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The Canfield *Learning Styles Inventory*: An Assessment of Its Usefulness in Accounting Education Research

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ABSTRACT: Recent reviews of accounting education research have called for continued assessment of learning style inventories in accounting contexts (Geiger and Boyle 1992; Rebele et al. 1998). This study presents a critical evaluation of the psychometric properties of the Canfield *Learning Styles Inventory (LSI)*, proposed by Francis et al. (1995) as an instrument for possible use by accounting educators. The study administered two versions (standard and scrambled) to 531 accounting majors from eight universities, applying a test-retest strategy after a 4–5 week interval. The versions were examined for internal consistency reliability, test-retest reliability, classification stability, and construct validity. We found moderate internal consistency (item analyses scores weaker than those reported by Canfield [1988]) and a substantial amount of learner-type classification instability across the two administrations. In terms of construct validity, two-factor solutions were not consistent with those reported by Canfield (1988). Further, three-factor solutions also were not consistent with Canfield's three learning domains. Therefore, along with limited theoretical support and the lack of empirical justification, we find little support for the use of the Canfield *LSI* in accounting education research.

As accounting educators we have long attempted to affect and assess the educational experiences of our students (Williams et al. 1988; Rebele et al. 1998). One such line of inquiry in this pedagogical quest has been the assessment of student learning styles, i.e., how individual students prefer to learn. In the recent literature review of accounting and general education research, Rebele et al. (1998, 198) conclude that:

> A continuation of efforts to describe the learning styles of accounting students is encouraged. Research efforts should continue to search for valid instruments to measure

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> student learning styles, so that accounting educators can reliably use information from these instruments to improve the learning process.

In the widely distributed AAA Monograph, *Intentional Learning: A Process for Learning to Learn in the Accounting Curriculum,* Francis et al. (1995, 37) indicate that:

> The Canfield Learning Style Inventory is one well-known instrument for assessing student instructional preference. Faculty have used the Canfield inventories to ascertain the learning preferences of their students and to initiate class discussion of learning styles and course assignments.

Although the Canfield *Learning Style Inventory (LSI)* has not yet been used in accounting education studies, it has been used in other, related disciplines. For example, authors have used the Canfield *LSI* to assess learning style preferences of various college student groups (Matthews 1994; Ladd and Ruby 1999), educator groups (Pettigrew and Buell 1989; Ladd 1995), and incarcerated adults (Felton 1994). In the most recently published study, Ladd and Ruby (1999) purported to assess the learning style preferences of international M.B.A. students.

In terms of the measurement properties of this instrument, Benton (1992) offers a critique based on information reported in the *Canfield Learning Styles Inventory (LSI) Manual* (*Canfield LSI Manual*) (Canfield 1988). To our knowledge there has been no assessment of the *LSI* by independent researchers.[1] Thus, the motivation for the current study is based on Rebele et al.'s (1998) call for assessment of alternative learning style instruments, encouragement by Francis et al. (1995) to use the Canfield *LSI*, and the use of this instrument by business and other educational researchers in varying contexts. Accordingly, the current study presents a critical assessment of the Canfield *LSI*, as developed by Canfield and Knight (1983) and presented in Canfield (1988). In addition, it assesses the *LSI*'s potential usefulness in accounting education.

Presenting a critical evaluation of the psychometric properties of the Canfield *LSI* will enable us to determine whether accounting education researchers may reliably use this instrument in the examination of accounting majors' individual learning styles. In addition, unlike several earlier studies published in the accounting education literature (e.g., Togo and Baldwin 1990; Stout and Ruble 1991a; Geiger 1992), we utilize intended accounting majors in upper-level accounting courses in the assessment of this instrument. The use of accounting majors allows us to focus the critical assessment of this instrument on the group of students of primary interest to most accounting faculty—students in our discipline.

The remainder of the paper is organized as follows. The next section provides a brief discussion of learning style research in the accounting education literature. Second, we present a discussion of the learning domains that comprise the Canfield *LSI* instrument, as well as how the instrument is scored. The paper then discusses

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[1] The only published study addressing the psychometric properties of the Canfield *LSI* was by Gruber and Carriuolo (1991). However, the lead author from the study is from Western Psychological Services (publishers of the *LSI*), and the study only reports data used to develop the *LSI*, which is principally available in the *Canfield (LSI) Manual* (Canfield 1988).

how the scores from the learning domains are combined to categorize individuals as to overall learner types. The fourth section describes the sample and procedures used to evaluate the Canfield *LSI* instrument, followed by a presentation of the results. The last section discusses the results of our analyses and offers recommendations to accounting educators and accounting education researchers.

PRIOR LEARNING STYLE RESEARCH IN ACCOUNTING

Accounting education researchers have attempted to ascertain the predominant learning styles of accounting students (Baker et al. 1986, 1987; Togo and Baldwin 1990; McKee et al. 1992) and of accounting practitioners (Collins and Milliron 1987), whether students with certain learning style preferences perform better or are more satisfied with accounting courses (Geiger 1992), and whether students with the same learning style as their instructor perform better or have higher satisfaction ratings in accounting courses (Geiger and Boyle 1992).

The vast majority of these studies have used Kolb's (1976, 1985) *Learning Style Inventory* (Kolb's *LSI*) to assess individual learning preferences. However, Kolb's *LSI* has received a substantial amount of criticism in the education literature (e.g., Sims et al. 1986; Sims et al. 1989; Wilson 1986; Veres et al. 1987; Veres et al. 1991; Atkinson 1991; Cornwell et al. 1991). Further, the specific use of Kolb's *LSI* in accounting education research has been criticized because of the instrument's poor psychometric properties (cf., Stout and Ruble 1994). In fact, Ruble and Stout (1993) and Stout and Ruble (1991a, 1991b, 1994) have assessed the use of Kolb's *LSI* in accounting education and have called for a curtailment of its use by accounting educators. Based in part on this call for the curtailed use of Kolb's *LSI*, Geiger and Boyle (1992), Stout and Ruble (1994), and more recently Rebele et al. (1998), indicate that alternative learning style instruments should be assessed.[2]

THE CANFIELD *LEARNING STYLES INVENTORY*

Numerous researchers (e.g., Cronbach 1967, 1977; Tallmadge and Shearer 1971; Joyce 1978; Claxton and Murrell 1987) have described individuals' preferences for learning as complex and multifaceted. Based on this supposition of multifaceted preferences, the Canfield LSI attempts to assess individuals over several affective learning domains. Thus, Canfield's *LSI* differs from the Kolb *LSI*, which addresses only preferences for learning modes. The Canfield *LSI* is intended to be broader in scope and, thus, was developed to address multiple aspects of learning. The Canfield *LSI* includes 21 scales designed to assess four basic learning domains: (1) conditions for learning, (2) area of interest, (3) mode of learning, and (4) expectation for course grade (see Table 1). Although intuitively appealing, Canfield does not provide any theoretical justification for the combination of these four learning domains. Nevertheless, according to the *Canfield LSI Manual* (Canfield 1988), scores from the first three domains are combined to create a learner typology that categorizes individuals into preferred learning types. The fourth domain (Expectation of Course Grade) is self-contained and scores on these four scales are combined to give an overall expectation score.

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[2] Recently, Duff (1997) presented an evaluation of the Mumford Learning Styles Questionnaire (LSQ) as a potential assessment instrument for use in accounting education research.

TABLE 1
Canfield *LSI*
Description of Learning Domains and Scales[a]

DOMAIN #1 Conditions for Learning (eight scales): Preferred Situation or Context of Instruction

Scale	
1 Peer	Enjoys teamwork, maintaining good relations with other students, having student friends, etc.
2 Organization	Desires clearly organized course work, meaningful assignments, and a logical sequence of activities.
3 Goal Setting	Wants to set own objectives, use feedback to modify goals or procedures, and make his or her own decisions on objectives.
4 Competition	Desires comparison with others, needs to know how he or she is doing in relation to others.
5 Instructor	Wants to know the instructor personally and have a mutual understanding and liking for him or her.
6 Detail	Likes to know specific information on assignments, requirements, rules, etc.
7 Independence	Prefers working alone, determining his or her own study plan, and doing things independently.
8 Authority	Desires classroom discipline, maintenance of order, and having informed and knowledgeable instructors.

DOMAIN #2 Area of Interest (four scales): Preferred Subject Matter or Objects of Study

Scale	
1 Numeric	Prefers working with numbers and logic, solving mathematical problems, etc.
2 Qualitative	Likes working with words or language—writing, editing, talking.
3 Inanimate	Enjoys working with things—building, repairing, designing, operating.
4 People	Prefers working with people—interviewing, counseling, selling, helping.

DOMAIN #3 Mode of Learning (four scales): Preferred Manner of Obtaining New Information

Scale	
1 Listening	Prefers hearing lectures, tapes, speeches, etc.
2 Reading	Enjoys examining written information, reading texts, pamphlets, etc.
3 Iconic	Likes interpreting illustrations, movies, slides, graphs, etc.
4 Direct Experience	Desires hands-on or performance situations, such as shop, field trips, practice exercises, etc.

DOMAIN #4 Expectation for Course Grade (five scales): Level of Performance Anticipated

Scale	
1 A-expectation	Outstanding or superior level.
2 B-expectation	Above average or good level.
3 C-expectation	Average or satisfactory level.
4 D-expectation	Below average or unsatisfactory level.
5 Total Expectation	Weighted sum of A-, B-,C- and D-expectations.

[a] Adapted from Canfield (1988).

The four learning domains, along with the 21 scales that comprise them, appear in Table 1. Since the *LSI* uses only the first three domains (Conditions for Learning, Area of Interest, and Mode of Learning) to classify individuals as to learning type, and since the Expectation of Course Grade domain is relatively self-contained, we will restrict our analyses to these first three domains, as well as to the classification of individuals as to learning preference.[3]

Learning Domains

Conditions for Learning

This domain refers to an individual's preferred dynamic surrounding the learning situation. These areas include the "roles that people in the learning task assume, the structure of course materials, the ways in which goals are set, and the source of motivation" (Canfield 1988, 19). The eight scales that are meant to comprise this domain are peer, organization, goal setting, competition, instructor, detail, independence, and authority. As depicted in Table 1, these eight scales are meant to capture the settings that the individual prefers when learning and include instructional-type information as well as interpersonal preferences between the learner and the learner's instructor. Thus, Canfield derives the conditions for learning scales from a traditional classroom setting based on teacher-assisted instruction, and not on the independent acquisition of new information or skill.

Area of Interest

This domain assesses the "basic objects of study or the course subject matter dealt with" (Canfield 1988, 23). The four scales that are meant to comprise this domain are numeric, qualitative, inanimate, and people. The scales in this domain are meant to reflect the preferred subject matter of the individual, but on the surface seem to capture two different continuums—working with quantitative things vs. qualitative things, and working with objects vs. people. Nonetheless, these four scales comprise the area of interest domain and are intended to reflect an individual's preferences for the subject matter.

Mode of Learning

This domain refers "to the basic sensory and cognitive modality in which new information may be acquired" (Canfield 1988, 24). The four modes of learning assessed in the *LSI* are listening, reading, iconic (visual), and direct experience. These four modes are largely different from those assessed in the Kolb *LSI*. Kolb's *LSI* was based on the Experiential Learning Model and attempted to assess four modes of learning as concrete experience, abstract conceptualization, reflective observation, and active experimentation.[4] The four posited modes of learning in the Canfield *LSI* appear to be considerably broader than those addressed by Kolb

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[3] The *Canfield (LSI) Manual* (Canfield 1988) also concentrates more heavily on these first three domains and on learner classifications. It provides comparatively little discussion regarding learning expectations and how these expectations interact with the other three learning domains or with preferred learning type. The only published study addressing the psychometric properties of the Canfield *LSI* (*viz.*, Gruber and Carriuolo 1991), also restrict their analyses to these three domains of the *LSI*.

[4] See Baldwin and Reckers (1984), Baker et al. (1986), and Geiger (1992) for a more detailed discussion of Kolb's *LSI* and the four modes of learning based on the Experiential Learning Model.

(1985). Canfield does not explain in the *Canfield (LSI) Manual* (Canfield 1988) how he chose these four learning modes. There appears to be no underlying theory or justification for their selection. This broader approach may be an attempt to overcome the problems encountered by Kolb in using only the Experiential Learning Model as a basis for evaluating preferred mode of learning.

Scoring the *LSI*

The instrument consists of 30 statements. Each statement includes four choices. The instructions tell the respondent to rank each of the four choices: 1—"most preferred" to 4—"least preferred," and they also remind respondents to use a different number for each response. To illustrate, the first four statements from the *LSI* appear in Figure 1. Statements 1 and 2 refer to the Conditions for Learning domain, statement 3 refers to the Area of Interest domain, and statement 4 refers to the Mode of Learning domain.

Each of the 16 scales (eight for Conditions for Learning; four for Area of Interest; four for Mode of Learning) consists of six responses, one in each of six statements (e.g., 1a, 6a, 11a, 16a, 21a, 26a). To illustrate using statement #1 in Figure 1, choice 1a refers to the Peer scale, 1b refers to the Organization scale, 1c refers to the Goal Setting scale, and 1d refers to the Competition scale.

The ipsative scoring (i.e., ranking) format of Kolb's *LSI* was cause for a considerable amount of criticism of that instrument (cf., Cornwell et al. 1991; Geiger et al. 1993; Stout and Ruble 1994). However, Canfield (1988) argues that the ipsative scoring format of his *LSI* is preferable to a response format that allows responses to each scale item to be independent of the other items (e.g., a Likert-type scale). In fact, Canfield (1988, 19) states that:

> This is a strength of the *LSI* in that it reflects the kinds of trade-offs that people must face when selecting educational experiences. Obviously, it is not possible to maximize one kind of educational experience without giving up some alternatives. It is reasonable to demand that high preferences in one area come at a cost of preferences in other areas.

Accordingly, the *LSI* requires individuals to indicate their preferred "trade-off" by ranking choices among the sets of four scales presented in each statement. Canfield (1988, 19) provides no justification for why the groups of scales within the domains must necessarily be trade-offs. Further, while it may be more logical in some cases (e.g., listening vs. reading), it appears less logical in others (e.g., peer vs. organization). Further, as noted by Bonham (1988, 15), Canfield provides no justification why the first four of the eight conditions for learning are grouped together, and similarly why the second four are grouped together. That is, among the Conditions for Learning domain, Canfield does not explain why Peer, Organization, Goal Setting, and Competition should be grouped together as trade-offs, nor why Instructor, Detail, Independence, and Authority should similarly be considered trade-offs. The first set of four may be more closely linked with the student, the second set of four with the instructor; however, Canfield provides no justification for these groupings. Canfield (1988, 19) does warn that the test interpreter must remain aware of this ipsative scoring and "interpret the score on any given scale in conjunction with those of the three others that are part of its group."

FIGURE 1
Sample Statements from the Canfield *LSI*

1. Rank the following items in terms of how well they describe the classes you've liked most. (1 for the most descriptive statement, 2 for the second most, etc.)

_____ a. I enjoyed the other students and we shared our ideas and feelings with each other.
_____ b. The course was well organized and the topics followed one another in a meaningful sequence.
_____ c. I more or less set my own goals and studied the things of most interest to me.
_____ d. I knew how my work compared with others and the best work was fairly recognized.

2. Number the following descriptions of teachers from 1 to 4 in the order in which you normally prefer them. (1 for most preferred, etc.)

_____ a. Teachers who are pleasant, friendly, and who take a personal interest in me.
_____ b. Teachers who provide specific and clear information about assignments and requirements.
_____ c. Teachers who give me the opportunity to decide what I want to study and how I want to do things.
_____ d. Teachers who impose high standards and make me do the work necessary to accomplish them.

3. Rank the following courses in terms of their general appeal to you.

_____ a. Mathematics and physical science.
_____ b. Language and literature.
_____ c. Household and craft repair skills.
_____ d. Interviewing and counseling.

4. Rank the following in terms of their general value to you as ways to learn.

_____ a. Listening to others talk about a subject.
_____ b. Reading what others have written about it.
_____ c. Seeing pictures, graphs, movies, etc.
_____ d. Handling or working with something tangible.

The physical layout of the Canfield *LSI* is structured so that each of the four scales to be ranked on the related six statements are all on the same row. That is, with the statements pertaining to Conditions for Learning, the Peer scale choice always appears first, the Organization scale choice always appears second, and so on. Further, when respondents look at the responses they make across all six choices on the same row, they find a visible "Total" column at the end of the preprinted cut-away pages. Accordingly, a respondent can easily tell (even before filling out the instrument) that responses to the first choices will be summed across all statements, and responses to the second choices will be summed across all statements, and so on.

As in the Kolb *LSI*'s one-scale-per-column scoring, the Canfield *LSI*'s one-scale-per-row scoring may artificially inflate measures of internal consistency reliability (e.g., alpha coefficients) (Stout and Ruble 1994). This possible inflation may not be as dramatic as with the Kolb *LSI* since the Canfield *LSI* is scored across six pages, compared to Kolb *LSI*'s one-page instrument.

We assess this possible one-scale-per-row response bias problem by administering an alternate form of the instrument to a separate group of accounting majors. The alternate form presented students with a scrambled order of statements and a scrambled set of choices. The modified version also eliminated the visible "Total" column and with it the respondent's ability to easily identify that choices were to be summed. The scrambled instrument attempted to minimize the ability of the respondents to discover that they were ranking among sets of the same four scales. Comparisons of internal consistency reliability measures (i.e., coefficient alpha) between the standard and scrambled versions of Canfield's *LSI* will enable us to discern whether there exists a response-set bias in the original instrument that is manifest in inflated internal consistency estimates (Stout and Ruble 1994).

Typology of Learners

To arrive at a categorization of learner types, the Canfield *LSI* combines several of the scale scores from the first three domains (Conditions for Learning, Area of Interest, and Mode of Learning). Initially, respondents' summed raw scores are translated into standardized t-scores included with the *LSI* instrument (Canfield 1988).[5] The standardized t-scores for 10 of the 16 scales are then combined to calculate values for two learning dimensions (Canfield 1988, 7). The ten scales used in the calculations of the two dimensions are based on a multistage factor analysis of the 16 scales.[6]

The combinations of scales (based on the standardized t-scores) for the two learning dimensions are as follows:

X-dimension: Organization + Qualitative + Reading – Direct Experience – Inanimate – Iconic

Y-dimension: Peer + Instructor – Goal Setting – Independence

[5] Canfield (1988) indicates that these standardized t-score norms were derived from a sample of 851 male and 543 female (n = 1,394) midwestern community college students.

[6] Canfield (1988) and Gruber and Carriuolo (1991) indicate that this combination of ten of the 16 t-scores is based on a two-stage procedure of a factor analysis and then an extension analysis (Gorsuch 1974). See Gruber and Carriuolo (1991) for further discussion of this procedure. The critical examination of this procedure is beyond the scope of this paper. We will assess the classification stability of the instrument using this scoring method for our sample of accounting students.

The X-dimension is labeled "Applied-Conceptual," and the Y-dimension is labeled "Social-Independent." Together these two dimensions interact to form nine learner types. Figure 2 presents the resultant typology.

These nine learner types are used to categorize individuals according to their overall learning preferences and represent four "pure" types, four "mixed" types, and a neutral preference. Figure 2 also provides a description of these learner types. Cut-off scores for the X- and Y-dimensions were not derived theoretically, but were determined based on Canfield's (1988, 45) initial samples to intentionally create equal numbers of learners across the nine learner types.

Ruble and Stout (1991, 483) indicate that when the learning environment remains relatively stable over time, it seems reasonable to expect learning styles to remain relatively stable. Using a test-retest strategy, our study examines how stable the Canfield *LSI* is in categorizing accounting students according to these nine preferred learning types over a 4–5 week interval. Canfield (1988) did not validate the stability of the learner typology by re-testing. Gruber and Carriuolo (1991) used the identical data and results presented in the *Canfield LSI Manual* (Canfield 1988) and, thus, did not re-test. Consequently, the current study extends the previous analysis to also examine the classification stability of the *LSI*.

RESEARCH METHOD

Subjects

The sample of 531 accounting majors was heterogeneous in terms of enrollment in public vs. private and size of institution, with geographical representation from northeastern (n = 30), midatlantic (n = 181), southern (n = 127), and midwestern (n = 193) regions (based on the American Accounting Association's regional classification). The students ranged in age from 18 to 52 years (mean age 22.9 years). There were 262 males and 269 females in the sample. Table 2 presents a summary of the sample by university, gender, class standing, and mean age for both the standard and scrambled forms of the instrument.

Instruments and Procedure

We administered two versions of the Canfield *LSI* instrument in upper-level accounting courses. Approximately 79 percent of the sample (n = 417) completed the standard version. The remainder of the sample (n = 114) completed an alternate version of the instrument that scrambled the order of statements and set of choices. As indicated earlier, the scrambled version also removed the "Total" column in an attempt to minimize the respondent's ability to identify that choices were summed across the six related statements.

In addition, we administered the same version a second time after a 4–5 week interval. At the time of the first administration, students were not informed that the instrument would be administered a second time. The final sample used for analysis represents only those respondents who properly completed both administrations. Students in each class were matched by using the last four digits of their social security numbers.

Statistical Analyses

To assess instrument reliability we used alpha coefficients to estimate the internal consistency of the scales (Nunnally and Bernstein 1994). In addition, we

FIGURE 2
Canfield *LSI* Learner Typology[a]

	X less than –15	X from –15 to 15	X greater than 15
Y greater than 10	**SA (Social/Applied)**	**S (Social)**	**SC (Social/Conceptual)**
Y from –10 to 10	**A (Applied)**	**N (Neutral Preference)**	**C (Conceptual)**
Y less than –10	**IA (Independent/Applied)**	**I (Independent)**	**IC (Independent/Conceptual)**

Description of Learner Type

Pure Types:

Social—prefers extensive opportunities to interact with peers and instructors; has no strong preference for either applied or conceptual approaches; instruction involving small groups and teamwork will create the closest match.

Independent—prefers to work alone toward individual goals; has no strong preference for either applied or conceptual approaches; instructional techniques such as analysis of case studies or self-selected and self-paced programs will create the closest match.

Applied—prefers to work in activities directly related to real-world experience; has no strong preference for either social or independent approaches; instruction involving practicums, site visits, and team labs will create the closest match.

Conceptual—prefers to work with highly organized language-oriented materials; has no preference for either social or independent approaches; instruction involving lectures and reading will create the closest match.

Mixed Types:

Social/Applied—prefers to have opportunities to interact with students and instructors in activities closely approximating real-world experiences; instruction involving role-playing, group problem solving, and supervised practicums will create the closest match.

Social/Conceptual—prefers to have opportunities to interact with students and instructors using highly organized language-oriented materials; instruction involving a balance of lecture and discussion will create the closest match.

Independent/Applied—prefers to work alone toward individual goals in activities closely approximating real-world experience; instruction involving individual labs or unsupervised technical practicums will create the closest match.

Independent/Conceptual—prefers to work alone toward individual goals with highly organized language-oriented materials; instruction allowing for independent reading, literature searches, and reviews will create the closest match.

Neutral Type: Neutral Preference—tends to have no clear areas of strong preference; may find adequate match in any other type, but may also find it difficult at times to become entirely involved.

[a] Adapted from Canfield (1988).

TABLE 2
Demographic Characteristics

Standard Version

	University	Respondents	Male	Female	So[a]	Jr	Sr	Other[a]	Mean Age
	1	30	15	15		3	27		21.1
Large	2	44	21	23			34	10	22.1
Public	3	30	16	14			27	3	23.0
	4	63	29	34		21	16	26[b]	28.4[b]
Medium	5	35	8	27		25	10		23.7
Public	6	37	20	17		5	32		22.6
	7	90	46	44	18	35	33	4	22.3
Private	8	88	55	33	1	43	43	1	20.6
Total sample		417	210	207	19	132	222	44	22.95
			(50.4%)	(49.6%)					

Scrambled Version

	University	Respondents	Male	Female	So[a]	Jr	Sr	Other[a]	Mean Age
Large	2	83	40	43			46	37	22.7
Medium	7	31	12	19		17	13	1	22.5
Total sample		114	52	62		17	59	38	22.6
			(45.6%)	(54.4%)					
Total		531	262	269	19	149	281	82	22.9
			(49.3%)	(50.7%)					

[a] At University 7 second-semester sophomores (So) enroll in Intermediate Accounting. "Other" consists of individuals in a five-year program or individuals who have a nonaccounting degree and are preparing for the CPA exam.

[b] The university offers a post-baccalaureate certificate program composed primarily of students returning to school after several years of employment.

performed item analyses on the scales. A principal components factor analysis was conducted to assess construct validity and determine whether the Canfield *LSI* measured the two dimensions of learning he proposed (Canfield 1988). Varimax rotation also was performed to determine final factor loadings.

RESULTS

Descriptive Statistics

Table 3 presents a comparison of the scale means and standard deviations of our sample of accounting majors with the normative sample provided in the *Canfield (LSI) Manual* (Canfield 1988). The normative sample consisted of 2,544 community college students. Descriptive statistics are based on the first administration of the

TABLE 3
Descriptive Statistics for the Canfield *LSI*

Scale	Current Sample: Standard (n = 417) M	Current Sample: Standard (n = 417) SD	Current Sample: Scrambled (n = 114) M	Current Sample: Scrambled (n = 114) SD	Normative Sample[a] (n = 2,544) M	Normative Sample[a] (n = 2,544) SD
Conditions for Learning						
Peer	16.4	3.3	16.5	3.1	14.6	3.9
Organization	10.2	2.7	11.1	3.0	12.2	3.5
Goal Setting	15.9	3.2	16.2	3.2	15.2	2.9
Competition	17.5	3.0	16.4	3.1	18.0	3.1
Instructor	12.5	3.6	12.6	3.8	12.8	4.0
Detail	11.2	3.5	11.9	3.5	13.3	3.4
Independence	18.8	3.3	18.8	3.8	17.3	2.9
Authority	17.5	3.2	16.7	3.4	16.8	3.5
Area of Interest						
Numeric	9.8	3.6	11.1	3.7	16.1	4.6
Qualitative	17.5	4.1	18.2	4.2	16.2	4.0
Inanimate	16.8	4.4	16.4	4.6	14.1	4.7
People	15.9	4.2	14.3	4.3	13.7	4.3
Mode of Learning						
Listening	13.5	4.0	14.4	3.8	14.5	4.0
Reading	18.8	4.2	18.2	4.6	17.8	4.5
Iconic	14.4	4.0	15.4	4.2	13.6	3.8
Direct Experience	13.4	4.8	12.0	4.2	14.0	4.8

Scores are ranks. Lower values signify higher preferences. Scores are based on the first administration.

[a] *Canfield LSI Manual* (Canfield 1988).

standard and scrambled versions of the instrument.[7] The means and standard deviations are similar for the standard and scrambled versions. There are only slight differences in the order in which the respondents ranked their preferences with respect to the scales in each of the three learning domains.

The standard deviations for the scrambled version are not sufficiently higher than the standard version to indicate a response-set bias related to the layout of the instrument. Except for Peer, Organization, Numeric, and Iconic, the scale means and standard deviations are fairly consistent with those reported for the normative sample. Since the scores represent ranks, lower values signify higher preferences.

The current sample of accounting majors ranked Competition, Numeric, and Direct Experience higher, with Peer and Iconic lower than the normative sample of

[7] Results based on the second administration are similar to those presented. The means and standard deviations did not vary significantly. There were no differences in the order in which the respondents ranked their preferences for the scales within each of the three learning domains.

community college students. These differences indicate that the accounting majors in the current study differ on these scales compared to the group of community college students used to develop the instrument. However, the scale differences appear reasonable. Accounting students may well be expected to indicate, on average, stronger preferences on scales such as Competition and Numeric, and lower preferences on the Peer and Iconic scales than the average community college student/adult learner. Ladd and Ruby (1999) found that the international M.B.A. students in their study indicated similar preferences as our sample of accounting majors.

Because the Canfield *LSI* was normed separately for males and females, Table 4 presents scale means and standard deviations by gender. Table 4 also identifies those scales showing statistically significant differences between male and female preferences. Our results differ from those presented for the normative sample. Canfield (1988) reported extensive differences due to gender across a majority of the scales, particularly for the Area of Interest domain. However, for our sample of accounting majors there appears to be much less variation in preferences due to gender. For the current sample of accounting majors, females generally showed a stronger preference on the Organization and Qualitative scales and males a stronger preference on the Independence and Inanimate scales. These results indicate that male and female accounting majors may be more homogeneous than gender groups in the general population of community college students/adult learners examined by Canfield (1988). Alternatively, shifts may have occurred over time. (Data from the current study are more recent than those in the normative sample.)

Reliability

The alpha coefficients and test-retest correlations for both versions of the instrument are presented in Table 5. Overall, the internal consistency reliability measures seem modest. Nunnally and Bernstein (1994) consider alpha coefficients over 0.70 to be adequate for instruments used for general assessment, while Carmines and Zeller (1979) suggest a more stringent level of 0.80 for widely used scales. For both *LSI* versions, alpha coefficients were relatively low on the Conditions for Learning scales (i.e., no average alpha above 0.70), but were generally higher on all other scales (i.e., all average alphas over 0.70). In addition, alphas were generally higher for the second administration (i.e., 31 of the 32 alphas were higher in the second administration than the first). However, compared with the standard version, average alpha coefficients for the scrambled version were slightly lower on the three learning domains. The difference in coefficient alpha for the standard and scrambled version was very slight for the first administration (average differences ranged from 0 to –0.01), while the overall average difference ranged from –0.03 to –0.07 for the second administration.[8] Further the average test-retest correlations for the scrambled version are actually higher than those of the standard version on each of the three learning domains. Based on Ruble

[8] An analysis of the individual scale differences between the scrambled and standard versions of the *LSI* also reveals no clearly discernable pattern. Of the 32 comparisons (16 Time 1 and 16 Time 2), the standard version had higher coefficient alphas than the scrambled version 21 times, lower coefficient alphas 9 times, and the same coefficients 2 times. If significant response-set bias existed, then we would expect the standard version to have a higher coefficient alpha in almost all of the 32 comparisons. These detailed comparisons also do not support the notion of significantly inflated alpha reliability measures in the standard *LSI*.

TABLE 4
Gender Differences on Canfield *LSI* Scales

	Current Sample											
	Standard (n = 417)				Scrambled (n =114)				Normative Sample (n = 2,544)			
	Male (n = 210)		Female (n = 207)		Male (n = 52)		Female (n = 62)		Male (n = 1,364)		Female (n = 1,180)	
Scale	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Conditions for Learning												
Peer	16.4	3.3	16.5	3.1	16.7	3.1	16.3	3.1	15.5	3.3	15.6	3.5
Organization	10.6	2.9	9.8	2.4*	12.0	3.3	10.3	2.6*	11.8	3.0	11.3	3.0**
Goal Setting	15.6	3.3	16.3	3.1	15.4	3.4	16.8	2.8	14.6	3.2	14.5	3.2
Competition	17.4	3.0	17.5	3.0	16.4	3.4	16.6	2.8	18.1	3.9	18.6	1.9**
Instructor	12.7	3.7	12.3	3.5	13.0	4.0	12.3	3.6	12.9	3.7	12.9	3.6
Detail	11.6	3.7	10.8	3.3	12.6	3.8	11.3	3.1	13.2	3.4	13.3	3.4*
Independence	18.2	3.6	19.3	2.9*	18.2	3.6	19.3	3.1	16.2	3.5	16.6	3.5**
Authority	17.4	3.3	17.6	3.1	16.2	3.6	17.2	3.2	17.3	3.6	17.2	3.7
Area of Interest												
Numeric	10.1	3.6	9.5	3.4	10.8	3.2	11.3	4.1	15.8	4.8	17.8	4.7**
Qualitative	17.5	4.1	16.9	4.0*	19.0	3.8	17.5	4.3	17.4	4.0	14.1	4.1**
Inanimate	16.8	4.4	17.9	4.1**	14.9	4.4	17.7	4.4*	12.5	4.7	16.2	4.0**
People	15.9	4.2	15.7	4.2	15.2	4.3	13.6	4.1	14.3	4.3	11.8	3.9**
Mode of Learning												
Listening	13.5	4.0	13.3	4.1	14.3	4.1	14.6	3.5	14.7	3.9	13.7	3.8**
Reading	18.8	4.2	18.6	4.3	18.3	4.9	18.2	4.3	18.4	4.0	18.5	4.2
Iconic	14.4	4.0	14.7	3.9	15.6	4.9	15.3	3.6	14.5	3.9	14.5	3.8
Direct experience	13.4	4.8	13.4	4.9	11.9	4.4	12.0	4.1	12.8	4.5	13.4	4.3**

*, ** $p < 0.05$, $p < 0.01$, respectively.

Scores are ranks. Lower values signify higher preferences. Scores are based on the first administration.

and Stout (1994), if a substantial response-set bias were present, we would expect the standard version of the instrument to have both considerably higher alpha coefficients and higher test-retest correlations. Thus, these results do not support the existence of a response-set bias, which would be manifested in inflated alpha coefficients in scoring the Canfield *LSI*.

Investigating the internal consistency further, Table 6 (Panels A and B) presents analyses of the responses comprising the 16 scales (based on the results of the first administration). Canfield (1988) conducted what he called "item" analyses. To compare our results with Canfield's, each respondent's choice (ranking of a, b, c, and d on each statement as illustrated in Figure 1) is identified as an "item." For example, item analysis indicates whether the ranking given the Peer response on Item 1 tends to be the same as the average rank given the Peer response on Items 6, 11, 16, 21, and 26—the five other related items. To be consistent with

TABLE 5
Alpha Coefficients and Test-Retest Correlations for the Two Versions (decimals omitted)

	Coefficient Alpha					
	Standard		Scrambled		Test-Retest Correlations	
Scale	Time 1	Time 2	Time 1	Time 2	Standard	Scrambled
Conditions for Learning						
Peer	50	65	38	53	58	60
Organization	43	61	32	48	45	47
Goal Setting	53	66	52	59	50	61
Competition	44	63	42	50	46	51
Instructor	54	77	71	70	62	73
Detail	72	77	70	73	58	69
Independence	65	74	67	77	52	72
Authority	58	71	64	68	51	63
Average	**55**	**69**	**54**	**62**	**53**	**62**
Area of Interest						
Numeric	78	83	74	77	76	81
Qualitative	80	84	80	75	77	86
Inanimate	84	88	85	88	79	86
People	77	80	80	81	77	90
Average	**80**	**84**	**79**	**81**	**77**	**86**
Mode of Learning						
Listening	78	84	72	73	63	61
Reading	80	88	83	86	72	77
Iconic	77	87	82	85	67	74
Direct Experience	80	86	74	80	67	69
Average	**78**	**86**	**78**	**81**	**67**	**70**
Average for instrument	**67**	**77**	**66**	**71**	**63**	**70**

Canfield (1988), the values reported are corrected for scale attenuation (Nunnally and Bernstein 1994). The results indicate that responses on several items did not tend to be the same as the average of the other responses for most scales, and particularly for the first four scales. These results are in stark contrast to those reported by Canfield (1988, Table 8), who indicates that the lowest single item analysis score in his sample was 0.85, with the vast majority over 0.90. Our results produce item analysis scores ranging from –0.04 to 0.87 on the standard version and from –0.07 to 0.90 on the scrambled version, with the vast majority under 0.70.

The reliability results for the Conditions for Learning domain are the weakest of the three domains. The coefficient alpha reliabilities, test-retest correlations, and the item analyses results indicate that the groups of scales within the Conditions for Learning domain, especially the Peer, Organization, Goal Setting, and Competition group, as discussed earlier, may not necessarily be clear trade-offs, as suggested by Canfield (1988).

TABLE 6
Item Analyses
(decimals omitted)

Panel A: Standard Version

Scale	1st Item vs. Sum of Other 5	2nd Item vs. Sum of Other 5	3rd Item vs. Sum of Other 5	4th Item vs. Sum of Other 5	5th Item vs. Sum of Other 5	6th Item vs. Sum of Other 5
Conditions for Learning						
Peer	39	46	12	45	9	56
Organization	34	40	–4	22	45	51
Goal Setting	45	48	8	37	44	54
Competition	43	56	16	15	19	47
Instructor	60	39	50	66	64	37
Detail	58	53	67	60	64	59
Independence	50	51	51	50	55	57
Authority	46	55	35	43	46	39
Area of Interest						
Numeric	56	53	47	70	60	69
Qualitative	68	66	54	68	47	80
Inanimate	62	81	72	78	50	80
People	48	60	56	58	58	66
Mode of Learning						
Listening	63	74	30	73	72	78
Reading	57	70	52	74	64	78
Iconic	68	76	27	62	65	86
Direct Experience	55	73	45	82	65	87

Panel B: Scrambled Version

Scale	1st Item vs. Sum of Other 5	2nd Item vs. Sum of Other 5	3rd Item vs. Sum of Other 5	4th Item vs. Sum of Other 5	5th Item vs. Sum of Other 5	6th Item vs. Sum of Other 5
Conditions for Learning						
Peer	54	37	1	10	–5	58
Organization	48	39	–7	10	15	29
Goal Setting	50	36	6	27	49	40
Competition	57	34	20	3	29	32
Instructor	68	43	64	67	42	32
Detail	54	42	58	64	53	43
Independence	55	32	54	51	40	46
Authority	66	54	15	55	45	49
Area of Interest						
Numeric	46	48	49	66	51	59
Qualitative	65	63	60	60	37	71
Inanimate	68	71	68	73	47	80
People	44	58	45	56	55	63
Mode of Learning						
Listening	50	70	22	73	55	90
Reading	79	64	49	72	68	80
Iconic	72	73	49	69	60	81
Direct Experience	54	63	33	75	39	90

Classification Stability of Indicated Learner Types

The distribution of the nine learner types for the first and second administration on both versions of the instrument is presented in Table 7 (Panels A and B). Canfield (1988) derived cut-off scores so that each of the nine learner types was equally represented (10–11 percent) from his normative sample of community college students. On the standard version (Panel A), the distribution for the first administration ranged from 6.5 percent (27 out of 417) for Applied and Independent/Applied to 18.5 percent (77 out of 417) for Social/Conceptual. The distribution for the second administration ranged from 6.0 percent (25 out of 412) for Neutral to 20.1 percent (84 out of 417) for Social/Conceptual.

Results were similar for the scrambled version (Panel B), with the distribution ranging from 3.5 percent for Independent/Applied to 22.8 percent for Social/Conceptual. For the second administration, the distribution ranged from 6.1 percent for Conceptual to 18.4 percent for Social/Conceptual. Thus, according to the Canfield *LSI*, accounting majors have a preference for social over independent learning and conceptual over applied learning.

The stability of learner type classifications from the first to second administration is also shown in Table 7, with the diagonal representing agreement between the two administrations. The Kappa coefficient, measuring classification stability, was 0.298 ($p < 0.0001$) for the original version and 0.346 ($p < 0.0001$) for the scrambled version. While these coefficients are greater than chance, they seem relatively small and indicate a substantial amount of classification instability between the two administrations. Only 38.8 percent and 43.0 percent of the students were consistently classified (over a 4–5 week period) with the standard and scrambled versions of the instrument, respectively.

As little as a one-point change on the X- or Y-dimension can cause a shift in learner type classification. Based on the results of the current study, only 3 percent of the shifts on the standard version were caused by as little as a five- to eight-point change. On the scrambled version, a change of three to six points caused 11 percent of the shifts. Overall, 44 percent of the shifts on the standard version were along the Social/Independent dimension, 29 percent along the Applied/Conceptual dimension, and the remaining 27 percent were shifts along both dimensions. The scrambled version produced similar results, with 49 percent of the shifts along the Social/Independent dimension and 35 percent along the Applied/Conceptual dimension. In sum, the Canfield *LSI* classification stability improved with the scrambled version, but both versions remain relatively unstable regarding classification stability of individuals over short intervals of time.

Construct Validity of the Canfield LSI

In developing the learner typology, Canfield (1988) performed a three-stage analysis resulting in an unrotated two-factor solution. Canfield labeled the two learning dimensions "Conceptual-Applied" and "Social-Independent." The lack of detailed information in Canfield (1988) prevented us from specifically replicating the three-stage analysis. However, we performed a separate factor analysis on both versions of the instrument. For each version, two-factor and three-factor solutions were extracted. Two-factor solutions were extracted to examine the construct validity of Canfield's two learning dimensions. Three-factor solutions were extracted to assess the distinctness of the three learning domains (Conditions for

TABLE 7
Classification Stability of the Two Versions

Panel A: Standard Version (n = 417)

	Time 2									
Time 1	**Social/ Applied**	**Social**	**Social/ Conceptual**	**Applied**	**Neutral**	**Conceptual**	**Independent/ Applied**	**Indepen- dent**	**Independent/ Conceptual**	**Total**
Social/ Applied	**34**	7	2	4	4	1	3	5	—	60
Social	15	**26**	14	7	6	4	2	1	1	76
Social/ Conceptual	—	9	**42**	3	4	12	—	—	7	77
Applied	7	1	1	**6**	2	—	8	1	1	27
Neutral	5	10	5	4	**1**	3	2	4	2	36
Conceptual	1	5	16	—	4	**12**	—	2	9	49
Independent/ Applied	8	—	—	3	2	1	**11**	2	—	27
Independent	—	3	1	4	1	2	6	**9**	3	29
Independent/ Conceptual	1	—	3	—	1	6	1	3	**21**	36
Total	71	61	84	31	25	41	33	27	44	417

Kappa Coefficient = 0.298 ($p < 0.0001$)

% Classified consistently (162 out of 417) = 38.8%

(Continued on next page)

Table 7 (Continued)

Panel B: Scrambled Version (n = 114)

	Time 2									
Time 1	**Social/ Applied**	**Social**	**Social/ Conceptual**	**Applied**	**Neutral**	**Conceptual**	**Independent/ Applied**	**Indepen- dent**	**Independent/ Conceptual**	**Total**
Social/ Applied	**11**	1	1	6	—	—	1	—	—	20
Social	5	**6**	2	1	1	1	1	—	—	17
Social/ Conceptual	1	3	**15**	1	2	3	—	1	—	26
Applied	1	—	—	**3**	2	—	4	1	—	11
Neutral	1	3	—	2	**2**	—	—	1	—	9
Conceptual	—	—	3	—	—	**2**	—	—	4	9
Independent/ Applied	—	—	—	—	—	—	**2**	2	—	4
Independent	—	—	—	—	3	—	2	**3**	2	10
Independent/ Conceptual	—	—	—	—	1	1	1	—	**5**	8
Total	19	13	21	13	11	7	11	8	11	114

Kappa Coefficient = 0.346 ($p < 0.0001$)

% Classified consistently (49 out of 114) = 43.0%

Learning, Area of Interest, and Mode of Learning). In all cases, a factor loading cut-off score of 0.40 was employed. The resultant factor loadings (unrotated and rotated) are presented in Table 8.[9] These results are not consistent with those reported by Canfield (1988, Table 15). The discrepancies may be due in part to the inability to replicate Canfield's three-stage analysis and the sole use of accounting majors in our sample.[10]

Two-Factor Solutions

The two-factor solutions yielded results accounting for a rather limited proportion of the total variance. The two factors accounted for 33.48 percent of the variance for the standard version and 36.76 percent of the variance for the scrambled version. An average of approximately 35 percent of the variance explained by the two factors does not provide support for the two dimensions of learning proposed by Canfield.

The rotated two-factor solution for the standard version of the Canfield *LSI* produced factor loadings closer to those reported by Canfield, but it did not yield two strong factors representing the "Conceptual-Applied" and "Social-Independent" dimensions Canfield proposed. Peer and Instructor scales loaded negatively in our study, where Canfield reported positive loadings for these scales. The two-factor solution in the current study suggests an Applied-Social and Conceptual-Independent dimension. The rotated two-factor solution for the scrambled version yielded even more ambiguous results. Scales tended to reverse the factor on which they loaded in comparison to the standard version. Based on the current sample of accounting majors, the two-factor solutions for both versions of the instrument do not support Canfield's two dimensions of learning.

Three-Factor Solutions

As presented in Table 8, the third factor accounted for additional variance of 11.45 percent in the standard version and 11.17 percent in the scrambled version. The rotated three-factor solution for the standard and scrambled versions did not produce factor loadings indicating three distinct learning domains.

DISCUSSION

Francis et al. (1995) suggested the Canfield *LSI* as a potentially beneficial instrument for accounting education researchers. The current study represents an initial empirical effort to assess the potential usefulness of the Canfield *Learning Styles Inventory* in accounting education.

Based on the estimates of internal consistency reliability and the test-retest correlation of scales, the physical layout of the Canfield *LSI* does not appear to

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[9] Based on principal component and factor comparability analyses (Everett 1983), an eight-component solution (based on a screeplot and eigenvalues above 1.0) would best fit the data. These eight components accounted for 82 percent of the observed variance. For the scrambled version, a seven-component solution accounted for 78 percent of the observed variance. Since we are examining our data for correspondence to the two-dimension and three-learning domain format of the Canfield *LSI*, we present results of a two-factor and three-factor solution. Other results are available from the authors on request.

[10] With respect to the representativeness of Canfield's normative group, this comparison neither proves nor disproves that accounting majors are different from other learners, but only that accounting majors are different than Canfield's normative group.

TABLE 8
Factor Loadings and Patterns

Panel A: Unrotated Factor Patterns for the Two Versions (decimals omitted)

	Standard Version					Scrambled Version				
	Two-Factor		Three-Factor			Two-Factor		Three-Factor		
Scale	1	2	1	2	3	1	2	1	2	3
Conditions for Learning										
Peer		–61		–61		–52	45	–52	45	
Organization	47		47		–40	46		46		
Goal Setting					70	–43	–53	–43	–53	–48
Competition						54		54		
Instructor	–52	–50	–52	–50		–65		–65		
Detail	57		57			54		54		
Independence	–44		–44		68	–43	–49	–43	–49	–57
Authority	41		41			61		61		
Area of Interest										
Numeric										
Qualitative		–40					40		40	–61
Inanimate		64		64			–73		–73	
People		–57		–57		–52	57	–52	57	
Mode of Learning										
Listening	48		48							
Reading	61		61		42	56		56		–43
Iconic	–44		–44			–43		–43		
Direct Experience	–57		–57			–43	–46	–43	–46	
Variance explained (%)	19	14	19	14	11	21	16	21	16	11

Panel B: Rotated Factor Patterns for the Two Versions (decimals omitted)

	Standard Version					Scrambled Version				
	Two-Factor		Three-Factor			Two-Factor		Three-Factor		
Scale	1	2	1	2	3	1	2	1	2	3
Conditions for Learning										
Peer		–72	–75			–68		–74		
Organization		42			55		51		49	
Goal Setting	–47				–82		–68		–83	
Competition		41				51		46		
Instructor		–72	–75			–76		–80		
Detail		59	54				49			
Independence	–48				–84		–64		–85	
Authority						61		51	42	
Area of Interest										
Numeric		45	41							
Qualitative	49			55			44			75
Inanimate	–61			–58		45	–57			–68
People		–64	–64			–75		–70		
Mode of Learning										
Listening	61			62			48		42	
Reading	60			74		46		56		43
Iconic	–52			–54		–41		–41		
Direct Experience	–61			–72			–62			–62
Variance explained (%)	19	14	19	14	11	21	16	21	16	11

create a response-set bias that could potentially affect the psychometric properties of the instrument. However, the average alpha coefficients of 0.67 (standard) and 0.66 (scrambled) on the first administration and 0.77 and 0.71, respectively, on the second administration seem moderate and do not reach the suggested level of 0.80 for widely used scales (Carmines and Zeller 1979). Additionally, our test-retest results indicate that there was a considerable amount of classification instability, even across a short interval of 4–5 weeks.

The assessment of construct validity (via factor-analysis results) also questions the use of this instrument in accounting education research. The two-factor solutions accounted for a relatively limited proportion of variance (33.5 percent standard and 36.8 percent scrambled). The results provide little support for Canfield's two learning dimensions. Further, the three-factor solutions do not support the three separate learning domains (Conditions for Learning, Area of Interest, and Mode of Learning) nor the purported trade-offs within these domains, as suggested by Canfield. As noted by prior learning style researchers, construct validation using a factor analytic approach may not produce useful results when instruments use ipsative scoring procedures (Geiger et al. 1993; Ruble and Stout 1994).

This study, representing an initial effort to assess the usefulness of the Canfield *LSI* in accounting education, may warrant further empirical study to collaborate our results. Based on our sample we find moderate internal consistency reliability, considerable classification instability, and little support for the espoused two-dimensional learner typology. These results are not in our opinion altogether surprising, given the lack of theoretical support in Canfield's underlying model. In summary, therefore, contrary to the suggestions of Francis et al. (1995), the current study finds little support for the use of the Canfield *LSI* in accounting education research.

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