Ways of Knowing and Appraisals of Intellectual Activities

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This study explored implications of individual differences in epistemological approaches to knowledge and learning. We examine the relationship between "separate" and "connected" ways of knowing and assessments of how enjoyable and how important different intellectual activities are. In Study 1, undergraduates ($n = 108$) completed the Attitudes Toward Learning and Thinking Survey (ATTLS) and a new instrument, the Intellectual Activities Ratings (IAR) survey, listing 12 intellectual activities, including both academic tasks, such as "writing a proof of a theorem," and nonacademic tasks, such as "keeping a personal journal." Study 2 was conducted online with a larger sample ($n = 200$) of undergraduates from across the United States, with the same 12 IAR tasks but expanding the number of ratings of each task. Study 3 also was conducted online, again with a sample of 200, correlating ATTLS scores with various ratings of ongoing learning tasks: acquiring knowledge of different aspects of a new location-based augmented reality game, *Pokémon Go*. Our results replicated previous findings of gender differences in separate knowing (SK) and connected knowing (CK) scores in all three studies. SK and CK scores showed different and strong patterns of correlation with individuals' enjoyment ratings of academic and extracurricular tasks and with different aspects of learning the augmented reality game. Moreover, SK and CK scores showed different patterns of correlation with how important students perceived different intellectual tasks to be in their own self-definition.

KEYWORDS: epistemological development, epistemological styles, college students, ways of knowing, *Pokémon Go*

If you ask college students about their learning experiences (how they learn, what they enjoy learning, what learning experiences have been most significant to them) you are sure to elicit strongly held opinions and beliefs. Some of these beliefs, for example, that they learn best when taught according to a personal "learning style," have been shown to be ill-founded (Kirschner, 2017; Kirschner & van Merriënboer, 2013; Pashler, McDaniel, Rohrer, & Bjork; 2008).

Although beliefs about learning may not be good predictors of learning efficacy, they may nonetheless predict other educationally relevant behaviors. For example, even if learning beliefs and preferences do not predict learning mastery or outcomes, they could still predict peoples' choices of which learning activities or experiences to engage in.

In the studies reported here, we ask whether different learning preferences correspond to individuals' affective reactions to various intellectual tasks and

their view of whether those tasks are important to their self-conception. We believe that it is important to examine whether preferences predict liking and centrality of self-definition of different intellectual activities. High school and college students have increasing amounts of choice over the learning experiences they have, by virtue of the courses they select and the extracurricular activities they take on. If learning preferences predict affective reactions, and affective reactions are an element of decisions, understanding their relationships becomes important to understanding real-life decision making.

The proposal for the kind of learning preference we studied comes from literature on epistemological positions. Belenky, Clinchy, Goldberger, and Tarule (1986/1997) defined a *way of knowing* as an orientation to learning and knowledge that feels natural. They described different stages or phases of ways of knowing, but we will focus here on procedural knowing, a phase common to college students, which entails developing and honoring one's own procedures for acquiring, validating, and evaluating knowledge claims (Goldberger, Tarule, Clinchy, & Belenky, 1996, p. 5). Within the phase of procedural knowing, these authors defined two categories. One was called "separate knowing (SK)," which is "characterized by a distanced, skeptical, and impartial stance toward that which one is trying to know" (Goldberger et al., 1996, p. 5). Clinchy (1989) described this stance more elaborately:

> The heart of separate knowers 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)

The second category of procedural knowledge is called "connected knowing (CK)," characterized by "a stance of belief and an entering into the place of the other person or the idea that one is trying to know" (Goldberger et al., 1996, p. 5). Or, as Clinchy (1989) put it,

> 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)

Using statements from the original publications on *Women's Ways of Knowing* (Belenky et al., 1986/1997; Clinchy, 1989, 1990) and the first survey instrument for measuring SK and CK by Knight, Elfenbein, and Messina (1995), Galotti, Clinchy, Ainsworth, Lavin, and Mansfield (1999) devised the Attitudes Toward Thinking and Learning Scale (ATTLS). This survey is made up of 20 statements equally divided between those exemplifying SK and those exemplifying CK, to be rated on a 7-point Likert scale.

Although Belenky et al. (1986/1997) stopped short of equating CK with "feminine" and SK with "masculine," several studies have found significant gender correlations that point to men having higher SK scores and women having higher CK scores, with women often having significantly higher CK scores than SK scores (Galotti et al., 1999; Galotti, Drebus, & Reimer, 2001; Schommer-Aikins & Easter, 2008). This gender difference has been shown to emerge especially strongly in conditions where gender is made salient (Ryan & David, 2003).

Previous work has shown that ways of knowing predict affective reactions to experiences, either from the immediate past or considered hypothetically. For example, when learning to play the fantasy card game *Magic: The Gathering* (1997) with a partner they did not previously know well, participants with high CK scores tended to be more cooperative and congenial in tone, as rated by researchers blind to scores who watched videotapes of the interaction (Galotti et al., 2001). Being paired with a partner with very different SK and CK scores did not seem to detract from the amount of learning that took place (as measured by several game-related performance indices), but participants were less likely to engage with one another, exchange questions about the game, and build on one another's ideas unless their partners' scores were close to their own. Additionally, participants reported lower levels of enjoyment when learning occurred with a partner with different ways of knowing.

Similarly, differences in epistemological positions appear to predict students' attitudes toward different modes of learning. Schommer-Aikins and Easter (2008) demonstrated that SK scores correlated with differences in self-reported study strategies. Students who reported difficulty selecting the main idea from a reading or fully concentrating while studying tended to have lower SK scores. In a different study, both CK and SK scores correlated with a greater willingness to argue and to describe "argument" as a constructive form of communication (Schommer-Aikins & Easter, 2009). Students with low SK scores, in contrast, saw "argument" as a destructive emotional battle. Schommer-Aikins and Easter argued that this negative perspective could pose a barrier for engaging students in classroom activities and in critical thinking.

STUDY 1

The first study sought to extend the findings that SK and CK may predict the level of enjoyment for different tasks, beyond a person's willingness to argue, capacity to concentrate, or enjoyment of learning a new game. A wide-ranging list of intellectual activities, both classroom-based and outside formal learning environments, was compiled into a new scale we have titled the Intellectual Activities Ratings (IAR) instrument. We chose items we believed would appeal selectively to separate knowers and selectively to connected knowers based on readings of Belenky et al.'s (1986/1997) and Clinchy's (1989, 1990) writings on these distinct forms of procedural knowing.

In this study, we concentrated on two distinct affective/descriptive reactions to the 12 different intellectual tasks. The first was the degree to which a participant reported enjoying working on a particular task. The second was how central to their view of themselves they felt their performance on a particular task to be in order to distinguish between tasks that a participant felt to be important to their self-identity, independent of whether or not they enjoyed it. Thus, the IAR elicited two ratings for each of 12 distinct tasks.

METHOD

Participants

Participants in this study were students at Carleton College, a small liberal arts institution in southeastern Minnesota. One hundred eight Carleton students in their sophomore and senior years participated. The participants were evenly distributed across genders and class years (27 sophomore men, 27 sophomore women, 27 senior men, 27 senior women). The approximate age range of participants was 18–22 years old. We did not solicit the racial or ethnic identity of participants. However, among the Carleton student body at large, 22% identify as students of color (Anthony, 2012). To remunerate participants for their time and participation, each received $3 at the completion of the session.

Materials

Each participant was asked to complete two questionnaires: the ATTLS (Galotti et al., 1999) and the IAR survey, developed for this project. The ATTLS includes 20 statements, with 10 statements exemplifying CK (e.g., "I can obtain insight into opinions that differ from mine through empathy") and 10 statements measuring SK (e.g., "I value the use of logic and reason over the incorporation of my own concerns when solving problems"). Participants were instructed to rate the degree to which they agreed with each statement on a Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Of the 12 intellectual activities listed in the IAR, 6 are intellectual activities engaged for or within academic courses (e.g., "Advocating for a specific policy recommendation in a paper," "Discussing a personal experience in a class"), and six are fundamentally extracurricular intellectual activities (e.g., "Competing in a trivia tournament," "Traveling to a new country and living with a host family"). Six of these (three academic and three nonacademic) were written to appeal to people with high SK scores, the remaining six for people with high CK scores. Participants were instructed to rate each item according to two separate queries: "How much would you enjoy working on this task?" and "How central to your view of yourself would your performance on this task be?" on a 7-point Likert scale from 1 (*not at all*) to 7 (*completely*). The individual items of the IAR are presented in Table 1.[1]

Procedure

Nine undergraduate research assistants each recruited 12 participants (6 sophomores and 6 seniors), evenly split between male and female. The order of administration of the ATTLS and IAR was counterbalanced across participants. Participants were run individually, and no time limit was imposed. Most participants took 15 min or less to complete both instruments.

TABLE 1. Items Rated on the IAR Survey

Tasks appealing to separate knowing

Academic tasks

Writing a proof of a theorem

Anonymously editing a paper for grammaticality for a class assignment

Advocating for a specific policy recommendation in a paper

Nonacademic tasks

Participating on a debate team

Competing in a trivia tournament

Writing a letter to the editor critiquing a previously published article

Tasks appealing to connected knowing

Academic tasks

Leading a small study group of classmates to prepare for test

Collaborating on a skit with two other people for a class

Reading course assignment about the structure of a different culture

Nonacademic tasks

Traveling to a new country and living with a host family

Sharing a personal reaction to a play with the close friend

Keeping a personal journal

TABLE 2. Correlations Between CK and SK Scores and Ratings of IAR Tasks, Study 1

	Academic tasks		Nonacademic tasks	
	CK score	SK score	CK score	SK score
Enjoyment rating				
CK appeal	0.41***	−0.05	0.57***	−0.11
SK appeal	−0.03	0.27**	0.17	0.33*
Centrality rating				
CK appeal	0.30**	−0.03	0.45***	−0.07
SK appeal	0.19*	0.29**	0.11	0.17+

+p < .10. *p < .05. **p < .01. ***p < .001.

RESULTS

We first examined the internal reliability of the SK and CK subscales of the ATTLS using coefficient alpha. Overall, the internal reliability was .79 for CK and .74 for SK, values very similar to those previously reported in our studies and those by others (Galotti et al., 1999, 2001, Schommer-Aikins & Easter, 2009). CK and SK scores were computed by summing the ratings for each of the 12 items pertaining to the scale, yielding a possible range of 10 to 70. CK and SK scores were significantly and negatively correlated, $r(106) = -.26, p < .01$.

A 2 (gender) × 2 (year in school) × 2 (order of survey administration) × 2 (score: CK, SK) mixed ANOVA, with repeated measures on the last factor, was run on scores. It yielded no significant main effects on any of the between-subject factors but a main effect for score, with CK scores ($M = 54.21$) significantly higher than SK scores ($M = 45.72$), $F(1, 100) = 52.69, p < .001, MSE = 73.60, \eta^2 = .24$. This effect was moderated by a significant two-way interaction between gender and score. Men demonstrated a smaller difference between CK and SK scores ($Ms = 53.14$ vs. 48.05) than did women ($Ms = 55.26$ vs. 43.40), $F(1, 100) = 8.40, p < .01, MSE = 73.60, \eta^2 = .05$.

We next examined the internal reliability of the ratings for CK-appealing and SK-appealing tasks of the IAR using coefficient alpha. In computing these values, we used both ratings (enjoyment and centrality) for all six CK-appealing tasks and all six SK-appealing tasks. The overall alphas were .75 and .63, respectively. Overall means and standard deviations (in parentheses) for these variables were 4.73 (.87) and 3.88 (.79) respectively.

We next correlated SK and CK scores with mean ratings for IAR items. These correlations are presented in Table 2. It shows that all four of the CK-appealing tasks showed significant and moderate to substantial correlations with CK scores, and none with SK scores, and three (out of four) of the SK-appealing tasks showed significant and moderate correlations with SK scores (the fourth correlation was marginally significant). Only one of the SK-appealing mean task ratings showed a significant relationship with CK scores.

DISCUSSION

The purpose of this investigation was to see whether SK and CK scores correlated differently with affective reactions to a variety of academic and nonacademic intellectual tasks. The data suggest unambiguously that they do: SK scores are associated with liking for the tasks thought to place a premium on detached, objective, critical thinking but not with tasks conducive to a holistic, intuitive, collaborative kind of reflection. CK scores show the opposite pattern of correlation. These results provide an extension to the work of both Galotti et al. (2001) and Schommer-Aikins and Easter (2009).

STUDY 2

Study 1 was conducted at one selective Midwestern liberal arts college, leading to the question of how generalizable the results would be to undergraduates throughout the United States. Thus, in Study 2, we used the services of the Qualtrics Insight Platform to recruit a larger sample ($n = 200$) of current undergraduates at 4-year institutions from across the United States. We also expanded the rating scales we used to four, in order to gain a more comprehensive view of students' perspectives on the 12 tasks of the IAR.

METHOD

Participants

Participants in this study were 200 undergraduates from across the United States who participated in an online survey run through the Qualtrics Panel program. Students were recruited and remunerated by Qualtrics for their participation and were included in the study only if they affirmed that they were current undergraduates at a 4-year institution, that they were between the ages of 18 and 24, and that they had native or near-native fluency in English. One hundred (50%) of the sample reported themselves as male; the rest reported themselves as female. Of the 200 respondents, 38 reported themselves to be first-year students, 53 to be sophomores, 64 to be juniors, and 45 to be in their senior year. We did not solicit ethnic or racial demographic information.

Materials

Each participant was asked to complete two questionnaires: the ATTLS (Galotti et al., 1999), described in Study 1, and a modified version of the IAR survey. The modification left the description of the 12 intellectual activities intact but changed the rating scales.

Participants were instructed to rate each item according to four separate queries: "How much would you enjoy this activity?," "How important to your identity would it be to do well on this activity?," "How skilled would you be in performing this activity?," and "How important would it be to you that your classmates perceive you as skilled at this activity?" All ratings were made on a 7-point Likert scale, from 1 (*not at all/none*) to 7 (*completely/a lot*).

Procedure

Participants took the surveys online, and no time limit was imposed. The online survey incorporated an attentional filter (e.g., "Type the word 'Survey' here") to encourage careful reading of the survey items. The order of administration of the ATTLS and IAR was counterbalanced across participants. Most participants took 15 min or less to complete both instruments.

RESULTS

We first examined the internal reliability of the SK and CK subscales of the ATTLS using coefficient alpha. Overall, the internal reliability was .83 for CK and .70 for SK, values very similar to those previously reported and those obtained in Study 1. CK and SK scores were computed by summing the ratings for each of the 12 items pertaining to the scale, yielding a possible range of 10 to 70. CK and SK scores were significantly and positively correlated, r (198) = .34, $p < .001$.

A 2 (gender) × 4 (year in school) × 2 (score: CK, SK) mixed ANOVA, with repeated measures on the last factor, was run on ATTLS scores. It yielded no significant main effects on any of the between-subject factors but a main effect for score, with CK scores ($M = 53.02$) significantly higher than SK scores ($M = 47.92$) $F(1, 192) = 51.44$, $p < .001$, $MSE = 49.67$, $\eta^2 = .20$. This effect was moderated by a significant two-way interaction between gender and score. Men demonstrated a smaller difference between CK and SK scores (Ms = 52.03 vs. 48.63) than did women (Ms = 54.01 vs. 47.21) $F(1, 192) = 5.76$, $p < .02$, $MSE = 49.67$, $\eta^2 = .02$. These results replicate those of Study 1 with a larger and more diverse sample.

We next computed the internal reliability of the ratings for CK-appealing and SK-appealing tasks of the IAR using coefficient alpha. In computing these values, we used all four ratings for all six tasks within a category (i.e., CK-appealing or SK-appealing). The overall alphas were .92 and .92 for each set of ratings, respectively. Overall means and standard deviations (in parentheses) for these variables were 4.13 (3.30) and 3.00 (3.30) respectively.

We correlated SK and CK scores with mean ratings for IAR items. These correlations are presented in Table 3. Using Fisher's r to z transformation, we ran a paired-samples t test on the correlations on the diagonals versus the correlations of the off-diagonals. All correlations on the diagonals, that is, correlations between a particular score (e.g., CK score) and the corresponding task (e.g., CK-appealing tasks, M = .30) are significantly larger than the corresponding off-diagonal correlations (e.g., between SK score and CK-appealing tasks, M = .18) $t(15) = 8.32$, $p < .001$.

DISCUSSION

The results of Study 2 largely replicate the pattern of results found in Study 1, with a larger and more diverse sample of undergraduates from across the United States and an expanded set of rating scales. Once again, we see that SK and CK scores correlated with affective reactions to a variety of academic and nonacademic intellectual tasks selectively: SK scores correlate with liking for the tasks thought to place a premium on detached, objective, critical thinking but not for tasks conducive to a holistic, intuitive, collaborative kind of reflection and vice versa for CK scores. However, as in Study 1, the ratings of tasks were self-reported and hypothetical, an obvious limitation on the generalizability of the results.

STUDY 3

Studies 1 and 2 both involved ratings of familiar but hypothetical tasks. We wanted to supplement these data with ratings of actual learning episodes, preferably ones for which respondents had equal levels of experience. In mid-July 2016, Niantic Inc. launched a new game, *Pokémon Go,* that served these purposes. *Pokémon Go* is a free-to-play location-based augmented reality game for smartphones. Players use a mobile device's location-sensing capability to locate, capture, battle, and train virtual creatures, called Pokémon, who appear on the screen as if they were in the same real-world location as the player. The game is complex,[2] with more than 150 Pokémon of different types and with different capabilities, as well as a plethora of tools that are acquired in various ways during the game. Official instructions for the game were initially sparse, apparently intentionally. Although unofficial online guides to the game slowly began to appear after the game launched, many players simply experimented in the first weeks to develop knowledge of the game and strategies. The game rapidly became popular, within days of its introduction. We collected data from a national sample of undergraduate *Pokémon Go* players in August 2016 who were still exploring and discovering new aspects of the game.

Although *Pokémon Go* is not an academic task, it presented an immersive and complicated environment that prompted players to learn. We believe this study captures learning activities and beliefs of undergraduates who are motivated to acquire information about a particular complex activity and thus serves as an opportunity to study sustained learning episodes that would evoke CK and SK approaches to knowledge and learning.

TABLE 3. Correlations Between CK and SK Scores and Ratings of IAR Tasks, Study 2

	Academic tasks		Nonacademic tasks	
	CK score	SK score	CK score	SK score
Enjoyment rating				
CK appeal	0.35***	0.25***	0.34***	0.18*
SK appeal	0.18*	0.27***	0.10	0.26***
Identity rating				
CK appeal	0.25***	0.25***	0.33***	0.20**
SK appeal	0.09	0.26***	0.13	0.26***
Skill rating				
CK appeal	0.32***	0.25***	0.38***	0.21**
SK appeal	0.23***	0.32***	0.14*	0.29***
Others' perceptions rating				
CK appeal	0.27***	0.22**	0.24***	0.21**
SK appeal	0.12	0.26***	0.10	0.29***

*p < .05. **p < .01. ***p < .001.

METHOD

Participants

Participants in this study were 204 undergraduates from across the United States who participated in an online survey run through the Qualtrics Panel program. Students were recruited and remunerated by Qualtrics for their participation and were included in the study only if they affirmed that they were current undergraduates at a 4-year institution, that they were between the ages of 18 and 24, that they had native or near-native fluency in English, that they had not participated in Study 2, and that they were currently playing *Pokémon Go*. Ninety-five (47%) of the sample reported themselves as male; the rest reported themselves as female. Of the respondents, 40 reported themselves to be first-year students, 69 to be sophomores, 55 to be juniors, and 40 to be in their senior year. We did not solicit ethnic or racial demographic information.

Materials

Each participant was asked to complete two questionnaires: the Attitudes Toward Thinking and Learning Survey (ATTLS; Galotti et al., 1999), described in Study 1, a *Pokémon Go* version of the Intellectual Activities Ratings (IAR) survey, and several measures of *Pokémon Go* knowledge and *Pokémon Go* performance.

The *Pokémon Go* knowledge instrument consisted of 20 multiple-choice items regarding the game, each with four possible answers, covering items that a beginning player would already know to more obscure information about the game. Appendix A presents these items.

The *Pokémon Go* performance measures asked participants to self-report a number of statistics from their own game, including their current level of their game avatar, the number of Pokémon already caught, and the number of gym battles the participant had won. Appendix B presents these items.

The *Pokémon Go* version of the IAR listed several aspects of the game, including finding wild *Pokémon* in the environment; hatching *Pokémon* from eggs; battling with *Pokémon* in gyms; taking over a rival gym; training specific *Pokémon* types to prepare for battle; going online to learn new tricks, tips, and hacks; talking with friends about how to play the game. Each of these aspects was rated on four distinct scales: 'How much do you enjoy this aspect of the game?,' 'How important to you is your performance on this aspect of the game?,' 'How skilled are you at playing this aspect of the game?,' and 'How important is it to you that other people perceive you as skilled at playing this aspect of the game?'

RESULTS

We first examined the internal reliability of the SK and CK subscales of the ATTLS using coefficient alpha. Overall, the internal reliability was .85 for CK and .80 for SK, values very similar to those previously reported and those obtained in Studies 1 and 2. CK and SK scores were computed by summing the ratings for each of the 12 items pertaining to the scale, yielding a possible range of 10 to 70. CK and SK scores were significantly and positively correlated, $r(198) = .47$, $p < .001$. We next computed internal reliabilities for the *Pokémon Go* knowledge and performance measures, again with coefficient alpha. These reliabilities were .81 and .87, respectively. Overall means and standard deviations (in parentheses) for these variables were 10.98 (4.39) with a range of 2–19, and 17.37 (5.15) with a range of 8–34, respectively.

The knowledge and performance measures were positively correlated, $r(198) = .26$, $p < .01$. The *Pokémon Go* knowledge measure correlated significantly and negatively with SK scores, $r(198) = -.26$, $p < .01$, and the *Pokémon Go* performance measure correlated significantly with gender, with men showing higher totals, $r(198) = -.24$, $p < .01$.

We next correlated CK, SK, *Pokémon Go* Knowledge, and *Pokémon Go* Performance scores with the ratings given to the different aspects of the game. The resulting correlations are presented in Table 4. Once again, CK and SK scores showed distinctly different patterns of correlations with the ratings. CK scores tended to correlate with aspects of the *Pokémon Go* game such as finding wild Pokémon, hatching eggs, and talking with friends about the game. In contrast, SK scores were stronger for battling in gyms, taking over rival gyms, training Pokémon to prepare for battle, and going online to learn new tricks. The ratings of how important it is that other people perceive you as skilled at an aspect of the game showed no significant correlation with CK scores for any aspect of the game, whereas SK scores correlated significantly with this rating scale for every aspect of the game.

Game aspect and rating	CK score	SK score	Knowledge score	Performance score
TABLE 4. Correlations Between CK and SK Scores and Ratings of Aspects of *Pokémon Go* Game, Study 3				
Finding wild Pokémon				
Enjoyment	.26***	.10	.20**	.08
Importance	.26***	.11	.19**	.14
Skilled	.25***	.18**	−.01	.07
Others' perception	.10	.23***	−.14	.01
Hatching eggs				
Enjoyment	.20**	.10	.10	.10
Importance	.17*	.21**	.11	.23***
Skilled	.29***	.17*	−.06	.18*
Others' perception	.13	.30***	−.18*	.10
Battling in gyms				
Enjoyment	.21**	.18**	−.02	.30***
Importance	.14*	.25***	−.16*	.29***
Skilled	.07	.30***	−.11	.29***
Others' perception	.11	.27***	−.22**	.22**
Taking over rival gyms				
Enjoyment	.14*	.17*	.06	.26***
Importance	.04	.22***	−.07	.27***
Skilled	.08	.24***	−.17*	.31***
Others' perception	.06	.25***	−.18**	.22**
Training Pokémon to prepare for battle				
Enjoyment	.15*	.26***	−.11	.14
Importance	.20**	.27***	−.07	.11
Skilled	.10	.24***	−.11	.23***
Others' perception	.13	.31***	−.17*	.21**
Going online to learn new tricks, tips				
Enjoyment	.09	.23***	−.19**	.06
Importance	.14	.23***	−.25***	.05
Skilled	.09	.21**	−.17*	.08
Others' perception	.06	.26***	−.34***	.10
Talking with friends about game				
Enjoyment	.21**	.13	.07	.13
Importance	.15*	.24***	−.01	.16*
Skilled	.23***	−.01	−.08	.19**
Others' perception	.17**	.16*	.19**	.12

*p < .05. **p < .01. ***p < .001.

DISCUSSION

Pokémon Go is a complex game with many different aspects. Some are very competitive and adversarial, such as battling in gyms or taking over gyms. Other aspects of the game are nonadversarial, such as finding Pokémon or hatching eggs, and could even be cooperative as players congregate in areas where rare Pokémon are likely to spawn, for instance. SK scores tended to correlate with adversarial aspects of the game, CK scores with the nonadversarial aspects. Furthermore, CK scores correlated with respondents' ratings of talking with friends about the game in order to learn it, whereas SK scores correlated with going online for their sources of information. Participants with higher CK scores seemed to value collaborative learning with friends and the construction of an intersubjective knowledge of the game in that friend group. Participants with higher SK scores, on the other hand, placed less value on the interactive element of communicating in person with others about the game, preferring the more "objective" (and static) advice found in online FAQs and gameplay guides.

GENERAL DISCUSSION

Students' affective reactions to learning activities are important to study independently of their task performance, we argue, because they are likely to influence the venues in which students choose to engage. During high school and college, students have increasing amounts of latitude to opt for courses, co-curricular activities, summer camps and programs, and other settings that selectively encourage some skills and habits of mind more than others. If personal enjoyment of an activity drives some of these choices (and it seems likely that it does), then being able to predict enjoyment from SK and CK scores might allow the designers to predict which students will be drawn to a class or activity and perhaps how to broaden its appeal to other students.

In addition to enjoyment, students' self-conception is likely to play a role in their enrollment decisions. One may not particularly enjoy a task but choose to engage in it anyway, considering it worthwhile for independent reasons such as furthering one's education or career. Or one may see doing something they dislike, or feel neutrally toward, as nevertheless central to who they are as a person or as

simply what they need to do on axiological grounds. Therefore, we included "centrality" and "importance" ratings along with enjoyment ratings. The correlations presented throughout our three studies suggest that SK and CK ratings predict these ratings as well as enjoyment ratings. Future studies might profitably examine the relationships between self-confidence in a field of study and self-conception and whether or not SK and CK scores predict the strength of the relationship. Moreover, departments and programs looking to address gender or other imbalances may want to examine curricular or co-curricular elements through the lens of SK and CK.

In keeping with previous research, the results also exhibited significant gender differences in SK and CK scores. Our results consistently showed a larger disparity between SK and CK among women, as has been found in previous studies (Galotti et al., 1999, 2001; Ryan & David, 2003; Schommer-Aikins & Easter 2006, 2008, 2009). Internal reliabilities for CK and SK scores were similarly comparable. A fruitful area of future investigation might be to use CK and SK scores to think about gender disparities in college attendance, college completion, and college performance.

In their 2001 study, Galotti et al. expressed concern that the chosen game (*Magic*) may have been difficult for their study participants to take seriously because of the fantasy setting and its departure from the academic domain. Our work in Studies 1 and 2 addresses this issue and suggests that SK and CK scores predict affective reactions (enjoyment and centrality, or importance) of a range of activities more typically engaged in by undergraduates. However, all items on the IAR were hypothetical, raising the possibility that the ratings may have been governed principally by epistemological self-concept rather than in situ indications of enjoyment and engagement while performing these tasks.

Study 3 was designed to fill just this gap. Although *Pokémon Go* is an augmented reality game, its much stronger popular and cultural appeal makes *Pokémon Go* a better context for in situ indications of enjoyment and engagement. Moreover, we included undergraduates who were already playing *Pokémon Go* in the study, as opposed to having participants learn the game as part of a study. Therefore, it seems reasonable to conclude that our participants in Study 3 already had strong motivation to learn the game. The ratings

of different aspects of this complex learning task that participants were already engaged in occurred as the game first appeared, and thus the ratings were concurrent with the learning activity. Study 3 results suggest once again that SK and CK scores predict different ratings and do so in ways consistent with the original definitions of these two epistemological styles.

In essence, our investigations make the case for broadening the view of learning and motivation. We argue that although epistemological positions are not ability measures, they remain important to consider, particularly in contexts where learners make choices about which tasks and environments they will engage. When learners have such choices, understanding predictors of their affective appraisals and reactions becomes a critical piece of the puzzle to understand.

APPENDIX A. POKÉMON GO KNOWLEDGE SURVEY

1. When a wild Pokémon appears in the game, the *first* action a player must take to capture it is to:
   a. tap the Pokémon
   b. throw a Poké ball at it
   c. retrieve a Rasp Berry from the backpack
   d. visit the nearest PokéStop

2. All of the following are possible "starter" Pokémon (i.e., the first Pokémon a player can catch, *except:*
   a. Squirtle
   b. Bulbasaur
   c. Jigglypuff
   d. Charmander

3. Items that can be used to increase the availability of Pokémon available for capture include:
   a. Lucky Eggs
   b. Incense
   c. Lure Modules attached to PokéStops
   d. all of the above
   e. b and c only

4. If you and a friend are walking together and playing *Pokémon Go* and you both see the same Pokémon,
   a. only one of you can catch it
   b. both of you can catch it
   c. it may appear to both of you with different CP (combat power)
   d. b and c

5. The function of Rasp Berries is:
   a. to increase the CP of a given Pokémon
   b. to provide some advantage in a gym battle
   c. to repair damage to a Pokémon who is injured in a gym battle
   d. to make a Pokémon easier to catch

6. In order to evolve a Pokémon you will need:
   a. candy specific to the species of Pokémon
   b. any kind of candy
   c. stardust
   d. PokéCoins

7. In order to join a team, a player must achieve Level:
   a. 3
   b. 5
   c. 7
   d. 9

8. All of the following are names of teams in *Pokémon Go* except:
   a. Mystic
   b. Valor
   c. Instinct
   d. Harmony

9. A starter Pokémon can only be hatched in what kind of egg?
   a. 2 km
   b. 5 km
   c. 10 km
   d. any of the above

10. Hatching an egg requires which of the following:
    a. walking
    b. riding in a car
    c. sitting still or standing
    d. visiting a PokéStop

11. Which of the following activities could yield a player the most experience points?
    a. visiting a PokéStop
    b. catching a Pokémon
    c. hatching a 10 km egg
    d. using a potion

12. A Pokémon whose evolution is unpredictable is:
    a. Pikachu
    b. Eevee
    c. Oddish
    d. Drowzee

13. A *Pokémon Go* item that, when used, doubles all the experience points awarded for 30 minutes is:
    a. a potion
    b. a superpotion
    c. a Lucky Egg
    d. a Rasp Berry

14. All of the following Pokémon are encountered rather routinely except:
    a. Pidgey
    b. Rattata
    c. Weedle
    d. Kabuto

15. The rewards for having your Pokémon *defending* a gym (i.e., stationed there) include:
    a. stardust and PokéCoins
    b. PokéCoins and experience
    c. stardust and experience
    d. stardust, PokéCoins, and experience

16. How often can you receive a reward for assigning your Pokémon to defend a gym?
    a. every 8 hours
    b. every 12 hours
    c. every 15 hours
    d. every 21 hours

17. Every Pokémon has how many different kinds of attacks?
    a. one
    b. two
    c. three
    d. depends on the specific Pokémon

18. Which of the following is *not* a correct type for the Pokémon it is paired with?
    a. Magnemite–steel
    b. Ghastly–ghost
    c. Zapdos–flying
    d. Primeape–normal

19. A gym which is unclaimed by any team shows up as what color?
    a. white
    b. black
    c. grey
    d. green

20. Which of these is *not* an action you can take during a gym battle?
    a. dodge
    b. attack
    c. block
    d. special attack

APPENDIX B. POKÉMON GO *PERFORMANCE MEASURES AND CATEGORIES OF RESPONSES*

What level has your trainer achieved?
   Level 4 or below   Level 5 to Level 10   Level 11 to Level 15
   Level 16 to Level 20   Above Level 20

How many Pokémon are listed as "Caught" in your Pokédex?
   0–25, 26–75, 76–125, 126–175, 176–225, over 225

What is the highest CP value of any of your Pokémon?
   0–100, 101–500, 501–1000, 1001–1500, over 1500

How many eggs have you hatched?
   0–10, 11–25, 26–75, over 75

How many PokéCoins have you acquired?
   0–25, 26–75, 76–125, over 125

How many Gym battles have you won (at either a friendly or rival Gym)?

0–10, 11–50, 51–100, over 100

How many Pokémon have you assigned to a friendly Gym to strengthen it?

0–1, 2–5, 6–10, over 10

How many times have you teamed up with friends to challenge a rival Gym?

0–1, 2–5, 6–10, over 10

1. A copy of both instruments is available from the first author.

2. Since its initial introduction the game has had several new features added. However, all our participants were run in August 2016, during one specific and early phase of the game.

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