parent GoodWork® Project, the Interdisciplinary Studies Project is exploratory

and descriptive, with only occasional efforts at explanation, prediction, or theorizing. To their credit, their work certainly advances our understanding and appreciation for interdisciplinary work as their access to, and interviews with, interdisciplinary researchers and teaching programs provides insights. Yet this vast body of work could be more useful if there was a more active effort toward integrating interdisciplinary theory and practice. The empirical work undertaken by the GoodWork® Interdisciplinary Studies Project should be grounded not only in the literature on interdisciplinary studies, but also in the disciplinary literatures on learning, teaching, and discovery. Researchers should then explicitly strive to contribute to (while integrating) these relevant literatures.

Of course, the theorizing of scholars associated with AIS is not always interdisciplinary in orientation either. Many of us do *interdisciplinary-related work* but not, by the strictest definitions or processes, *interdisciplinary work*. As with any subject, disciplines can provide useful insights into interdisciplinarity. Yet the study of interdisciplinarity certainly qualifies as worthy of interdisciplinary analysis. One important step forward for both groups of scholars would be to pay greater attention to the work of the other. It would be ironic if our understanding of interdisciplinarity were to be limited by the failure of scholars of interdisciplinarity to integrate across the widest body of insights.

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