



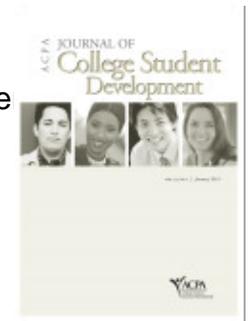
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Journal of College Student Development, Volume 51, Number 5, September/October 2010, pp. 550-562 (Article)

Published by The Johns Hopkins University Press
DOI: 10.1353/csd.2010.0010



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Preliminary Evidence of the Reliability and Validity of a Quantitative Measure of Self-Authorship

Elizabeth G. Creamer Marcia Baxter Magolda Jessica Yue

This article presents preliminary evidence of the reliability and validity of a measure of self-authorship derived from 18 items in the Career Decision Making Survey. The research conceptualizes a quantitative measure of self-authorship as a three-part score that reflects level of agreement with statements at each of the first three phases of development toward self-authorship. The instrument could be used to assess the outcomes of initiatives designed to promote growth in the development of self-authorship.

Defined as “the internal capacity to define one’s beliefs, identity, and social relations” (Baxter Magolda, 2008), *self-authorship* is required to achieve many of the most critical outcomes of higher education. These include effective reasoning and problem solving, leadership skills, moral reasoning, and intercultural maturity, among others things (Baxter Magolda & King, 2007). Self-authorship provides a theoretical framework that defines development holistically and as occurring in distinct stages that are marked by alternating periods of equilibrium and disequilibrium. Each stage reflects a qualitative shift, not in the content or *what* is known, but in structure or *how* it is known (Kegan, 1994). The stages capture distinct points in the evolution of the capacity to be internally authored and the transition from a reliance on authority, through a growing awareness of the role of self and the uncertainty of knowledge, and culminating in

the development of an internally defined sense of self. The development of self-authorship is a necessary prerequisite to be able to genuinely engage different opinions and to make complex life choices (King & Baxter Magolda, 2005).

Self-authorship has been conceptualized as a multidimensional construct with phases and dimensions. The three dimensions of self-authorship are interrelated and address three broad questions: How do I know? Who am I? and What relationships do I want? (Baxter Magolda, 2001b). The cognitive dimension—addressed by the question How do I know?—encompasses epistemic assumptions about the nature, limits, and certainty of knowledge. The intrapersonal dimension—Who Am I?—refers to a sense of self. The interpersonal dimension—What relationships do I want?—refers to how one constructs relationships that are increasingly characterized by interdependence and mutuality. Baxter Magolda describes the dimensions as interwoven (2009).

In a longitudinal study of a group of traditional-aged college students that now spans more than 20 years, Baxter Magolda (2001b) identified four phases of development (External Formulas, Crossroads, Becoming Author of One’s Life, Internal Foundation), but noted that External Formulas and Crossroads were most common during college for her participants. Additional research with college students suggests that these two phases and Becoming Author of One’s Life are possibilities during

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college (Jones & Abes, 2004; Pizzolato, 2003; Torres & Hernandez, 2007).

Students' progress toward self-authoring has almost exclusively been measured through semistructured interviews. One-on-one, face-to-face interviews have been used to assess self-authorship (Baxter Magolda & King, 2007; Creamer & Laughlin, 2005; Pizzolato, 2003, 2004, 2005a, 2005b, 2007, 2010; Torres & Baxter Magolda, 2004; Torres & Hernandez, 2007), as well as to assess the impact of educational environments, including courses with a service-learning component (Boes, 2006; Jones & Abes, 2004), programs for high-risk students (Pizzolato & Ozaki, 2007), and other educational contexts identified by Baxter Magolda and King (2004). The interactive nature of the interview offers the opportunity to ground the exchange in experiences that are meaningful to the participant and to interject the probes necessary to explore the boundaries of the meaning making structures employed (Baxter Magolda & King, 2007; Baxter Magolda & King, 2008). The intensive time demands of conducting and transcribing the interviews and of training the interviewers and scorer who are well versed in the theoretical framework are among the disadvantages of the qualitative approach to assessing self-authorship.

Pizzolato (2005b, 2007), the only researcher to publish results from pen-and-paper instruments explicitly designed to measure self-authorship, found only a moderate correlation between students' scores on two such instruments. The first instrument, the Self-Authorship Survey (SAS), is a 29-item pen-and-paper questionnaire designed to assess recognition of statements reflecting different types of meaning making. The second instrument, the Experience Survey (ES), aspires to assess optimal ways of knowing by asking respondents to write an essay wherein they describe the process they used to make two important decisions, including the decision to apply to college. Narratives were

scored on a scale of 1 to 4 on three domains that overlap with the subscales on the SAS (decision making, problem solving, and autonomy).

Further work on a reliable quantitative measure of self-authorship is needed to provide a way for practitioners to assess the impact of interventions designed to promote its development that is not time intensive, and to provide empirical evidence to address emerging theoretical questions. Baxter Magolda and King (2007) pointed to the central role of assessment when they wrote:

[D]esigning educational practice to promote self-authorship necessitates assessing students' current epistemological, intrapersonal, and interpersonal development. In turn, judging the effectiveness of educational practice in promoting self-authorship requires some means of assessing students' developmental progress. (p. 494)

A quantitative measure of self-authorship will add to the impetus for practitioners to create educational interventions targeted at promoting self-authored ways of reasoning. It will also offer a way to compare the impact of educational environments that promote its development.

A quantitative measure of self-authorship has the potential to address a number of theoretical questions emerging from the research about self-authorship. Researchers have taken different positions on the role of the three dimensions in the development of self-authorship. Some have provided evidence the dimensions are equally as strong and interrelated at each phase of development (Baxter Magolda, 2010), while others have articulated arguments for the dominance of one dimension over the other. For example, King (2010) put forward arguments for why the cognitive dimension may dominate, and Pizzolato (2010) concluded that the interpersonal dimension was overriding in a sample of Asian American students. A reliable quantitative measure of self-authorship

can provide an empirical way to determine the strength of the relationship among the dimensions at each phase of development.

This article presents results about the validity and reliability of 18 items in the section of the Career Decision Making Survey (CDMS) constructed to measure the first three phases in the development of self-authorship. Although further refinements are needed, the instrument has the potential to offer a way to assess the impact of interventions designed to promote self-authorship, particularly during the process of making personal and educational decisions such as choosing a major or a career.

The CDMS was developed by members of the Women and Information Technology (WIT) team to meet the goals of a research program initially funded by the National Science Foundation (HRD 0120458) to explore the process high school and college students use to consider information technology (IT) as a career option. Results document a statistically significant positive link between a preliminary measure of self-authorship called Decision Orientation and openness to input, information-seeking behavior, and the meaning made of multiple viewpoints during the process of career decision making (Creamer, Lee, & Meszaros, 2007; Meszaros, Creamer, & Lee, 2009; Meszaros, Lee & Laughlin, 2007). The model was confirmed in later research (Creamer, 2010) with the revised measure of self-authorship that is presented here.

RELATED LITERATURE

Regardless of methodology, scholars face numerous challenges in their efforts to measure a construct as complex and multidimensional as self-authorship. Lahey, Souvaine, Kegan, Goodman, and Felix (1988) formalized a qualitative measure of adult meaning called the Subject-Object Interview (SOI) that has been widely used (e.g., Boes, 2006; Berger,

2004; Villegas-Reimers, 1996). Reflecting the assumption that self-authorship is not domain specific, interaction during the interview is shaped by the topics chosen by the participant. Analysis of the interview transcript is conducted using a highly nuanced scoring system that produces a score reflecting a dominant and, if present, a subordinate mode of meaning making from among five possible stages and four transitions between each stage (Lahey et al.). The dimensions play no formal role in SOI scoring.

Lahey et al. (1988) captured some of the complexity involved in any attempt to categorize what amounts to an unfolding process of development with the observation:

[O]ur theory assumes a given subject-object relationship is the consequence of an on-going *process* of evolution, a gradual unfolding. An assessment is a snapshot capturing a moment of an ongoing process. It is not just an analysis to determine whether the phenomenon fits this category or that category. (p. 43, emphasis in the original)

The SOI produces a numerical score but remains fundamentally a qualitative measure because the score reflects a scorer's judgment about the dominant mode of thinking evident in an interview transcript. Reliability in scoring is only achieved through an intensive program of training and practice that is impractical for most practitioners.

Qualitative and quantitative instruments designed to measure self-authorship developed to date share some common assumptions, but do not yield scores that can be compared. Common elements include an emphasis on identifying a phase of development, the assumption that the meaning making structure employed is domain general or does not vary by topic, and the assumption that reasoning and action are consistent. Scores on a quantitative measure may overestimate levels of self-

authorship because respondents typically score higher on questionnaires or similar types of approaches because they can recognize statements that are more complex than they routinely employ or can produce (King, 1990). On the other hand, respondents often score higher on interviews because there are contextual supports, such as those provided through interaction, prompts, or the opportunity to practice (King & Kitchener, 2004).

Some of the challenges presented by the task of developing a quantitative measure of self-authorship derive from its origins as a theoretical construct emerging from clinical practice. Foremost among these challenges is the difficulty of translating the theoretical assumption that the phases and dimensions of development are highly inter-related into quantitatively derived scales that distinguish them. A second place where there is tension between theoretical assumptions about the construct and the practical demands of developing an instrument revolve around the assumption that meaning making structures are subsumed in more complex structures. The fact that each meaning making structure subsumes the prior one makes it challenging to separate External Formulas, Crossroads, and Early Self-Authoring in ways that clearly stand apart from each other. Kegan (1994) articulates the relationship of meaning making structures (or organizing principles) across the developmental continuum leading to self-authorship:

[D]ifferent principles of mental organization are intimately related to each other. They are not just different ways of knowing, each with its preferred season. One does not simply replace the other, nor is the relation merely additive or cumulative, an accretion of skills. Rather, the relation is transformative, qualitative, and incorporative. Each successive principle subsumes or encompasses the prior principle. That which was subject becomes

object to the next principle. The new principle is a higher order principle (more complex, more inclusive) that makes the prior principle into an element or tool of its system. (p. 330)

External influences are in the foreground in External Formulas and remain so through part of the Crossroads. Once the internal voice moves to the foreground, external influences remain but move to the background. In-depth interview data can identify when some structure is reframed in the service of a more complex one, particularly when the interviewer is skilled at asking questions to ascertain the relationship of various structures the interviewee exhibits. It is very difficult for a questionnaire item to achieve this level of nuance. Interpretation of interview data often involves identifying the boundaries of meaning making structures (Lahey et al., 1988), or identifying the reasoning structures under which all the data available would be coherent (Baxter Magolda, 2001a).

An additional theoretical issue arises from the intersections among the three dimensions. This points again to the difficulty of separating the three dimensions to clearly stand apart from each other during the measurement process. Kegan (1994) explains that the subject-object relationship stands at the core of each meaning making structure. Our thinking, feeling, and social relating all stem from the same underlying principle or structure: the subject-object relationship. In each meaning making structure there are elements to which we are subject: we are so embedded in these elements that we do not recognize them. Other elements are object: we can stand back from them and reflect and act on them. When something that was subject becomes object, we now "have it" rather than being "had by it" (Kegan, p. 34), and subsequently transform to a new meaning making structure. Thus externally defined persons adopt the beliefs of

authorities, identify themselves according to who they think others want them to be, and act to gain approval in relationships. Their functioning in each dimension comes from the same underlying meaning making structure.

A closely related challenge is to maintain a distinction between the content and the structure of respondents' meaning making. Content refers to *what* respondents think, whereas structure refers to the underlying structure through which they organize their meaning making. The reason, or justification, for the response is a more accurate indicator of structure than what the person thinks (Baxter Magolda, 2001a; Gibbs & Widaman, 1982). A quantitative questionnaire consisting of recognition items cannot evaluate respondents' underlying patterns of reasoning. Two respondents may agree with the same questionnaire item, but for reasons that reflect entirely different phases of development.

There is little doubt that the challenge of measuring a construct as complex as self-authorship in an effective and efficient way is one that will continue to require the efforts of multiple researchers. Because of its potential to detect subtle nuances in underlying reasoning, an in-depth interview conducted by a trained interviewer remains that most accurate way to assess individual development. That leaves unresolved, however, the challenge of creating a psychometrically sound instrument that can be used by educators whose prime interest is not research or theory development, but to produce evidence of impact of educational activities and programs designed to advance the development of self-authorship and ways to improve them.

RESEARCH METHODS

Instrument

Self-authorship questions in the CDMS were developed initially in collaboration

with Baxter Magolda. The questions share some similarities with those appearing in the Measure of Epistemological Reflection (MER; Baxter Magolda & Porterfield, 1985; Baxter Magolda, 2001a), with the distinction that the questions reflect a more holistic framework and were reworded to be about career advisors or counselors rather than teachers. Some of the self-authorship questions were revised and others were added in the second (2004-2005) and third versions (2006-2007, 2007-2008) of the CDMS.

The measure of self-authorship appears in a section of the CDMS called "Diverse Viewpoints and Decision Making." The measure can be described as domain specific because most of the questionnaire items are framed within the context of the career decision-making process. There are 28 items in the section, each using a 4-point Likert-type scale from 1 (*disagree*) to 4 (*agree*). Six negatively worded items were deleted from the analysis because they significantly reduced the reliability of the measure (Yue, Creamer, & Wolfe, 2009). Three others were deleted from the analysis because they significantly reduced reliability.

The self-authorship section of the CDMS contains seven prompts, five of which make a direct tie to career decision making or career advisors/counselors, and two of which are the more abstract kind often found on measures of epistemological development. The career-related prompts are: (a) "My primary role in making an educational decision, like the choice of a major or career, is to . . ."; (b) "If a teacher or advisor recommended a career in a field that I never considered before, I would . . ."; (c) "To make a good choice about a career, I think that . . ."; (d) "In my opinion the most important role of an effective career counselor or advisor is to . . ."; and (e) "When I am in the process of making an important decision and people give me conflicting advice, I . . ."

TABLE 1.
Questionnaire Items from the Career Decision Making Survey by Phase and Dimension of Development of Self-Authorship

Phase and Dimension	Questionnaire Item (by Item Number)
<i>Phase 1: External Formulas</i>	
Epistemological	9. To make a good career choice about a career, I think that facts are the strongest basis for a good decision.
	11. To make a good career choice about a career, I think that experts are in the best position to advise me about a good choice.
Interpersonal	13. The most important role of an effective career counselor or advisor is to be an expert on a variety of career options.
	14. The most important role of an effective career counselor or advisor is to provide guidance about a choice that is appropriate to me.
Intrapersonal	1. My primary role in making an education decision . . . is to acquire as much information as possible.
	2. My primary role in making an education decision . . . is to seek direction from informed experts.
<i>Phase 2: Crossroads</i>	
Epistemological	10. To make a good career choice about a career, I think that it is largely a matter of personal opinion.
	22. When people have different interpretations of a book, I think that some books are just that way. It is possible for all interpretations to be correct.
Interpersonal	8. If a teacher or advisor recommended a career in a field that I have never considered before, I would to explain my point of view.
	15. The most important role of an effective career counselor or advisor is to help students think through multiple options.
Intrapersonal	4. My primary role in making an education decision . . . is to consider my own views.
<i>Phase 3: Early Self-Authoring</i>	
Epistemological	12. To make a good career choice about a career, it is not a matter of facts or expert judgment, but a match between my values, interests, and skills and those of the job.
	24. When people have different interpretations of a book, I think that multiple interpretations are possible, but some are closer to the truth than others.
	26. Experts are divided on some scientific issues, such as the causes of global warming. In a situation like this, I would have to look at the evidence and come to my own conclusion.
	27. Experts are divided on some scientific issues, such as the causes of global warming. In a situation like this, I think it is best to accept the uncertainty and try to understand the principal arguments behind the different points of view.
Interpersonal	6. If a teacher or advisor recommended a career in a field that I have never considered before, I would try to understand their point of view and figure out an option that would best fit my needs and interests.
	16. In my opinion, the most important role of an effective counselor or advisor is to direct students to information that will help them to make a decision on their own.

TABLE 2.
Demographic Characteristics of the Respondents

Demographic	<i>n</i> (%)
Gender (<i>n</i> = 178)	
Male	121 (68.0)
Female	57 (32.0)
Age (<i>n</i> = 173)	
≤20	35 (20.2)
21	51 (29.5)
22	50 (28.9)
23	37 (21.4)
Race (<i>n</i> = 180)	
White	131 (72.8)
under-represented	49 (27.2)

* Differences in the number of respondents among subgroups reflect missing values.

The two probes that are not grounded in career decision making are: (a) “When people have different interpretations of a book, I think that . . .”; and (b) “Experts are divided on some scientific issues, such as the causes of global warming. In a situation like this, I think that . . .”

In 2007, Baxter Magolda reviewed the self-authorship section in the CDMS and provided her expert opinion regarding how likely someone from each of the first three phases of development would be to agree with each of the questionnaire items. At her suggestion, one final item was deleted from the analysis (“My primary role in making an education decision, like the choice of a major or career, is to acquire as much information as possible.”), because she said that a person at any level of self-authorship would be likely to agree with it.

Table 1 shows the distribution of the final set of 18 items used in this analysis, organized by phase and dimension of self-evolution, as confirmed through the statistical

analysis described below. The same set of questionnaire items is used to measure both dimensions and phases in the development of self-authorship.

Sample

A sample 183 college juniors and seniors took the 2007-2008 Career Decision Making Survey (n.d.). As the data collection was part of a larger research project designed to predict interest in a career in IT, the questionnaire was distributed in settings selected because of access to students interested in or majoring in IT. Most of the respondents (*n* = 109) were upper-level students pursuing an IT major in one of three research universities. Because of the under-enrollment of women in IT majors, the majority of respondents were male. The sample of respondents is smaller and more homogenous, including by gender, age, and academic field than is optimal for measurement purposes. See Table 2 for demographic characteristics of the sample.

The majority (*n* = 177) of the questionnaires (*N* = 183) were completed in upper-level IT course classrooms at two universities after an intermediary secured permission from the instructors to administer the questionnaire during class time. The remaining questionnaires (*n* = 6) were completed by respondents attending an IT-related career fair hosted by a third university. Students received a \$10 incentive to complete the questionnaire.

ANALYSIS

The initial data analysis for the study involved two statistical procedures: (a) a confirmatory factor analysis (CFA), and (b) an Item Response Theory (IRT). Cronbach’s alphas were used to test the reliability of multi-item scales developed to measure the theoretical conceptualization of the phases and dimensions. The Multidimensional Random Coefficients Multinomial Logit Model

(MRCMLM; Adams, Wilson, & Wang, 1997) is a modeling method based on a generalized IRT that provides a statistical procedure to determine if the three-phase, three-dimension factor structure is the most robust statistical measure from among other configurations. These procedures are a good fit for the analysis, because both reflect that the research was launched with the intent of confirming theory by demonstrating the multidimensional nature of the evolution of self-authorship and that it is manifested in distinct ways during phases of its development. A full description of these procedures and results is presented elsewhere (Yue, Creamer, & Wolfe, 2009). Results from each of these procedures are described below.

RESULTS

Four statistical procedures provide additional evidence of the validity and reliability of the 18 items from the portion of the CDMS dealing with self-authorship.

Data about the validity of the measure is presented first through evidence of the correlations among the dimensions and phases. Data about the reliability of the scales developed to measure each of the dimensions and the first three phases of self-authorship are presented following that. A way to conceptualize an overall CDMS self-authorship score is presented in the last part of this section.

Correlation Among the Three Dimensions

The three dimensions of self-authorship are conceptualized as intertwined, but expressed in a qualitatively different way at each phase in development. Three scales developed from the confirmatory factor analysis are used in this analysis that cluster items from the questionnaire into the intrapersonal, interpersonal, and epistemological dimensions of self-authorship. The scale constructed to represent each dimension reflects a level of

agreement with clusters of statements reflecting External Formulas, Crossroads, or Early Self-Authoring.

The correlations among the dimensions, as shown in Table 3, confirm our theory in that they demonstrate moderate to strong positive correlations that are statistically significant between the scales representing each of the three dimensions of self-evolution. The interpersonal dimension is more strongly related to the intrapersonal dimension of self-evolution ($r = .706$; $p < .001$), than intrapersonal is to the epistemological dimension ($r = .654$; $p < .001$). The strongest correlation is between the epistemological and interpersonal dimensions ($r = .809$; $p < .001$). These findings add strength to the argument that the cognitive dimension often leads development of the other dimensions.

The correlations provide moderately strong support for the theoretical proposition that there is consistency among (a) views about the nature of knowledge and authority (epistemological), (b) expectations for the role of others in decision-making (interpersonal), and (c) views about one's own role in decision making (intrapersonal). The strength of the correlations demonstrates that there is greater consistency between views of knowledge (epistemological) and expectations of authorities (interpersonal), than there is between views of knowledge (epistemological) and expectations for one's

TABLE 3.
Correlations Among the Dimensions of Self-Authorship Development

Correlating Dimensions	<i>r</i>
Interpersonal–Intrapersonal	.706*
Intrapersonal–Epistemological	.654*
Epistemological–Interpersonal	.809*

* $p < .001$.

TABLE 4.
Correlations Among the Phases of
Development of Self-Authorship

Correlated Phases ^a	<i>r</i>
EF–CR	.369*
CR–ESA	.888*
ESA–EF	.298*

^a EF = Phase 1: External Formulas, CR = Phase 2: Crossroads, ESA = Phase 3: Early Self-Authoring.

* $p < .001$.

own role in decision-making (intrapersonal).

Correlation Among the Phases of Development

It is theorized that development occurs in a sequential fashion with each phase in development subsuming the structures of meaning making in the previous phase. What evidence there is indicates that regression between phases, when it occurs, is temporary and does not exceed one phase. Correlations among the phases would, therefore, be expected to be positive, but not particularly strong.

As shown in Table 4, the correlations among the three phases of development of self-authorship (in order: External Formulas, Crossroads, and Early Self-Authoring), provide statistical confirmation of our theory. The items in scales overlap with those used in the previous section, but in this case the questionnaire items are grouped by phase. There is a weak, but statistically significant positive correlation between the first and second phases ($r = .369$; $p < .001$), and a much stronger positive correlation between the second and third phases ($r = .888$; $p < .001$). As would be expected theoretically, the correlation between the first and third phases is weak ($r = .298$; $p < .001$).

The findings about the relationships among

the phases are consistent with theory in a number of substantive ways. That there is a weaker correlation between the first and second phases than between the second and third phases is reasonable in that it suggests that it is a bigger conceptual leap to move from External Formulas to the Crossroads, than from the Crossroads to Early Self-Authoring. The weak correlation between the first and third phases ($r = .298$; $p < .001$) is also consistent with theory: it is a barometer for just how very different meaning making is when it comes from the perspective of External Formulas and Early Self-Authoring.

Indications of Reliability of the Dimensions and Phases

Table 5 provides descriptive statistics about the way respondents replied to the items in the questionnaire grouped by dimensions measured and phases of development of self-authorship. The scales used to measure the dimensions and the phases demonstrate moderate reliability. The greatest reliability is in measuring the intrapersonal dimension and the third phase of the development of self-authorship. The reliability of the scales measuring the dimensions range from moderate for epistemological ($\alpha = .595$) and interpersonal ($\alpha = .614$) dimensions to high for the intrapersonal dimension ($\alpha = .713$). The reliability of the scale to measure each of the three phases of development range are moderately strong and range from a low of $\alpha = .58$ for External Formulas, to $\alpha = .62$ for the Crossroads, to a high of $\alpha = .70$ for Early Self-Authoring.

Conceptualizing a Self-Authorship Score

It is possible to conceptualize the CDMS measure of self-authorship (CDMS-SA) as a 3×3 matrix with 9 cell scores. Each cell score is a mean of the sum of responses to the items

in that cell based on a 4-point Likert-type scale from 1 (*disagree*) to 4 (*agree*). The scores in the rows of the matrix represent the average level of agreement with questionnaire items about each of the three dimensions (epistemological, interpersonal, intrapersonal). The scores in the three columns reflect the level of agreement with questions reflecting each of the first three phases in the movement toward self-authorship (External Formulas, Crossroads, and Early Self-Authoring).

Summing and averaging responses to questionnaire items in each of the columns of the matrix produces a CDMS-SA three-part summary score. An overall mean score between 1 and 2 would mean that the respondent largely disagreed with the statements in the cells in that column, while a mean score between 3 and 4 would mean that he or she largely agreed with them. A respondent whose summary score, for example, was 3-1-1, shows the highest level of agreement with questions reflecting External Formulas, while a 1-2-3 scores reflects meaning making that is more reflective of self-authorship.

Comparing overall means on a pre- and post-summary score on the CDMS-SA could be one way to assess the effectiveness of developmentally targeted experiences. A shift in the overall mean from a 3-1-1 score to a 2-2-1 score, for example, could be interpreted to mean that there is some developmental progress because there was a decrease in the level of agreement with questions reflecting External Formulas and an increase in thinking that reflects the Crossroads.

DISCUSSION

Results from the analysis of 18 items that measure self-authorship in the CDMS produced six statistically derived scales that measure the three dimensions (epistemological, interpersonal, and intrapersonal), and three early developmental phases (External Formulas, Crossroads, and Early Self-Authoring), with strong enough reliability to support use in future research. The CDMS-SA can yield a single overall score or three scores that reflect the extent to which a respondent agrees with

TABLE 5.
Mean, Standard Deviation, and Reliability of the Scales Used to Measure the Dimensions and Phases of Development of Self-Authorship

Scale	Mean*	Standard Deviation	Reliability
<i>Phases</i>			
External Formulas	.110	1.030	.58
Crossroads	.120	1.010	.62
Early Self-Authoring	.110	0.620	.70
<i>Dimensions</i>			
Epistemological	.052	0.614	.59
Interpersonal	.124	1.100	.61
Intrapersonal	.134	1.370	.71

* These are raw scores calculated from MRCML and scaled on a 4-point Likert-type scale.

statements corresponding to each of the early phases of development of self-authorship, thus showing the balance of these three developmental phases for the respondent. The construct validity of the scales is demonstrated by the findings of statistically significant positive correlations among the dimensions and among the phases of development toward self-authorship that are consistent with the theoretical framework. One of the advantages of the CDMS-SA measure is that it is designed so that each of the dimensions is given equal weight in calculating an overall score.

Conceptualizing a quantitative measure as a matrix has the potential to advance theoretical understanding of self-authorship, particularly regarding ways that the dimensions operate. A quantitative measure offers an empirical way to determine if growth on one dimension can lead to growth on another. This might be the case, for example, when exposure to activities designed to promote intercultural maturity creates a safe environment for interactions with diverse others that is associated with growth on the interpersonal dimension that does not yet translate to other dimensions. A quantitative measure can help pinpoint the types of activities and experiences in and out of class that contribute to development, as well as to identify those that set development back.

The advantage of the CDMS-CA matrix for educational practice is that it may offer an approach that is sensitive to the small, incremental advances that would typically be associated with an educational activity or class of a relatively short duration, such as a semester-long course that incorporates service-learning designed to promote more complex thinking. The instrument could be used to assess the outcomes of such initiatives through changes in the levels of agreement with the set of questions reflecting External Formulas and those reflecting the two later phases.

CONCLUSIONS

As fits any scientific endeavor, there is a healthy amount of skepticism among members of the community of scholars conducting research about self-authorship about the feasibility of constructing a quantitative instrument that captures the complexity of the way self-authorship has been conceptualized. Initial efforts have produced mixed results. Reports from two team efforts (Goodman & Siefert, 2009; Pizzolato & Chaudhari, 2009) are inconclusive.

A central question raised by the research presented in this article is a conceptual one that has implications for the future development of other quantitative measures of self-authorship: How helpful is the conceptualization of a self-authorship score as a matrix that gives equal weight to both dimensions and phases? Other researchers have used a matrix to highlight the conceptual differences between the dimensions and phases (e.g., Baxter Magolda, 2004; Bekken & Marie, 2007; Torres & Hernandez, 2007). This formulation gives weight to the dimensions in a way that is not evident in other measures of self-authorship. The dimensions are theorized to be so strongly interrelated that the validity of measuring them with separate statistical scales might well be contested.

Members of the WIT team have plans for launching future research using the CDMS measure of self-authorship. Efforts are underway to revise the instrument for use with high school students and questions drafted to equalize the number of questions in each of the cells in the matrix. The most immediate need is to validate the quantitative CDMS-SA score with the SOI score. The efficacy of CDMS-SA as a measure of pretest and posttest outcomes also awaits testing. A population of respondents that is diverse by age, ethnicity, and field of study is essential for each of these steps.

Another area that remains open for theoretical debate is the question of whether self-authorship operates in comparable ways across domains. Taking a modest stance that acknowledges uncertainty about whether individuals' meaning making structures may be altered by the content of the decision and those impacted by it, the most direct application of the measure of self-authorship produced by the CDMS is in matters related to career decision making. This could involve, for example, using CDMS-SA to measure the outcomes of efforts

designed to combat gender stereotypes about careers involving information technology. Developing effective ways to assess self-authorship remains a roadblock to promoting an agenda that advances self-authorship as a central goal of a higher education.

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