Ways of Knowing as Learning Styles: Learning MAGIC With a Partner

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Ninety-six pairs of college students, relatively unacquainted with one another were asked to learn a novel and complex fantasy card game in a 50-min video-taped session, using first a scripted set of turns and written explanations of game rules and procedures, then playing until the end of the session or until a clear winner emerged. They then filled out a series of rating scales about their percep-tions of and reactions to the session and their partner. Last, students filled out the Attitudes Toward Thinking and Learning Scale (ATTLS), a survey instru-ment that measures purported stable individual differences in epistemological approaches to learning and knowledge. Significant differences in perception of partners and the learning sessions were correlated with epistemological ap-proach. Moreover, raters blind to students' epistemological approaches rated congeniality of the sessions differentially as function of the approaches of tar-get students. Discrepancies between the partners' epistemological approaches led to differences in their ratings of their enjoyment of the learning session. Connected knowing (CK) and separate knowing (SK) differed as a function of participant's gender, as expected; however, scores were unrelated to any of the performance measures. This suggests once again that epistemological approaches do not affect the amount of learning that occurs, but rather the attitude a learner holds toward the process.

The psychological construct of "style" has received much attention over the last century, especially as it pertains to learning. William James recognized as early as 1890 that there are relatively stable individual differences in how people learn. Jung proposed a theory of personality individualization in 1923 that is closely related to many current theories of learning styles.

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Later work in the 1930s furthered the idea that cognitive processes may be individualized, and soon the construct of "style" was referred to in relation to cognition (Rayner & Riding, 1997). More recent work with the styles construct has produced numerous measures of cognitive style, learning style, and thinking style, and tied them in not only with instructional attitudes, but even vulnerability to depression (Alloy, Abramson, & Francis, 1999).

Unfortunately, there is no clear agreement on what constitutes a style. The large number of studies has led to the development of so many terms to refer to styles and tests to measure them that one term often has a very different meaning depending upon which researcher one asks. Some recent work has attempted to clarify and organize the vast literature on styles (e.g., Rayner & Riding, 1997; Sternberg & Grigorenko, 1997).

Sternberg and Grigorenko (1997) describe three distinct approaches to styles. The first is the "cognition-centered approach." Researchers in this tradition study individual differences in cognition and perception, as measured by various tests of information processing. Cognitive style is treated as a fundamental construct, more or less innate, that is influenced little by environment or socialization.

A second approach to style is referred to as the "personality-centered approach." Adherents to this approach use the term, *learning styles*, and view them as mediators between how a person thinks and how a person acts, given a particular situation (Sternberg & Grigorenko, 1997). Unlike the cognitive-centered approach, the personality-centered approach's concept of learning style is seen as more affected by environment and socialization.

Sternberg and Grigorenko (1997) discuss a third, "activity-centered" approach to styles, but only briefly, as it has received much less empirical investigation. This approach attempts to bridge the gaps between the cognition-centered and personality-centered approaches by way of the activities an individual chooses to engage in. Different activities presumably draw on different cognitive processes, and hold differing appeal for people of different temperaments.

Sternberg and Grigorenko (1997) assert that the concept of styles is an important one for psychology and education, primarily because it serves as an interface between cognition and personality. They therefore propose further investigation of cognitive styles, offering both criteria with which to assess any proposal for styles, as well as their own proposal for a taxonomy of styles.

The "Ways of Knowing" (WOK) framework (Belenky, Clinchy, Golberger, & Tarule, 1986), represents another related proposal. According to this framework, learning occurs in different ways for different people in different situations, and may be affected by the learning styles of others

who are present. Specifically, people are presumed to have different sets of spontaneous orientations to learning and knowledge, and, as a consequence, employ different procedures as they test and refine their own ideas (Clinchy, 1999, personal communication).

Belenky et al. (1986/1997) have proposed that the different ways of knowing are related to gender, although not exclusively. Clinchy describes this proposal as growing from her own observations in the classroom (Clinchy, 1989, 1990, 1995). She reported that her students (almost all females) frequently seemed to approach learning in different ways than did the students of her colleagues at coeducational universities.

An introduction to the WOK framework must begin with Clinchy's own disclaimer about how her research actually began: "We did not expect to find sex differences. We studied women because they were the only gender attending the college where we taught. In its inception, then, our work was 'gender blind'" (Clinchy, 1995, p. 259).

Clinchy (1995) found that many females were often silent in academic situations, especially when those situations were directed by people taking an adversarial stance (1995). According to Clinchy, these students were not silent because they were unable to express themselves; instead, she hypothesized that these students could speak quite eloquently about almost any topic, if given the right environment in which to express themselves.

Clinchy discovered these silent women while investigating their counterparts: women who excelled at "playing the doubting game" (Clinchy, 1989, p. 649). These young women, who tended to look for flaws in whatever was presented to them, were labeled "separate knowers," described as follows:

> The heart of separate knowing is detachment. The separate knower keeps her distance from the object she is trying to analyze. She takes an impersonal stance. She follows certain rules or procedures that will ensure that her judgments are unbiased. All our various disciplines and vocations have these impersonal procedures for analyzing things. (Clinchy, 1989, p. 650)

Separate knowing involves objective, analytical, and detached evaluation of an argument or piece of work. It often takes on an adversarial tone, involving argument, debate, playing devil's advocate, "shooting holes" in another's espoused position, or critical thinking (Clinchy, 1990). Separate knowers attempt to "rigorously exclude" their own feelings and beliefs when evaluating a proposal or idea (Belenky et al., 1986, p. 111).

The other kind of knowing, the one exhibited by many of Clinchy's "silent" students, was termed "connected knowing":

> Connected knowers are not dispassionate unbiased observers. They deliberately bias themselves in favor of the thing they are examining. They try to get right inside it, to form an intimate attachment to it. The heart of connected knowing is imaginative attachment ... The connected knower believes that in order to understand

what a person is saying, one must adopt the person's own terms. One must refrain from judgment. In this sense, connected knowing is uncritical. But it is not unthinking. It is a personal way of thinking, and it involves feeling. (Clinchy, 1989, p. 651)

Connected knowing involves "walking a mile in the shoes" of a person who holds a position that one may initially find alien. Connected knowers place themselves in alliance with another's position, even when it is initially disagreed with. "Instead of looking for what is wrong with the other person's ideas, [connected knowers] look for why it makes sense, how it might be right" (Clinchy, 1989, p. 651). Connected knowers try to look at things from the other's own terms, and try first to understand the other's point of view before evaluating it.

Though the authors explicitly disavowed equating "separate" with "male" and "connected" with female, there was much reason to expect at least some relationship between gender and one's predominant way of knowing. Previous work on epistemological development using a largely male sample (Perry, 1970, 1981) failed to report any evidence of the connected stance toward knowledge and learning; the all-female sample of Belenky et al. (1986/1997) reported finding it frequently. Investigators studying women's responses to moral dilemmas (Gilligan, 1982; Lyons, 1983) reported that women more often than men made moral judgments in terms of personal "care" rather than impersonal "justice," and more often described themselves as connected rather than autonomous in relationships. Baxter Magolda (1992) reported consistent, though not absolute, gender differences in the ways women and men approached the task of learning and understanding.

The ways of knowing proposal raised a plethora of issues, both theoretical and applied. How are different ways of knowing acquired, and how do they operate? Are the two ways of knowing independent or mutually exclusive? Do different ways of knowing correlate with traditionally measured intellectual abilities, or are they independent of them? Are different ways of knowing more like attitudes, coloring the comfort with which knowers approach or immerse themselves in different tasks? Do they correlate with different behaviors during an actual episode of learning?

In a further set of studies, a survey instrument to assess attitudes toward separate and connected knowing was created (Galotti, Clinchy, Ainsworth, Lavin, & Mansfield, 1999). The instrument developed (the Attitudes Toward Thinking and Learning, or ATTLS) showed very good internal reliability (as above .80). In three of four studies conducted with undergraduate participants, scores on the separate knowing (SK) and connected knowing (CK) scales were uncorrelated, supporting the view that the two epistemological

positions are orthogonal. Exploratory factor analyses yielded evidence that the two scales "held together," but were distinct.

This set of studies, which included equal numbers of male and female participants, showed predicted gender differences. Females consistently rated their endorsement of CK statements significantly higher than SK statements, while males showed a slight, but nonsignificant difference favoring SK statements. This result and other results suggest a pronounced difference in the ways males and females respond to the ATTLS.

SK and CK scores were also shown to be independent of nonverbal intelligence test (Raven's Advanced Progressive Matrices) scores, deductive and inductive reasoning, performance, and a recall memory measure of texts created to embody either a SK or CK perspective (Galotti et al., 1999). However, there were a number of statistically significant relationships with different attitudinal measures. For example, CK scores correlated significantly with ratings subjects gave to the purported intelligence of different writers (who embodied either a SK or CK outlook), and CK and SK scores correlated with different descriptions participants gave of "ideal" teachers. Thus, the above results suggested that connected and separate knowing represent different kinds of cognitive or learning styles, not intellectual abilities or capacities. However, previous work only looked at students' performance on abstract ability measures (such as the Raven's Progressive Matrices, a nonverbal IQ test) or their retrospective descriptions of what qualities they liked in a teacher. It did not examine the ways in which separate and connected knowers functioned differently in an actual episode of learning.

The present study attempted to address this issue. We sought a learning task that involved a fair degree of complexity, in an effort to offer a challenging experience. We wanted a task that would be engaging, and for which there existed some sort of measures of performance. At the same time, we did not want the task to seem like a test of intelligence, because we did not want our participants to feel self-conscious or pressured to perform well. We wanted the task chosen to afford enough ambiguity that participants could, if they chose, discuss or debate with each other in order to clarify interpretations. We avoided traditional academic tasks (such as mathematical or logic problems, or interpretation or translation of literature), because there would be no way to control for individual differences in background knowledge.

In the course of searching for a task to fit the above desiderata, we discovered a commercially available fantasy card game Magic: The Gathering (1997). This task simulates a learning environment in which other learners can be seen either as adversaries playing a game, or partners in learning.

Moreover, one version of this particular game contains a special feature: instructions that take novice players through five scripted turns that introduce them to the rules before allowing them to begin playing on their own. This script allows experimental control over the initial presentation of information to participants.

Although this task is not, superficially, similar to traditional academic tasks, we believe that the complexity of the game mirrors academic learning in essential respects. There are various kinds of cards, each of which functions differently in the game. Land cards give a player energy that in turn allow creature cards to be put into play, or sorcery cards to be used. Creatures can be used either as attackers or defenders, and each one (there are hundreds) possesses different characteristics and abilities. Cards (land, creature, and sorcery) are also of different color types, which affects when each can be played. The official rule book of the game is 26 pages long. Our undergraduate participants showed consistent evidence of finding it difficult to completely master all of the rules in the single session.

Fifty-minute learning sessions were videotaped (with the participants' knowledge and consent) for later coding and analysis. Moreover, immediately after the session, participants independently filled out a survey instrument describing their reactions to the session and their partner, and also filled out the ATTLS.

We tested four hypotheses in this study. They were

Hypothesis 1: Gender Differences in SK and CK Scores. We hypothesized that males would generally score higher on SK scales than females would, while females would score highest on CK scales. This result would provide a replication of those reported by Galotti et al. (1999).

Hypothesis 2: Lack of Performance Correlates of CK and SK Scores. We did not expect CK or SK scores to correlate with measures of performance in the game. This expectation grew out of the previous findings that CK and SK scores were uncorrelated with measures of ability of basic cognitive processes such as reasoning.

Hypothesis 3: Attitudinal and Behavioral Correlates of CK and SK Scores. We did expect, however, that those individuals who scored high on SK scales would be more adversarial, competitive, and critical than others during the learning session, while those scoring high on CK would be expected to be more cooperative, supportive, and empathic than others.

Hypothesis 4: Effects of Similarity of Partners' Learning Styles. Finally, we predicted that pairs of students with similar WOK scores would learn more, and enjoy the session more, than would pairs of students with dissimilar WOK scores. Presumably, being paired with a like-minded partner reduces conflict, provides more support for one's own learning style, and

allows emotional energy to be focussed on the learning of the task at hand.

METHOD

Participants

Participants were students at Carleton College in rural southeastern Minnesota. Carleton enrolls approximately 1850 students, with approximately even numbers of men and women, and a minority enrollment slightly above 15%. Students come from a variety of socioeconomic classes, with over 50% receiving some sort of financial assistance (grants, loans, work-study jobs, etc.) from the College. All students are candidates for a bachelor of arts degree.

One hundred ninety-two students (96 male, 96 female), with a fairly even distribution of participants across class years, and who did not know the game *Magic* (1977) participated. Although race/ethnicity was not specifically recorded, participants were drawn from a population that is primarily Caucasian and middle class. US News and World Report (2000) reports, for example, that Carleton College enrolls about 17% of the student body drawn from racial and ethnic minorities. Participants were assigned to pairs in one of three conditions: male–male, female–female (each with 24 pairs), or male–female (48 pairs). These conditions were chosen to highlight the predicted aspects of Ways of Knowing (WOK) that are related to gender, as demonstrated in previous research (e.g., Galotti et al. 1999). Participants learned the game with someone whom they did not know well in a single 1-h session. Each participant received either five dollars or a movie rental gift certificate for taking part in the study.

Materials and Procedure

The primary materials used in the present experiment included game playmats, cards, a specially-constructed sheet that summarized procedures to be followed during a player's turn in the game (called the "Turns" sheet), and a *Play Guide* from the fantasy/role-playing game *Magic: The Gathering Portal Version* (1997). In addition, a video camera mounted upon a tripod was used to tape each experimental session.

When both participants arrived at the session, the experimenter introduced the two players to each other and told them that they would be learning the game *Magic* together. Participants were informed they would begin by playing a scripted game of *Magic* (described in the *Play Guide*,

1997), during which they would read the instructions aloud and pass the *Play Guide* back and forth as each took his or her turn. One participant was designated "Player A" and the other "Player B," depending on which deck of cards each participant had (this was predetermined and assigned to counterbalance for gender).

Participants first completed the scripted section of the game, which included five rounds of turns. Then, participants continued playing on their own, and were encouraged to either ask questions of one another or, consult the *Play Guide* or Turns sheet as issues of interpretation arose, or both. Participants were explicitly encouraged to work out questions about the game or the rules with their partner, rather than asking the experimenter.

Each game was videotaped. In many of the sessions, the participants did not finish the actual game (i.e., neither player reduced his or her opponent's "life total" to zero lives or less during the unscripted portion of the game). The experimenter gave the participants a total of approximately 50 min to complete as much of both the scripted and unscripted sections of the game as possible. The experimenter stopped the game and the videotaping after Player B had completed his or her turn (so both players completed the same number of turns), or until a total of 55 min had elapsed, whichever came first. After the game was completed or stopped, participants were asked to leave all of the cards in play on the table. The experimenter recorded a number of pieces of information about the players' "life totals" and amounts of "offense" and "defense" (each "creature" card in *Magic* indicates the strength of the creature with values for both offense and defense). The experimenter also recorded the names of all the cards "in play" (this did not include cards that were in the players' hands or discard piles).

While the experimenter recorded this information, participants filled out two written assessments. The first was a 35-item self-report questionnaire. This questionnaire included 32 Likert-scaled items assessing enjoyment, mastery, and competition/cooperation between players in relation to the game. In addition, it included three open-ended items designed to allow for elaboration of themes from some of the scaled questions. Next, each participant filled out a modified version of the Attitudes Toward Thinking and Learning Survey (ATTLS, Galotti et al., 1999), which consisted of 20 self-report Likert-scaled items which assessed agreement with prototypical "separate knower" and "connected knower" statements. After completing these two assessments, each participant was given a "debriefing sheet" explaining the purpose of the study.

Actual behaviors during the learning sessions were coded from the videotapes. The three authors independently watched videotapes of the first 40 sessions, making independent ratings of the overall cooperativeness of the players, as well as the following

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aspects exhibited by the target participant: comfortableness, confidence, tendency to apologize, tendency to be controlling, interest in the other player, degree of task-orientation, argumentativeness, collaborativeness, patience, competitiveness, receptiveness, and tendency to gloat, on 9-point Likert scales, ranging from 1 (*not at all*) to 9 (*completely*).

RESULTS

We organize this section according to the hypotheses presented earlier, for clarity of exposition. For all analyses, we randomly selected one student from each pair as a target participant, with the restriction that an approximately equal number of males and females were chosen. Only data from target participants is included in the analyses below, to avoid unwanted statistical dependencies.[2]

Hypothesis 1: Gender Differences in SK and CK Scores

We first calculated internal reliabilities using coefficient alpha for both SK and CK scales. Both were acceptable (.82 for the CK scale, .81 for the SK scale). CK and SK scores were not significantly correlated ($r[94] = -.13, ns$).

A 2 (gender) $\times$ 2 (type of score, CK or SK) mixed ANOVA with repeated measures on the second factor indicated a main effect of type of score. Mean CK scores ($M = 53.80$) were reliably higher than mean SK scores ($M = 43.15; F[1, 94] = 61.62, p < .001, MSE = 86.76$). However, this result must be interpreted in light of a significant two-way interaction between gender and type of score; $F[1, 94] = 11.69, p < .001, MSE = 86.76$. For CK scores, the means were 56.36 for females and 51.13 for males; the corresponding means for SK scores were 41.20 and 45.17. Post hoc Newman-Keuls tests showed all pairs of means differed. Thus, supporting hypothesis 1, males did have significantly higher SK scores than did females; the reverse pattern held for females with CK scores.

Hypothesis 2: Lack of Performance Correlates of CK and SK Scores

CK and SK scores have previously been shown to be unrelated to nonverbal IQ scores or formal reasoning performance (Galotti et al., 1999). Therefore, we did not expect them to correlate significantly with performance measures of this on-line learning task either. To test this hypothesis, we used various measures of game performance.

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the sessions and overall congeniality of the players,

We had four such measures. One was a player's "life total," the primary measure of game achievement. Winning the game was defined as a player reducing her or his partner's life total to zero. Because not all games were completed within the 50-min session, we recorded three other "process" measures of game performance: life-total discrepancy, the difference between the target player's life total and that of her or his partner, the "offense total" of all the creature cards in play at the end of the game for the target participant, and the "defense total" of all the creature cards in play for the target participant at the conclusion of the session. None of these four measures correlated significantly with either CK or SK scores (range, $-.12$ to $+.17$, ns, median correlation = .025). Thus, hypothesis 2 was also supported.

Hypothesis 3: Attitudinal and Behavioral Correlates of CK and SK Scores

Recall that we had predicted that those individuals who scored high on SK scales would be more adversarial, competitive, and critical than others, while those scoring high on CK would be expected to be more cooperative, supportive, and empathic than others. To test these hypotheses, we first examined the correlations of CK and SK scores with the 32-Likert ratings given in the post-game portion of the session.[3] Table I presents these correlations. Of the 32 correlations with CK scores, seven were statistically significant; of the 32 correlations with SK scores, three were statistically significant.

In general, CK scores correlated with items having to do with perception of the session as enjoyable, the person they were working with as a partner rather than an opponent, and a willingness to ask questions and build on the ideas of the partner. All of these are consistent with the definition of connected knowing, which stresses looking for "what is right" in another person's ideas, and emphasizing understanding over debating.

SK scores, in contrast, correlated with evaluation of the effectiveness of the learning of the person the participant worked with, consistent with the description of separate knowing being a detached, critical stance.

We also analyzed the data from ratings of behaviors that occurred during the sessions. Interrater reliabilities (computed with coefficient α) ranged from .44 to .99, median = .69 over the 14 ratings made independently by the three authors. These reliabilities are presented in Table II. The remaining videos were viewed and coded by the first author; her ratings are used in the analyses that follow. All raters were blind to the SK and CK score of the participants at the time they made the ratings.

[3] For the latter 56 sessions, two additional questions were added to the instrument. These are identified as questions 17 and 18 in Table I. For these items, correlations are based on 56 data pairs; for all other items, correlations are based on 96 pairs.

Table I. Correlations Between SK and CK Scores and Self-Report Questionnaire Items

SK scores	CK scores	Questionnaire item
-.02	.10	1. How much did you enjoy learning *Magic*?
-.03	-.02	2. How effectively do you think you learned *Magic*?
-.07	.12	3. How enjoyable was it for you to learn *Magic* with the person you were paired with?
-.05	.05	4. How much did you consult the written "Turns" instructions after the scripted part of your game of *Magic*?
-.17†	.01	5. How helpful to you was completing an actual game (after the scripted part) in learning *Magic*?
-.09	.14	6. How much did the person you were paired with enjoy learning *Magic*?
-.06	.20*	7. How enjoyable was it for the person you were paired with to learn *Magic* with you?
-.20*	-.00	8. How effectively do you think the person you were paired with learned *Magic*?
-.00	.03	9. How often did the person you were paired with consult the written "Turns" instructions after the scripted part of your game of *Magic*?
-.22*	.07	10. How helpful to the person you were paired with was completing an actual game (after the scripted part) in learning *Magic*?
-.11	.09	11. Overall, how well do you think you cooperated with the person you were paired with to learn *Magic*?
-.05	.10	12. Overall, how well do you think the person you were paired with cooperated with you to learn *Magic*?
-.05	.45***	13. To what extent did you see the person you were paired with as a partner in learning *Magic*?
-.13	-.27**	14. To what extent did you see the person you were paired with as an opponent in learning *Magic*?
-.06	.44***	15. To what extent did the person you were paired with see you as a partner in learning *Magic*?
-.25*	-.14	16. To what extent did the person you were paired with see you as an opponent in learning *Magic*?
-.11	-.02	17. To what extent did you engage your partner in conversation (unrelated to the game of *Magic*)?
-.07	-.06	18. To what extent did the person you were paired with engage you in conversation (unrelated to the game of *Magic*)?
.07	.32**	19. To what extent did you offer ideas/suggestions about how to play to the person you were paired with while learning *Magic*?
.03	.16	20. To what extent did the person you were paired with offer you ideas/suggestions about how to play while learning *Magic*?
-.10	.03	21. How well do you feel you know the person you were paired with after learning *Magic*?
-.09	.04	22. How well do you think the person you were paired with knows you after learning *Magic*?
-.08	-.01	23. To what extent did you challenge the views of the person you were paired with?
-.17†	.01	24. To what extent did the person you were paired with challenge your views?

(Continued)

Table I. (*Continued*)

SK scores	CK scores	Questionnaire item
-.10	.09	25. To what extent did you ask the person you were paired with questions about the game after completing the scripted part of *Magic?*
-.06	.17	26. To what extent did the person you were paired with ask you questions about the game after completing the scripted part of *Magic?*
.00	.28**	27. To what extent did you try to build on the ideas/suggestions offered by the person you were paired with?
.12	.32***	28. To what extent did the person you were paired with try to build on ideas/suggestions you offered while learning *Magic?*
-.07	.00	29. To what extent did you argue with the person you were paired with while learning *Magic?*
-.02	.01	30. To what extent did the person you were paired with argue with you while learning *Magic?*
-.10	-.04	31. To what extent did you try to find out what the person you were paired with was thinking as you learned *Magic?*
-.03	-.04	32. To what extent did the person you were paired with try to find out what you were thinking as you learned *Magic?*
.05	-.11	33. To what degree were you alert while playing *Magic,* watching for mistakes?
-.01	.01	34. To what degree was the person you were paired with alert while playing *Magic,* watching for mistakes?

Note. $^†p < .10.$ $^*p < .05.$ $^{**}p < .01.$ $^{***}p < .001.$

We computed correlations among the 14 ratings and CK and SK scores. Five of the 14 ratings correlated significantly with CK scores; none of the 14 ratings correlated significantly with SK scores. Table II presents these correlations. CK scores of the target participant were correlated with over-all rated session cooperativeness and the congeniality of the players to each other. Moreover, CK scores correlated significantly with the rated recep-tivity of the target participant, as well as with the rated interest the target participant showed in the partner. Finally, CK scores correlated negatively with the target participant's rated argumentativeness.

With both the attitudinal and behavioral data, then, there is evidence that CK scores have clear correlates. In contrast, there are no behavioral correlates, and very few attitudinal correlates, of SK scores. Thus, support for our third hypothesis was mixed.

Hypothesis 4: Effects of Similarity of Partners' Learning Styles

We predicted that pairs of students with similar WOK scores would perform better and enjoy the task more. We believed that similarity of SK and CK scores might reduce stress during learning as well as offer a more congenial learning environment.

Table II. Correlations Between SK and CK Scores and Behavioral Ratings From Videotapes

$α^a$	Rated dimension[b]	r with CK	r with SK
.58	Comfortable	-.05	.09
.79	Confident	-.12	.16
.45	Apologetic	.07	-.03
.82	Controlling	-.16	.15
.44	Interested in other player	.20*	-.15
.74	Task-oriented	.16	.05
.65	Argumentative	-.24*	.04
.54	Collaborative	.14	.10
.76	Patient	.14	-.01
.78	Competitive	-.10	-.04
.69	Receptive	.23*	-.02
.90	Gloating	-.01	-.13
.99	Session was cooperative overall	.28**	-.08
.66	Players were congenial to each other	.26**	-.09

[a] Interrater reliability, computed with coefficient α, over the first 40 videotapes.
[b] Except for the last two dimensions, ratings were done on the target participant. The last two ratings were made on the overall behavior and interaction of both participants.
$^†p < .10.$ $^*p < .05.$ $^{**}p < .01.$ $^{***}p < .001.$

To test this hypothesis, we first created measures of similarity of SK scores, similarity of CK scores, and overall similarity of SK and CK scores. These were computed as the absolute value of the difference of the partners' SK scores, the absolute value of the difference of the partners' CK scores, and the sum of these two discrepancy scores, respectively. For ease of reference, we will call these SK discrepancy scores, CK discrepancy scores, and total discrepancy scores.

We first looked at correlations of the three discrepancy scores with measures of game performance, including life total, life total discrepancy, offense total, and defense total. None were statistically significant. Thus, the similarity of WOK scores did not seem to be associated with either improved or decreased game performance. Similarly, when we correlated the three discrepancy scores with the behavioral ratings shown in Table II, none were statistically significant except one: the rated interest the target player showed in her/his partner was correlated with the SK discrepancy score, $r(94) = .21, p < .05.$

We next looked at correlations of the 3 discrepancy scores with attitudi-nal measures, specifically the ratings from the items shown in Table I. Here, seven of the 34 ratings were significantly correlated with total discrepancy score, and six of the 34 ratings were correlated with CK discrepancy scores. Only 2 of the 34 ratings were correlated with SK discrepancy scores. Table III presents these correlations.

Table III. Correlations Between Discrepancy Scores and Self-Report Questionnaire Items

Total discrepancy	CK discrepancy	SK discrepancy	Questionnaire item
.06	.03	.05	1. How much did you enjoy learning *Magic?*
.11	.15	.01	2. How effectively do you think you learned *Magic?*
.02	−.04	.05	3. How enjoyable was it for you to learn *Magic* with the person you were paired with?
.07	−.03	.11	4. How much did you consult the written "Turns" instructions after the scripted part of your game of *Magic?*
.05	.02	.05	5. How helpful to you was completing an actual game (after the scripted part) in learning *Magic?*
−.02	−.04	.01	6. How much did the person you were paired with enjoy learning *Magic?*
−.02	−.19†	.13	7. How enjoyable was it for the person you were paired with to learn *Magic* with you?
−.08	−.01	−.10	8. How effectively do you think the person you were paired with learned *Magic?*
.05	−.02	.08	9. How often did the person you were paired with consult the written "Turns" instructions after the scripted part of your game of *Magic?*
.06	.05	.04	10. How helpful to the person you were paired with was completing an actual game (after the scripted part) in learning *Magic?*
.03	−.13	.15	11. Overall, how well do you think you cooperated with the person you were paired with to learn *Magic?*
.01	−.05	.05	12. Overall, how well do you think the person you were paired with cooperated with you to learn *Magic?*
−.22*	−.25*	−.07	13. To what extent did you see the person you were paired with as a partner in learning *Magic?*
.25*	.26**	.10	14. To what extent did you see the person you were paired with as an opponent in learning *Magic?*
−.25*	−.25*	−.10	15. To what extent did the person you were paired with see you as a partner in learning *Magic?*
.19†	.13	.13	16. To what extent did the person you were paired with see you as an opponent in learning *Magic?*
−.01	−.04	.02	17. To what extent did you engage your partner in conversation (unrelated to the game of *Magic*)?
.05	−.01	.07	18. To what extent did the person you were paired with engage you in conversation (unrelated to the game of *Magic*)?
−.12	−.21*	.02	19. To what extent did you offer ideas/suggestions about how to play to the person you were paired with while learning *Magic?*
−.22*	−.15	−.16	20. To what extent did the person you were paired with offer you ideas/suggestions about how to play while learning *Magic?*
−.01	−.13	.09	21. How well do you feel you know the person you were paired with after learning *Magic?*
−.01	−.13	.10	22. How well do you think the person you were paired with knows you after learning *Magic?*
.16	.07	.14	23. To what extent did you challenge the views of the person you were paired with?
.03	−.05	.08	24. To what extent did the person you were paired with challenge your views?
−.25*	−.09	−.24*	25. To what extent did you ask the person you were paired with questions about the game after completing the scripted part of *Magic?*
−.05	−.04	−.03	26. To what extent did the person you were paired with ask you questions about the game after completing the scripted part of *Magic?*
−.27**	−.17†	−.20†	27. To what extent did you try to build on the ideas/suggestions offered by the person you were paired with?
−.19†	−.19†	−.08	28. To what extent did the person you were paired with try to build on ideas/suggestions you offered while learning *Magic?*
.01	−.15	.14	29. To what extent did you argue with the person you were paired with while learning *Magic?*
−.04	−.15	.08	30. To what extent did the person you were paired with argue with you while learning *Magic?*
.02	−.06	.08	31. To what extent did you try to find out what the person you were paired with was thinking as you learned *Magic?*
−.02	−.10	.06	32. To what extent did the person you were paired with try to find out what you were thinking as you learned *Magic?*
.32**	.28**	.17†	33. To what degree were you alert while playing *Magic*, watching for mistakes?
.07	.13	−.01	34. To what degree was the person you were paired with alert while playing *Magic*, watching for mistakes?

Note. † $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

In general, discrepancy scores, especially CK discrepancy scores, were associated with a lowered likelihood of seeing the other participant as a partner or perceiving the other person as seeing the self as a partner, and a greater likelihood of seeing the other person as an opponent. Perhaps relatedly, discrepancy scores were associated with a lower reported tendency to offer one another suggestions or ideas, or to ask questions of the other person

during the session. Discrepancy scores were also moderately associated with reports of vigilance during the session, watching for mistakes.

DISCUSSION

Our first set of results provide replication of the ATTLS instrument (Galotti et al., 1999), showing the predicted gender differences. They also provide further evidence that the CK and SK scores are unrelated to ability, as neither they nor any of the discrepancy measures correlate with measures of game performance, which we take to be indirect measures of amount learned during the session.

Results from the attitudinal and behavioral measures provide further, and we think, stronger, validation of the CK and SK scores. The existence of significant and moderately strong correlations suggests that especially CK scores are associated with distinct observable behaviors and specific attitudes toward the learning session.

Students with higher CK scores reported perceiving the session as more enjoyable, perceived the other participant as a partner rather than as an opponent, and report themselves and their partners as being more willing to build on one another's ideas. Moreover, raters blind to students' WOK scores rated those sessions with a target participant with a higher CK score as both more cooperative and more congenial in tone. Additionally, raters saw target participants with higher CK scores as less argumentative and more interested in their partners. Clearly, these results are quite consistent with the description of connected knowing as being about attempting to understand another's viewpoint and to collaborate in learning, rather than to adopt an "adversarial stance" while acquiring new knowledge.

Students with higher SK scores showed fewer correlations with the attitudinal ratings, but did show a tendency to evaluate their partners more critically. Fewer of the predicted relationships with SK scores emerged in the results, however. For example, players with higher SK scores did not report themselves as being more likely to challenge or to argue; nor were they seen this way by raters.

Previous work as well showed SK scores to be less potent predictors of behavior or attitudes (Galotti et al., 1999). One possible explanation for this pattern of results is that separate knowing is the expected "norm" at academically rigorous institutions such as Carleton College. Thus, SK scores may not mark a distinctive epistemological style in this environment as much as CK scores do. Obviously, this speculation awaits further and more direct testing.

Discrepancies in WOK scores did not appear to impede learning or affect performance. However, they did seem to make the sessions less enjoyable. Partners with different ways of knowing, particularly with discrepant CK

scores, were less likely to ask each other questions or build on one another's ideas. Moreover, discrepancy scores were associated with a reported tendency to be alert for mistakes.

Of course, generalizing from these results must be done with considerable caution. MAGIC, after all, is a game as opposed to an academic task. The content of the game, including the fantasy setting, the florid creatures depicted in baroque artwork on cards, the spells and attacks appeared to some participants to be "hokey," which may have compromised the seriousness with which the participants approached the task.

On the other hand, the game did require learning a great number of rules, distinctions, and categories. Thus, novices to the game (such as the authors, at the beginning of the project) needed to work hard to understand how to interpret the rules, implement strategies, and remember and apply the relevant analogies while playing. That is, the game was complex and required a fair amount of active cognitive processing, which all of the participants appeared to engage in. Moreover, the fact that participants were not paired with their friends, and that they knew they were being videotaped, seemed to have boosted their motivation to perform at least at a credible level.

The population studied also must be borne in mind. The students here all came from a liberal arts college in a rural Minnesota town. The distribution and correlates of separate and connected knowing scores in other populations is, therefore, a question for further research.

Lastly, the finding that CK and SK scores correlate with attitudes but not performance, has implications worthy of further study. The lack of correlation with game performance seems to indicate a lack of association with amount learned (at least to a first approximation). Thus, one might be tempted to dismiss the importance of CK and SK and their effects on learning.

However, the effects of attitudes toward learning environments should not be dismissed too lightly. High school and college students have increasing autonomy over what courses they enroll in, and consequently, what types of learning experiences they have. If certain schools, disciplines, courses, or instructors set up situations that make students with some learning styles uncomfortable, they may in fact all but close the door on those students' further study in that area. Again, this speculation goes far beyond our findings and must be the focus of future study.

For the present, we argue that this work presents evidence that differences in CK and SK scores do produce different behaviors during an actual episode of learning, and do result in different descriptions of, and reactions to, that session. Left to explore is how widely these findings generalize to other learning sessions, other student populations, and what the

relationships are between comfort during a single episode of learning and students' proclivities to continue their studies in that domain.

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Use of Social Support: Gender and Personality Differences

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Sex differences in social support have been explained in terms of gender differences in socialization and personality. The current research focused directly on the link between social support and gender variables. An adult, largely Caucasian sample of both sexes reported an experience in which they had received support, and were assessed on masculinity, femininity, nurturance, affiliation, autonomy, and self-confidence. The results revealed that gender, but not sex, was significantly correlated with patterns of social support. Femininity (in both sexes) was associated with seeking and receiving emotional support, and with seeking and receiving support from women. Masculinity (in both sexes) was linked only with receiving tangible support. These findings argue for the significance of femininity in promoting a more social form of well-being, and underscore the importance of studying gender directly rather than relying on sex as a proxy variable.

Satisfaction with social relationships is an important contributor to general experiences of well-being. Unsatisfactory relationships, as well as social isolation and loneliness, are predictors of such negative outcomes as poor physical health and various forms of mental illness. One of the benefits of relationships is social support, which provides people with increased feelings of belonging and assistance from others. In order to optimize well-being, we need to understand how people deal with social support—how they seek it, how they are able to receive it, and how they utilize it.

There are several factors that make this task especially complex. First, support can take several different forms: emotional support; social

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