ESSAYS – CONTINUED

Using Biglan's and Holland's Classifications to Understand Similarities and Differences Between Disciplines in Multidisciplinary/Interdisciplinary Education

By Jeanne Williamson, The University of Tennessee, Knoxville

The disciplinary classification scheme of Biglan (1973) and Holland's hexagon of occupational interests and personality characteristics (1985) have been important conceptual frameworks for describing disciplines and occupations. Although the classifications were products of the twentieth century, both are still being used (Donnay et al., 2005; Simpson, 2017), and they are relevant for understanding collaborations between disciplines in multidisciplinary and/or interdisciplinary education. Differences between collaborators in multidisciplinary education can lead both to synergistic encounters and productive conflicts. Nevertheless, students may have little empathy for collaborators from different professions (Fleischmann & Huchison, 2012). Also, the differences between disciplines can be significant: "Disciplinary collaborators have to address the basic differences between themselves in terms of concepts, research questions, their perspectives upon those questions, their epistemology, methods, skills, language, and culture" (Collin, 2009, p. 107). One way in which members of disciplines differ is their profile of vocational interests. The idea of vocational interests, disseminated by John Holland in his RIASEC system over several decades (1985), is associated with there being different foci, self-concepts, and values among members of different occupations. There are six types of vocational interests in Holland's typology: realistic, investigative, artistic, social, enterprising, and conventional. Disciplines can also differ along Biglan's hard/soft, life/nonlife, and applied/pure dimensions (1973). For example, engineering, an applied discipline, has characteristics not shared by pure disciplines. In the present study, we used the two classification schemes to analyze disciplinary collaborations in education, and we also measured the correlation between the classification systems to determine the relationship between them. Differences in vocational interests and Biglan class membership suggest that members of disciplinary groups may have lots to learn from one another when they collaborate. The two classification schemes and their relationships provide helpful frameworks for understanding disciplinary similarities and differences.

Hollands Theory of the Six Vocational Personality Types

For this study, the framework of the Strong Interest Inventory (SII) was used. The SII measures general occupational themes, which correspond to Holland's six vocational personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (RIASEC). An individual's vocational personality types may be matched not only to occupations, but also learning environments, family environments, leisure activities, and living environments (Donnay et al., 2005). Holland stated that a person's interests and competencies "create a particular personal disposition that leads him or her to think, perceive, and act in special ways" (1985, p. 2). Table 1 summarizes the six personality types, showing some of the differences between them.

ESSAYS – CONTINUED

Table 1
Summary of the Six Personality Types

	Focus	Values/Self-Concept	Occupations
Realistic	Fixing, building, repairing; heavy and precision machinery and tools	Emotionally stable, shy, traditional	Engineer, Radiologic technologist
Investigative	Solving problems; scientific work; research	Analytical, independent, creative	Physician, Psychologist, Physicist
Artistic	Arts, music, writing	Independent, free-spirited, complicated	Fine artist, technical writer, architect
Social	Teaching, helping, leading discussions	Ethical, kind, cheerful	Elementary school teacher, social worker, nurse (LPN)
Enterprising	Selling, managing, political maneuvering	Competitive, sociable, attracted to money, possessions, and power	Marketing executive, store manager, buyer
Conventional	Organization, data management, record keeping	Conscientious, accurate, careful	Banker, Certified Public Accountant, Actuary

The Strong Interest Inventory was revised in 2012, but the reference data for this study (described in the methods section below) were available from the 2004 and 1994 manuals (Donnay et al., 2005; Harmon et al., 1994). The older 1994 manual provided data about occupations unavailable in the 2004 manual, which only provided data for college majors.

Biglan's Classification of Disciplines

Biglan classified disciplines along three dimensions as hard/soft, applied/pure, and life/non-life (1973). Examples of hard disciplines would be the sciences and soft, the arts and social sciences. An example of an applied discipline is engineering, and a pure is physics. An example of a life discipline is biology and non-life is English. Becher and Trowler described the classes in Biglan's initial classification, explaining several differences between the disciplinary groups (2001). In general, hard-pure (pure sciences) disciplines tend to be concerned with universals, are value-free, and have consensual standards. Soft-pure disciplines (humanities) are concerned with particulars, are value-laden, and lack consensus. Hard-applied disciplines (technologies) are pragmatic and purposive, applying heuristic approaches. Soft-applied disciplines (applied social science) are utilitarian, concerned with enhancing professional practice, and use case studies. The Biglan classification scheme was used to characterize disciplinary interrelationships in STEAM education in a recent issue of IMPACT (Williamson & Panigabutra-Roberts, 2021).

Before turning to relationships between Biglan's and Holland's classifications, we use the classifications to analyze similarities and differences between disciplines in three educational collaborations.

Engineering and Business

Engineering and business disciplines often collaborate in integrated design courses or capstone courses in which engineering students solve a problem from industry. In the Holland classification scheme, engineers have investigative and realistic vocational interests and business occupations have enterprising interests, which may be combined with conventional or other interests. Engineers would be expected to be shy and independent, whereas business students would be expected to be sociable and interested in leading or persuading others. One would expect the two disciplines to be complementary as well as sometimes producing conflicts. An illustration of the complementary nature of the relationship

ESSAYS – CONTINUED

is that engineers need to learn communication and writing skills, and the integrated design classes give them a chance to learn these skills more familiar to business students (Fleischmann & Huchison, 2012).

In Biglan's scheme, engineering students belong to hard applied nonlife disciplines whereas business students belong to soft applied nonlife disciplines. Thus, while they share two dimensions, hard disciplines deal more with universals and have a quantitative focus, whereas soft disciplines deal more with particulars and case studies.

Art and Nursing

Nurses often have social and investigative interests and artists have artistic interests. One would expect nurses to be interested in helping others and artists to be interested in expression and creativity. While the two disciplines might seem to have conflicting aims, art can complement nursing, for example, when art therapists provide patients with distraction from pain or help decorate hospitals to make them less stressful for patients and staff (Sonke et al., 2017). Similarly nursing students can benefit from the awareness of different disciplines, art being just one example.

In Biglan's scheme, art students belong to soft, pure, nonlife disciplines, whereas nursing students belong to soft, applied, life disciplines. Pure disciplines do not have a practical purpose as applied disciplines do, and nonlife disciplines do not primarily emphasize working with people or other living things.

Computer Scientists and Education or Healthcare

The field of social robotics (Feil-Seifer & Matarić, 2005) is an intersection of computer science or robotics engineering with education or healthcare, often involving the application of robots in schools or geriatric facilities. The robots carry out functions that teachers or aides or therapists typically do. Some populations, such as autistic individuals or individuals with dementia may be comfortable working with social robots. This field poses a challenge for computer science students or robotics engineering students in that they must learn about a whole new domain, and allows members of the healthcare or education domains to benefit from the helpful skills of more technical students. Computer scientists and engineers have investigative and realistic interests, whereas educators and healthcare aides have social interests. This poses opportunities for cooperation and conflict in that people with investigative and realistic interests tend to be shy and independent whereas those with social interests are cheerful and interested in helping and teaching.

Computer science students and robotic engineering students belong to hard, applied, nonlife disciplines, and healthcare students and education students belong to soft, applied, life disciplines. Thus, both are applied disciplines and have a practical emphasis. However, the disciplines differ in the other dimensions, suggesting very different emphases.

Exploring the relationship between the Biglan and Holland Classifications

Knowing the Biglan disciplinary classes and the Holland occupational interest types of the disciplines involved in the cases above gave me a framework for identifying characteristics of collaborating disciplines (both similarities and differences). After seeing this potential for using Biglan's and Holland's classifications to analyze collaborations in multidisciplinary education, I also was curious about how the classifications were related to one another. I decided to answer the following research question: What is the correlation between Holland's vocational interest types and Biglan's hard/soft, applied/pure, and life/non-life dimensions?

Methods

Strong Interest Inventory reference values (standard scores) for people in occupations (Harmon et al., 1994) and majors (Donnay et al., 2005) for Realistic, Investigative, Artistic, Social, Enterprising, and Conventional scales were used. These scores were the average scores for reference occupations (e.g., physicist-male). The Strong interest data points were selected based on a list of disciplines classified in the Biglan scheme. Although Biglan was able to place a number of disciplines along three axes in his original work (1973), we used a larger set of disciplines classified by Drees (1982).

ESSAYS – CONTINUED

Overall, 107 data points for occupations and majors were coded as hard/soft, life/non-life, and applied/pure. Correlations between the Biglan classes and the Strong interest scales were calculated using SPSS, so that the strength of association could be determined.

Results

Table 2
Descriptive Statistics

	N	Min	Max	Mean	Std. Deviation
Realistic	107	39.20	62.00	49.3140	5.35067
Investigative	107	41.40	62.00	51.5617	5.62049
Artistic	107	41.00	62.00	50.9757	4.68204
Social	107	41.60	62.00	50.8551	4.58132
Enterprising	107	41.00	61.00	49.0215	4.11227
Conventional	107	40.00	63.00	49.3813	4.14643

Table 3
Correlations Between the Holland Vocational Interest Types and the Biglan classes (hard-soft (hs); life-non-life (ln); applied-pure (ap)). Correlations significant at the level p< 0.05 are in bold.

	hs	ln	ap
Realistic	**-.392**	-.163	-.166
	.000	.098	.093
Investigative	**-.631**	-.140	.161
	.000	.157	.103
Artistic	**.297**	.077	**.445**
	.002	.436	.000
Social	**.472**	**-.473**	-.173
	.000	.000	.079
Enterprising	**.443**	-.042	**-.486**
	.000	.670	.000
Conventional	-.025	-.002	**-.502**
	.797	.986	.000

Discussion

The correlations show how Biglan's and Holland's classifications inform one another. For example, if one knew a discipline was associated with Realistic vocational interest, one would predict that it was more likely to be a hard discipline than soft since there is a moderate negative correlation between Realistic and the hard/soft dimension. (Investigative disciplines are even more strongly correlated negatively with the hard/soft dimension.) By contrast, artistic disciplines are moderately positively correlated with the hard/soft dimension, and social and enterprising disciplines, more strongly so. As soft disciplines, they have different methods and epistemologies than hard ones. Thus, beyond knowing that individ-

ESSAYS – CONTINUED

uals with Social interest are cheerful and people oriented in contrast to individuals with Realistic personality types, one could also infer that Social disciplines were more likely to be soft disciplines and Realistic disciplines were more likely to be hard disciplines. This provides additional information beyond that conveyed by the Holland or SII definitions. Similarly, one would thus expect members of hard disciplines to be less social and tenderminded than members of soft disciplines, when one considers what vocational types are associated with them (e.g. Realistic and Investigative versus Artistic, Social, and Enterprising). The life-nonlife dimension was associated negatively with Social vocational interests. This is not surprising since individuals with Social interests enjoy interacting with people (who are living) in order to help or teach them. The applied-pure dimension was associated positively with artistic and negatively with enterprising and conventional. While this is not a surprising finding it conveys information beyond the Holland vocational interest type descriptions. For example, expressive creativity is associated with pure disciplines, even in hard sciences like physics. Psychology, too, a pure discipline, is associated with expressive and creative artistic interests. By contrast, applied disciplines tend to be profit-oriented like business (enterprising) or systematic and organized (conventional).

Conclusion

All in all, Biglan's disciplinary classification and Holland's typology of vocational interests allow one to posit differences and similarities between collaborating disciplines in multidisciplinary education. The classification schemes' characterization of individuals in disciplines (Holland) or classes of disciplines (Biglan) can give insight into ways in which members of collaborating disciplines may complement or conflict with one another. Some implications for multidisciplinary education are that students may benefit from the different viewpoints and knowledge of students or instructors from other disciplines, and/or that they could fail to understand one another in certain ways. For example, this could be important in the context of student teamwork or in instructional design by members of different disciplines.

In addition, since Holland's and Biglan's classifications have many moderate and strong correlations, knowing one attribute (Holland type or Biglan class) allows one to infer additional characteristics from the significantly correlated classes from the other classification scheme. Collaborators can thus construct richer portraits of the perhaps unfamiliar disciplines represented in their teams.

Works Cited

Becher, T., & Trowler, P. (2001). *Academic tribes and territories: Intellectual enquiry and the culture of disciplines* (2nd ed.). Society for Research into Higher Education & Open University Press.

Biglan, A. (1973). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology*, *57*(3), 195-203.

Collin, A. (2009). Multidisciplinary, interdisciplinary, and transdisciplinary collaboration: Implications for vocational psychology. *International Journal for Educational and Vocational Guidance*, *9*(2), 101-110. https://psycnet.apa.org/record/2009-10948-005

Donnay, D. A. C., Morris, M. L., Schaubhut, N. A., & Thompson, R. C. (2005). *Strong interest inventory manual: Research, development, and strategies for interpretation* (Rev. ed.). CPP.

Drees, L. A. (1982). *The Biglan model: An augmentation* [Doctoral dissertation, University of Nebraska].

Feil-Seifer, D., & Matarić, M. J. (2005). *Defining socially assistive robotics,* IEEE 9th International Conference on Rehabilitation Robotics,

Fleischmann, K., & Huchison, C. (2012). Creative exchange: An evolving model of multidisciplinary collaboration. *Journal of Learning Design*, *5*(1), 23-31.

Harmon, L. W., Hansen, J.-I. C., Borgen, F. H., & Hammer, A.L. (1994). *Strong Interest Inventory: Applications and Technical Guide : Form T317 of the Strong Vocational Interest Blanks*. Palo Alto, CA.

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Prentice-Hall.

Simpson, A. (2017). The surprising persistence of Biglan's classification scheme. *Studies in Higher Education*, *42*(8), 1520-1531. https://doi.org/10.1080/03075079.2015.1111323

Sonke, J., Pesata, V., Lee, J. B., & Graham-Pole, J. (2017). Nurse perceptions of artists as collaborators in interprofes-

ESSAYS – CONTINUED

sional care teams. *Healthcare (Basel)*, *5*(3). https://doi.org/10.3390/healthcare5030050

Williamson, J. M., & Panigabutra-Roberts, A. (2021). An analysis of STEAM disciplinary interrelationships described in abstracts of higher education articles. *IMPACT: Journal of the Center for Interdisciplinary Teaching & Learning*. https://sites.bu.edu/impact/previous-issues/impact-winter-2021/an-analysis-of-steam-disciplinary-interrelationships/