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# Empirical Support for the Integration of Dispositions in Action and Multiple Literacies into AASL's Standards for the 21st Century Learner

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*AASL's Standards for the 21st Century Learner are based on a number of common beliefs, including the importance of reading and technology skills, and the acknowledgement that the concept of information literacy has indeed become more complex since the last century. The data provided in this article support the importance of considering the dispositions-in-action component of the new standards when planning instruction. Specifically, this article investigates the contributions of perceived competence in information and digital literacy skills, perceived competence in reading, the disposition to read for enjoyment, and the disposition of curiosity, towards actual performance in an information and digital literacy skills knowledge test. Study participants included more than twelve hundred eighth grade students from twenty states. The study is grounded in historical literature on the construct of curiosity and on self-determination theory. Implications for curriculum design are discussed. The research was supported by a National Leadership Grant from the Institute of Museum and Library Services.*

## Introduction

School library media specialists in the twenty-first century face both challenges and opportunities in the recent evolution of the idea of information literacy (IL)—which is now widely accepted as embracing rapid advances in technologies and recognizing the multiple literacies required of students living and learning in this century. The new American Association of School Librarians (AASL) Standards for the 21st Century Learner (2007, 2009b) reflect a holistic approach for learners that includes not only skills that cut across multiple literacies but also critical dispositions for learning, responsibilities, and self-assessment. The importance placed on learning dispositions in the new standards is justifiable because "students who can (and do) read and inquire with thoughtfulness and curiosity are empowered to push their own learning to deeper levels and wider vistas" (AASL 2009, 12).

This study provides empirical support for the inclusion of affective components in the new standards. It describes how reading for enjoyment, curiosity, and perceived competence (confidence in one's abilities) contribute to both IL and digital literacy (DL) according to a 2008 cross-sectional survey of U.S. eighth-graders. Finally, it investigates the relationship between the multiple literacies we explored.

## Self-Determination Theory

This study is grounded in Self-Determination Theory (SDT), a macrotheory of human motivation and development, which holds that the needs for competence (to be affective), autonomy (to experience choice and endorsement of one's actions), and relatedness (to feel connected to others, loved, and cared for) are important motivators of human behavior, are innate needs, and are essential to psychological growth and well-being (Deci and Ryan 2000; 2008). An excellent review of studies that have used SDT in education can be found in Guay, Ratelle, and Chanal (2008). The needs described by SDT are central to motivation—both its type (autonomous versus controlled) and amount (strength). For example, a student may study for an exam (a motivated behavior) because of an inherent need for competence and may feel autonomous in taking the responsibility to do so. Further, the needs for competence, autonomy, and relatedness can be supported or thwarted by the learning environment. To put this in the context of the school library, an educator who incorporates strategies for building confidence in one's information and digital literacy skills (via encouragement, practice opportunities, corrective feedback, peer tutoring, etc.) helps to create a learning environment that supports the need for competence and enhances perceived and actual competence.

While other studies have used SDT to explore perceived and actual competence in different domains, this article explores SDT within the domains of both IL and DL. It addresses the extent to which *perceived competence* toward information and digital skills plays a role in actual information-skills and digital-technology-knowledge outcomes. A relationship between perceived competence and actual skills may indicate that greater support for affective learning outcomes is needed in information and digital resource contexts to help stem knowledge gaps and the digital divide, which can be defined as the gap between those who use digital resources and those who do not.

The school library context is an environment rich in resources to support student formal and informal learning processes—much more so with the advent and growing accessibility and ubiquity of new media technologies. Curiosity can be a powerful motivator, initiating the exploration of one's environment to resolve uncertainty and make the novel known. However, curiosity does not automatically lead to the development of strong individual interest, greater learning, and mastery if supports and resources are not available to satisfy that curiosity. We have found no studies that link curiosity to information- or digital-skills knowledge. Therefore this article also explores the extent to which curiosity contributes to actual IL and DL. Curiosity in the context of SDT is an indicator of intrinsic motivation and is driven by the need to feel a sense of competence over one's environment. It would thus be reasonable to expect curiosity to be related to perceived competence and possibly contribute to the acquisition of actual digital and information skills.

The study also investigates whether perceived competence in reading ability and reading for enjoyment helps predict knowledge and skills in these domains. A predictive relationship between these variables would lend support to the first common belief that is the foundation of the new standards: "Reading is a window to the world" (AASL 2007, 2008, 2009); specifically, reading in all of its formats and contexts is a foundational skill for learning. This study expands the literature that supports reading as integral to learning into the domains of IL and DL.

The "6th common belief" underlying the new AASL standards is that multiple literacies have now "joined information literacy as crucial skills for this century" (AASL 2009, 13). The study also investigates the relationship between information skills and digital technology knowledge. Given the call to incorporate multiple literacies into the overarching IL domain, we anticipate a relationship between the two skill sets explored in this study (for both perceived and actual competence). This finding would support the notion of integrating multiple literacies into our field's research definitions and practical interventions, and would further strengthen the argument for this "6th common belief."

# Literature Review

## Information Literacy

IL has been defined by the National Forum on Information Literacy as "the ability to know when there is a need for information, and to be able to identify, locate, evaluate, and affectively use that information for the problem or issue at hand" (National Forum on Information Literacy 2008). The "ability to find and use information" also was the basic definition put forth by AASL for many years in what had become a bible of sorts for school library media specialists (SLMSs) in the United States: *Information Power: Building Partnership for Learning* (ALA 1998, 1). New updated standards were announced in 2007 and were further refined in 2008. AASL's new Standards for the 21st Century Learner encompass not only skills that contribute to multiple literacies but also their affective and motivational counterparts (2007, 2008). This is great news because a number of researchers have been arguing the critical importance of such issues in information-seeking behaviors for years (Kuhlthau 1993; Nahl 1993; Small and Arnone 2000; Wang, Hawk, and Tenopir 2000; Bilal 2002; Bilal and Kirby 2002; Bilal 2005; Nahl 2007; Ke and Zhang 2008). The new standards provide additional credibility to ongoing research exploring affective correlates to information-seeking behaviors, including the process and products of student research.

*Affect* refers to one's emotions or feelings while *motivation* refers to the direction and intensity of behavior. It is generally accepted that motivation answers the "why" of behavior, that is, why we persist longer or apply more effort toward one task over another. (In speaking generally of motivation, it is understood that motivation is not a unitary construct and, as described above, can be differentiated into types, such as autonomous and controlled.) Studies have shown that motivational factors can influence feelings or affect.

The new AASL standards address affective issues in part through the incorporation of *dispositions in action*. A disposition has been defined as a "tendency to exhibit frequently, consciously, and voluntarily a pattern of behavior that is directed to a broad goal" (Katz 1993). As described above, motivation is responsible for the direction and intensity of an individual's effort toward achieving a goal. Thus a disposition can have motivational power behind because it is goal-directed. Several examples of dispositions in action from the new AASL standards include the following:

1. Show an appreciation for literature by electing to read for pleasure and expressing an interest in various literary genres.
2. Demonstrate confidence and self-direction by making independent choices in the selection of resources and information.
3. Display curiosity by pursuing interests through multiple resources.
4. Demonstrate personal productivity by completing products to express learning.
5. Demonstrate persistence by continuing to pursue information to gain a broad perspective.

## Digital Literacy

Research into DL is a multidisciplinary endeavor that in many ways has paralleled the IL research. The concept of DL has roots in the longstanding media literacy program of research and pedagogy in the field of media studies, IL research in the field of information studies, and studies of technological fluency in the education field. Livingstone, Van Couvering, and Thumim (2005) point out that the primary difference between the two literacies is that IL emphasizes more broadly the identification, location, evaluation, and use of a wide range of media materials, while DL focuses solely on uses of *technological* media for information seeking and other purposes. In discussing the problems of the digital divide, Livingstone, Van Couvering, and Thumin (2005) suggest that among those who already have access to technological media (i.e., those who get beyond the first barrier to DL), the key considerations for audience technology uses may reside within the concepts of motivation and interest as well as technology skills or depth of knowledge (literacy). This study explores relationships between motivation and skills.

Unlike the AASL's new Standards for the 21st Century Learner (2007, 2009b), the most recent National Educational Technology Standards (NETS) and Performance Indicators for Students by the International Society for Technology Education (ISTE 2007) do not specify motivation or affect in its objectives for student learning. While the ISTE NETS Standards for Teachers (2008) call for educators to "facilitate and inspire student learning and creativity," they again do not mention of affect or motivation. However, media scholars such as Livingstone, Van Couvering, and Thumin (2005) are recognizing that motivation and skills play a significant role in a person's technology uses.

Because of the past research highlighted above addressing information skills and digital technology knowledge, this study explores the contributions of the constructs (presented in the subsequent sections) toward students' actual performance in (a) an IL test focusing on a range of IL skills as specified by AASL's national IL standards outlined in *Information Power: Building*

*Partnerships for Learning* (ALA 1998) and (b) a DL test focusing solely on technology skills as specified by the NETS for Students (ISTE 2005).

## Curiosity

SDT holds that the need for competence "leads people to seek and conquer challenges that are optimal for their capacities, and that competence acquisition results from interacting with stimuli that are challenging" (Deci and Ryan 1985, 28). In this study, curiosity is studied as a disposition that is driven by the need for competence. Curiosity has been studied across a number of theoretical perspectives (e.g., White 1959; Berlyne 1960; Maw and Maw 1965; Beswick and Tallmadge 1971; Deci 1985; Lowenstein 1994; Litman and Jimerson 2004) and often has been associated with one's willingness to explore their environment in the face of uncertainty or challenge. Thus an individual's state of curiosity in a particular situation may be associated with their capacity or "predisposition" to be curious in curiosity-provoking situations (e.g., Day 1982). Individuals will remain in a zone of curiosity manifested by actions such as exploration and questioning to the extent that the provided curiosity-provoking stimuli are optimal for their capacities. Too many stimuli may cause an individual to withdraw from their explorations because of unease while too few may result in a state of boredom. Measures to assess this construct have ranged from self-reporting and observation to the number of questions asked by a child while they explore their environment (e.g., Arnone, Grabowski, and Rynd 1994). It is likely that the need for competence provides the impetus for curiosity behaviors, such as exploring for information in an effort to master one's environment, and that curiosity would then be related to both perceived and actual competence in information-seeking skills. However, little is known in the school media field about the relationship between curiosity and actual competence in information or digital skills.

## Previous Findings

Assessment of competence plays a dominant role in education today, and SLMSs must promote IL competence across the curriculum. School libraries and SLMSs play a critical role in student achievement, which has been shown in a number of studies (e.g., Todd, Kuhlthau, and OELMA 2004; Lance, Rodney, and Hamilton-Pennell 2000; Small, Snyder, and Parker 2008). One important consideration in information-seeking is *perceived competence*, or a feeling of confidence in one's ability to successfully accomplish an information task. Nahl (1993) demonstrated that students who were more confident in their search capabilities were more successful and more satisfied in a search task; in a separate study, Nahl found that college seniors who indicated low confidence in their potential to do well in a course subsequently dropped the course in a matter of weeks (Nahl 1996). In a study of young adults, Cheong (2008) discovered that students' perceived skill and a belief in their own problem-solving ability (in building a website) were the best predictors of actual creativity. Research also indicates that children are able to differentiate their competence across domains (Chapman and Tunmer 1995; Eccles et al. 1993) even as young as the third grade (Hanich and Jordan 2004).

In a set of parallel national standards addressing technology skills more specifically, ISTE's 2007 NETS standards for student technology fluency do not indicate any focus on affective and motivational student contributors to technology performance. However, the 2008 NETS standards for *educators* do. Some examples from the educator standards reflecting an affective dimension include the following:

> Teachers promote, support, and model creative and innovative thinking and inventiveness.
> Teachers promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes.
> Teachers develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress.

While the 2007 NETS student performance indicators do not indicate student affect as a consideration in developing technology skills (and appear to be more behavior-oriented), the 2008 NETS educator guidelines promote attention to student affect and dispositions. Our exploration of the contribution of student perceived competence (affective confidence) in information and digital activities may highlight the importance of translating the affective dimensions of the educator NETS into future NETS standards for students.

## Perceived Competence in Reading Ability

Perceived competence in reading also may contribute to actual IL and DL competence, as measured in a test of each. That this basic literacy is embedded in IL is a logical, if not obvious, assumption. Perceived competence in reading has been shown to be a stable predictor of actual reading achievement (Hanich and Jordan 2004) and predictive of academic achievement overall, and reading is necessary for use of information resources. No studies were located that explored both perceived competence in information or digital activities, nor have we located prior studies addressing perceived competence in reading as predictors of actual information skills or digital technology knowledge.

## Reading for Enjoyment

Reading is not only a foundational skill for all learning and a key indicator of success in school and in life, but it is also required for personal growth and enjoyment (AASL 2007). Reading for enjoyment, which is sometimes referred to as reading for pleasure, independent reading (Cullinan 2000), and voluntary or self-selected recreational reading (Krashen 2002), also has been positively associated with actual or perceived reading ability (Clark and Rumboldt 2006; Read 2003). Reading for enjoyment is intrinsically motivated behavior; that is, the satisfaction is intrinsic to the activity itself. Clark and Rumboldt (2006) define it as "reading that we do of our own free will anticipating the satisfaction that we will get from the act of reading." We empirically explore the contribution that a disposition toward reading for enjoyment makes to both information skills and digital technology knowledge, as stipulated by the AASL standards and definitions.

## Multiple Literacies

Jewitt suggests that "multiliteracies has evolved into an international pedagogic agenda for the re-design of the educational and social landscape" (2008, 245). Yet assessments for a variety of literacies tap into a seemingly singular construct, targeting one specific literacy or another. Dow (2007) suggests that it may be more useful to SLMSs to evaluate information and technology literacies together as competencies than to evaluate either literacy on its own. Many scholars now describe literacy/literacies as going beyond the traditional notion of reading, writing, listening, and speaking and discuss the powerful opportunities for learning inherent in the everyday literacies that students engage in, from gaming to social media to creating their own electronic media (e.g., Friese 2008; Vasquez 2003). But there are three questions yet to be answered: (1) Has the distinction between literacies become blurred? (2) Should we expand the definition of literacy in general? (3) Should we no longer distinguish between *different* literacies but rather use the term "multiliterate" to describe one who is well-rounded? This study investigates the extent to which ILs and DLs represent similar constructs.

## The Research Model

We explored ten hypotheses in a multiple regression study. We tested whether curiosity, perceived competence in information skills, perceived competence in reading, and the disposition to read for enjoyment could help explain some of the variation in scores in a test of information skills and digital technology knowledge. We also included two more predictors in our models as demographics (students' self-reported parent level of education and grades). These variables are often used in predicting achievement and to test the robustness of the motivational model. Finally, hypotheses 9 and 10 anticipate a relationship between ILs and DLs in both perceived competence and actual skills.

The passage from middle school to high school is a critical childhood transition. Findings for eighth-graders addressing the contribution of curiosity and perceived competence in information and digital technology skills to actual skills can inform research and practice to better prepare students in these learning domains before they enter high school. Curiosity in SDT terms arises from a need for competence that may account for why individuals continue to explore for answers to their curiosity questions until they have resolved them. We thus hypothesized a relationship between curiosity and competence. If curiosity is found to be predictive, this suggests the environment should include supports to promote students' curiosity-driven behavior. If perceived competence in information and digital skills is found to be predictive, an instrument focused on this affective construct can be developed and used as a proxy diagnostic in the school setting by the SLMS and classroom teachers, who can use the results to identify and address gaps in student confidence through the design of appropriate instructional interventions. Further, understanding the relationship between students' perceptions of their own IL abilities and their actual skills could confirm the relationship between affect and actual skills in the library context. Thus hypotheses 1–4 are stated below.

> H1: The greater a student's curiosity, the better the performance will be in a test of IL.
> H2: The greater a student's curiosity, the better the performance will be in a test of DL.
> H3: The higher a student's perceived competence in information skills, the better the performance will be in a test of IL.

H4: The higher a student's perceived competence in digital technology activities, the better the performance will be in a test of DL.

The National Assessment of Educational Progress report (National Center for Education Statistics 2007) indicated that only about 29 percent of eighth-graders were proficient in reading. Students with only basic reading skills no more than partially master the knowledge and skills required for grade-level achievement. This finding provides justification that perceived competence in reading also explains some of the variation in scores on an achievement test in the IL and DL domains. Thus hypotheses 5 and 6 are stated below:

H5: The higher a student's perceived competence in reading, the better the performance will be in a test of IL.
H6: The higher a student's perceived competence in reading, the better the performance will be in a test of DL.

Reading for enjoyment, or self-selected recreational reading (Krashen 2002), has been positively associated with actual or perceived reading ability (Clark and Rumboldt 2006; Read 2003), but we found no studies that explored this construct with respect to IL or DL competence. For this reason, we proposed hypotheses 7 and 8.

H7: The greater a student's disposition to read for enjoyment, the better the performance will be in a test of IL.
H8: The greater a student's disposition to read for enjoyment, the better the performance will be in a test of DL.

Finally, the term "multiple literacies" (or "multiliteracies") is commonly used in discussing education of students in today's world. This term entered into the literature in the mid-1990s as the concept of literacy began to expand along with the exponential growth of new media. Here we also explore the extent which information skills and digital skills relate and contribute to each other.

H9: The better a student performs on a test of IL, the better the performance will be in a test of DL.
H10: The more perceived competence a student has in information skills, the better the performance will be in a test of DL.

Toward the study's purpose and significance, little research has been found exploring the contribution of curiosity to IL or DL skills. There has been, however, much conceptualization of curiosity's importance to IL. Hensley argued that "fostering an individual's sense of curiosity and creativity in tandem with developing his ability to find, locate, and evaluate information is the essence of information literacy" (2004, 35). We did find scholarly exploration of *perceived competence* in IL skills for teachers and young adults (e.g., Kurbanoglu, Akkoyunlu, and Umay 2006), but research studies addressing younger students are much needed. As for perceived competence (i.e., confidence in one's ability to engage) in digital technology activities, our research model appears to be the first developed that is testing aspects of Deci and Ryan's SDT in the technology and information context with middle school children.

We chose eighth-graders as our sample population because information and technology competency assessments typically occur at the eighth-grade level in great part because of mandated requirements of the No Child Left Behind Act of 2001. Assessment *methods*, however, are not mandated and can be determined by the school. They can include knowledge-based tests, rubrics, checklists, portfolios, or other means (Dow 2007). Some schools deliver a knowledge-based test at the beginning of eighth grade as a preassessment to identify information and technology skills that need to be addressed, and then again at the end of the year to determine if improvement has been made. However, a 2008 report of the National Education Association concludes that although all educators and students in public schools have some access to computers and the Internet, “we have few assurances that they are able to use technology effectively for teaching and learning” (National Education Association 2008). Without appropriate in-school interventions by educators and school librarians, testing students on information and digital skills is illogical. We expect the results in this paper to contribute to learning theory in the domain of information and digital skills development as well as instructional design.

# Method

## Sampling and Procedures

The project began with an initial pilot study conducted as an online survey with a convenience sample of 279 students from 9 schools in fall 2007. The results of the pilot helped to refine instruments for the main study.

We conducted the main study data collection in spring 2008 with a large convenience sample of U.S. eighth-graders and their SLMSs. We recruited schools during January and February 2008 from open invitations posted to the mailing list of the AASL Forum and to the Tools for Real-Time Assessment of Information Literacy Skills (TRAILS-9) discussion list. Interested individuals completed an initial online interest questionnaire that provided information about the study and collected demographics and contact information. We provided a small gift of $200 to be used in the school library media center as an incentive for participation in the full study.

SLMS participation both as administrators and participants was an important aspect of the study. In the past several years the literature has encouraged evidence-based practice by SLMSs (e.g., Loertscher and Todd 2003). It is accomplished through action-based research in which the SLMS collects data to improve instruction or some aspect of the library media program. For this reason, as further incentive we also offered to share school-level datasets and a results profile report to each participant school presenting school-level anonymized aggregate findings from the three student surveys.

## Participants

Eighty schools initially agreed to participate in response to our solicitations, but some determined the schedule of three survey sittings would be too demanding. Ultimately, forty-seven schools (which included forty-six SLMSs) fully participated in all three sessions of the survey data collection. There was some attrition in students at each location across the three survey sittings, which is reflected in some of the varying numbers for the descriptive statistics below (survey 1 N = 1,264; survey 2 N = 1,180; survey 3 N = 1,028). Furthermore, not all students answered each question. For example, not all students knew their parents' education levels, thus that question reflected a lower response rate (N = 933). An average of twenty-seven adolescents, with an average age of thirteen, participated from each school. Twenty states were represented in the sample. The geographical distribution, socioeconomic status, and setting of the schools sampled are indicated in table 1. The data source for table 1 is the prescreening participant recruitment survey for the fifty-seven librarian participants. We requested that each SLMS and student guardian complete a consent form for participation, providing permission and assuring participant anonymity and privacy.

## Protection of Minors

The Syracuse University Institutional Review Board (IRB) approved this project and all of its pilot and full-study components, instruments, and procedures. Participation was voluntary, and we acquired signed parent/guardian permission forms for all 1,272 students with copies of the forms residing both at Syracuse University and with the participating schools. Additionally, the administrator protocol required SLMSs to inform students in person that their participation was voluntary and that they could withdraw from the study at any time. As another measure of protection, each online survey session began with a written reminder that participation was voluntary and withdrawal at any point in the study was permitted. Skipping questions was permitted. They were also made aware that their responses to the survey would remain anonymous. We placed no time limits on the students; the time needed to complete each of the surveys ranged from twenty-five to thirty-five minutes.

## Training

The SLMSs learned how to implement the surveys through their study of the online instructions provided on the project training website. The SLMSs did not know the specific content of the questionnaires prior to administration. They were instructed to choose students randomly or to implement the survey within a class that they perceived to be representative of the school's student body. Each participant received via e-mail a spreadsheet for their school, providing unique participant ID numbers. They also received a survey administration script, the online survey links, and two support phone numbers. Participating schools carried out a hardware and software compatibility test to ensure browser compatibility when linking to surveys. SLMSs had flexibility in determining the most convenient times for them to access and administer the sessions, but all three surveys had to be completed within an eight-week timeframe at each location. The development of the instruments used in both the pilot and main studies will be discussed in a forthcoming article.

Table 2 and table 3 give the ethnic backgrounds and gender of the student participant sample, derived from the full-study student survey. The convenience sample appears to overrepresent white students and underrepresent black and Hispanic/Latino students.

## Measures

**Information Literacy Test**

We received this measure from researchers at Kent State University that developed and validated the thirty-item Tool for Real-time Assessment of Information Literacy Skills (TRAILS) test (Schloman and Gedeon 2007). The TRAILS test was developed for ninth-graders. Since our subjects were eighth-graders, the researchers worked with us to identify items from the original test that skewed lower on the item difficulty index. We used twenty of the thirty items from the general assessments in the pilot study. Reducing the number of items in the pilot lessened the cognitive load on students who also were completing other questionnaires. On the basis of the post–pilot item analysis, we replaced items that skewed as too difficult or too easy, added five more items from the TRAILS item pool to increase reliability, and used the revised version in the main study. The Cronbach's alpha reliability coefficient in the final twenty-five-item version was acceptable at .81.

**Digital Literacy Test**

Researchers at LearningPoint Associates, a private research consulting organization that conducts national research for a range of vertical markets, provided us with this measure. Their technology literacy test is based on the 2005 ISTE NETS standards and is targeted toward eighth-graders. The knowledge test asks students to identify the meaning, functionality, and appropriate-use case scenarios of various basic desktop technology tools and activities (e.g., engaging in online search, using various standard software tools such as Microsoft Excel and Word, the purpose of a database, etc). The test met generally accepted levels of reliability and content-and-construct validity in empirical validation conducted with more than two thousand students (LearningPoint Associates 2005). The eighty-four resulting items that the researchers retained fit the Rasch model expectations, and the overall reliability of .88 was within accepted norms. In addition, an external panel of educational technology experts reviewed the content validity of each item based on several criteria. Once the researchers generated the items, LearningPoint's panel of experts convened to validate the items. This panel rated each item on the criteria listed following a three-stage process involving an item-by-item analysis, evaluation of challenge, and evaluation of balance and range. The researchers state, "We are confident that it resulted in the development of items that are much more closely aligned with the NETS" (LearningPoint Associates 2005).

Our advisor at LearningPoint recommended that given our study constraints and concerns about survey fatigue, we should narrow our use of the questions to those within the "basic" and "proficient" levels of difficulty (comprising forty-six questions). The advisor ran an analysis of just these items, resulting in a Rasch reliability of .79, also deemed acceptable. We ultimately chose to implement forty of the forty-six items provided. We also added five of our own self-drafted questions to expand the range of constructs examined, reflecting advances in digital technology since the original test was administered, such as students' uses of social networking sites, blogging, and information-seeking uses of technology. Two questions from the original pool of validated LearningPoint items were skewed in our dataset and lacked fit, and thus were dropped during item analysis, leaving us a total of forty-three items. We combined these items into a single test score for each student that was based on correct and incorrect responses. This combined test score served as our digital knowledge construct with a Cronbach's alpha reliability coefficient of .86.

## Curiosity

We operationalized curiosity in this study specifically for an information-seeking context. In the study, students saw the name of this scale as "Making Sense of Things." Many studies (Maw and Maw 1965; Day, 1971; Arnone and Grabowski 1992; Arnone, Grabowski, and Rynd 1994) have operationalized curiosity in terms of how curiosity is demonstrated by a child, such as reacting positively to new or incongruous elements in the environment by exploring them, a desire to know more about one's environment (e.g., asking lots of questions), and persistence in exploring stimuli to better understand the unfamiliar. The curiosity items in this study's scale tapped into those elements. We used a five-point Likert scale ranging from "not at all true" to "very true." Five of the original six items loaded cleanly on one factor with a Cronbach's alpha reliability coefficient of .79, considered acceptable for exploratory research. We combined the five items below into a single composite:

> If something doesn't make sense to me, I tend to explore for answers until it does (make sense).
> I'm always asking questions and finding out how things work.
> Even if I don't find the answers to my questions right away, I will keep looking until I do.
> When I am curious about a topic, I enjoy the challenge of finding information to satisfy my curiosity.
> The more curious I am, the more questions I tend to ask.

## Perceived Competence in Information Skills

This instrument was refined from the pilot study and included seventeen items related to specific information skills. The instrument had high internal consistency (Cronbach's a = .93). Students responded to statements on a five-point Likert scale. Examples of items included the following:

I am *confident* in my ability to do well in the activities listed below:

> Formulating smaller (more specific) questions that help me narrow down my big (broad) research topic.
> Locating information on my research topic in sources like books, databases, encyclopedias, and websites.
> Recognizing if information I find is biased or slanted toward a particular point of view.

To establish construct validity, we correlated PCIS with a validated instrument from the family of SDT questionnaires, the four-item Perceived Competence in Learning scale applied to the domain of research ability ($r = .74$, $p < .001$). The correlation was strong, which would be expected of two measures (one more general and the other more specific) that tap into similar domains using the same motivational construct.

## Perceived Competence in Digital Technology Activities

This instrument was refined from the pilot study and included eleven items related to specific digital skills. The instrument had high internal consistency (Cronbach's a=.92). Students responded to statements on a 5-point Likert scale. Examples of items included:

> I am confident in my ability to be productive with technology.
> I am confident in my ability to express ideas with technology.
> I am confident in my ability to have fun with my friends with technology.

<.001. Establishing a significant relationship between the PCTA measure and actual performance on the DL test could be seen as a form of concurrent validity.

## Reading Enjoyment

This 3-item scale was operationalized with the following items, scored on a 5-point Likert scale of 1=not at all true, 2=not usually true, 3=sometimes true, 4=usually true, 5=very true: "I read for pleasure whenever I can," "I enjoy reading in at least one genre (e.g., fiction, non-fiction, poetry, realistic fiction, etc.)," and "I like to read in a variety of formats including books, magazines, and the Web."

Table 4 shows the composite reliabilities of each of the construct measures.

## Perceived Competence in Reading

Perceived competence in reading is the traditional literacy counterpart to perceived competence in information skills. While this variable was less of an influence in our research than information skills, we included it in our hypotheses because it reflects another affective variable indicating one's level of confidence. We operationalized this item in our research as "please rate yourself in terms of your reading ability" (1 = poor, 2 = fair, 3 = good, and 4 = excellent).

## Parent Education

We measured parent education as an additive combined mean of two items asking "please choose one of your parents or legal guardians. What is the highest level of education for this parent or legal guardian?" and "Now, if you have another parent or legal guardian, what is the highest level of education for your *other* parent or legal guardian?" Response categories included 1 = did not complete high school; 2 = completed high school; 3 = completed high school, attended some college; 4 = completed college (at least 4 years); 5=completed college, attended some graduate school; 6=completed graduate school.

## Self-Reported Grades

We operationalized self-reported grades as a single item asking "what grades do you usually get on your report card?" with response categories 1 = all As (or 4s); 2 = mostly As and some Bs (or

4s); 3 = mostly Bs and some Cs (or 3s); 4 = mostly Cs and some Ds (or 2s); 5 = mostly Ds and Fs (or 1s).

Table 5 shows the descriptive statistics of all the variables used in the analyses.

### Data Analysis

We used the ordinary least squares (OLS) regression method to analyze the survey data. Our outcome variable of IL is interval level, thus this method is appropriate. We checked the correlations of independent variables, and none of them were prohibitively high, so they may be included in the analyses simultaneously. We performed several other diagnostics to ensure our data met the requirements of OLS regression analysis. Table 6 reflects Pearson correlation coefficients for the variables used in the IL and DL models. The relationship between the two reading variables (perceived competence and enjoyment of reading) and perceived competence in information skills appears to be higher than the correlation between the reading variables and perceived competence in digital technology activities. Furthermore, the reading variables appear to correlate slightly more so with the actual information skills test than the digital skills test. These preliminary findings may suggest that the reading variables play a stronger role in the IL models than in the DL models. Both perceived competence in information skills and perceived competence in digital technology skills correlate strongly with curiosity. Using the theoretical framework of SDT, which has "need for competence" at the heart of curiosity, we would expect these two motivational constructs to be at least moderately correlated. As expected, information skills and digital technology knowledge were found to be strongly correlated, $r = .72$, $p < .001$. Perceived competence in information skills and perceived competence in digital technology activities were also found to be moderately correlated, $r = .58$, $p < .001$.

## Results

To test the study's hypotheses we conducted OLS regression, testing four models of four sets of independent variables' contribution to information skills. We tested parallel models for digital technology knowledge.

### Information skills models

In the first model, we measured just the demographic variables of self-reported grades and parent education for their contribution to information skills. In the second model we measure the contribution of curiosity to information skills over and above the demographic variables. If curiosity contributes significantly to the dependent variable over and above the demographic variables, then this result supports hypothesis 7: *The greater a student's disposition to read for enjoyment, the better the performance will be in a test of IL.*

In the third model, we measure just the perceived competence and reading variables' contribution to actual information skills over and above the demographic variables. If the perceived competence and reading variables contribute significantly to the dependent variable over and above the educational demographic variables, then this result supports our theoretical proposition regarding the contribution of perceived competence and reading towards information literacy knowledge.

In the fourth model we measure all of the independent variables together for their contribution to information skills. Results are presented in Table 7.

Regression results for model 1 indicate the contribution of parent education and self-reported grades to information skills on their own. For model 1, the $R^2$ results are statistically significant: $F(2, 909) = 99.02$, $p < .001$, accounting for 18 percent of the variation in scores for IL and information skills.

In the correlation matrix in table 6, we see that curiosity is positively correlated to information skills, with a Pearson correlation coefficient of .30 ($p < .01$). Results for model 2 indicate the contribution of curiosity to information skills above the demographic variables. For model 2, the $R^2$ change is .02 above model 1, and the results are statistically significant: $F(3, 908) = 76.15$, $p < .001$. In this model, we see that curiosity contributes significantly on its own to information literacy knowledge, over and above the demographic variables. Parent education and school performance, because of their relation to information skills, may play a role as mechanisms by which curiosity operates.

Results for model 3 indicate the contribution of perceived competence in information skills, reading enjoyment, and perceived competence in reading to information skills above the demographic variables. For model 3, the $R^2$ change is .12 more than model 1, and the results are statistically significant: $F(5, 903) = 78.18$, $p<.001$. In this model, we see that perceived competence in reading appears to contribute most, followed closely by reading enjoyment and perceived competence in information skills. All contribute significantly on their own more than the demographic variables.

Finally, in model 4 we add curiosity to the overall model, and we see that it is no longer a significant contributor. We expect this is because curiosity is a covariate of perceived competence for information skills. Indeed, the two are correlated in bivariate analysis at a Pearson correlation coefficient of .58**, quite high.

The results support the four IL hypotheses posed by this study:

> H1: The greater a student’s curiosity, the better the performance will be in a test of IL.
> H3: The higher a student’s perceived competence in information skills, the better the performance will be in a test of IL.
> H5: The higher a student’s perceived competence in reading, the better the performance will be in a test of IL.
> H7: The greater a student’s disposition to read for enjoyment, the better the performance will be in a test of IL.

Regression results indicate that the three independent variables addressed in the above hypotheses all contribute significantly on their own to information skills, over and above the educational demographic variables of self-reported grades and parent education. Furthermore, regarding H1, in the final combined model curiosity appears to be closely related to perceived competence in information skills, and while curiosity contributes independently to information skills in regression, when perceived competence in information skills is entered into the equation, it pulls some of its strength as a contributor from curiosity. Theoretically, this makes sense because curiosity emerges out of a need for competence—which also underlies perceived competence in information skills. Additionally, both measures are affective and motivational constructs, so the correlation between them picks up this commonality as well. We expect that the perceived competence in information skills simply worked better for predicting scores in the knowledge realm because it was more closely aligned with specific IL skills than was the generalized curiosity measure. That the study was able to definitively support the connection between constructs (both affective and motivational) and measures of actual IL is an important finding.

## Digital Technology Knowledge Models

In the first model, we measured just the demographic variables of self-reported grades and parent education for their contribution to digital technology knowledge. In the second model we measured the contribution of curiosity to digital technology knowledge above the demographic variables. If curiosity contributes significantly on its own over and above the demographics, then this result supports hypothesis 8: *The greater a student's disposition to read for enjoyment, the better the performance will be in a test of DL.*

In the third model, we measured just the contribution to perceived competence and reading to digital technology knowledge above the demographic variables. If perceived competence and reading variables contribute to digital literacy knowledge in the combined model, then this result supports to our theoretical proposition regarding a relationship between perceived competence and reading towards digital literacy knowledge.

Finally, in model 4 we measure all of the independent variables together for their contribution to digital technology knowledge. Results are presented in table 8.

Regression results for model 1 indicate the contribution of parent education and self-reported grades on their own to digital technology knowledge. For model 1, the $R^2$ results are statistically significant: $F(2, 868) = 90.55$, $p<.001$, accounting for 17 percent of the variation in digital technology knowledge.

In the correlation matrix in table 6, we see that curiosity correlates closely to digital skills, with a Pearson correlation coefficient of .29 ($p < .01$). Results for model 2 indicate that curiosity contributes on its own to digital technology knowledge more than the demographic variables. For model 2, the $R^2$ change is .03 more than model 1, and the results are statistically significant: $F(3, 867) = 70.78$, $p < .001$.

Results for model 3 indicate that perceived competence in information skills, reading enjoyment, and perceived competence in reading contribute to digital skills above the demographic variables. For model 3, the $R^2$ change is .17 more than model 1, and the results are statistically significant: $F(5, 867) = 88.85$, $p < .001$. In this model, we see that perceived competence in reading appears to contribute most, followed closely by reading enjoyment and perceived competence in information skills.

Finally, for model 4 we added curiosity to the overall model, and we see that it is no longer a significant contributor. We expect this is because curiosity is a partial covariate of perceived competence for technology skills. Indeed, the two are correlated in bivariate analysis at a Pearson correlation coefficient of .46**.

The results support the four DL hypotheses posed by this study:

> H2: The greater a student's curiosity, the better the performance will be in a test of DL.
> H4: The higher a student's perceived competence in digital technology activities, the better the performance will be in a test of DL.
> H6: The higher a student's perceived competence in reading, the better the performance will be in a test of DL.
> H8: The greater a student's disposition to read for enjoyment, the better the performance will be in a test of DL.

Regression results indicate that the three independent variables addressed in the hypotheses all contribute significantly to digital skills, even when accounting for the educational demographic variables of self-reported grades and parent education.

The results for the digital technology knowledge model mirror those for the information skills model. It is interesting that perceived reading ability played a significant a role in both DL and IL. This result warrants further exploration in future studies of DL. Furthermore, regarding H2, curiosity and perceived competence in digital technology activities appear to be closely related in the final model, and while curiosity contributes independently to digital skills in regression, when perceived competence in digital technology activities is entered into the equation, it pulls some of its strength as a contributor from curiosity. As this also mirrors the results for IL, the same theoretical explanation for the DL variable can be used as for IL variable posited earlier.

## The Relationship between Multiple Literacies

In a separate analysis, we explored the relationship between the two literacies studied. To do so, we measured the added effect of information literacy knowledge and perceived competence in information skills on digital literacy knowledge, in addition to the other independent variables explored. To the demographic variables of self-reported grades and parent education in model 1 we added the contribution of information skills to digital technology knowledge above the demographic variables. If perceived competence in information skills and IL knowledge contribute significantly above the demographic variables, then the result supports hypothesis 9: *The better a student performs on a test of IL, the better the performance will be in a test of DL.*

In model 3, we added the perceived competence in information skills variable and the information literacy skills knowledge variable, over and above the demographic variables to explore the total contribution of the two IL variables to digital literacy knowledge, controlling for demographics. This strongly supports hypothesis 10: *The more perceived competence a* *student has in information skills, the better the performance will be in a test of DL*. In model 4, we added the disposition to read for enjoyment to see if that variable might take away from the predictive quality of the IL variables. Results are presented in table 9.

Regression results for model 1 are naturally the same as in table 8, reflecting the contribution of the demographic variables on their own. Results for model 2, however, are compelling. For model 2, the $R^2$ change is .34 more than model 1, and the results are statistically significant: $F(3, 861) = 303.56$, $p < .001$. In this model we see the huge contribution that IL makes to digital literacy skills knowledge above the demographic variables, which are substantially diminished in model 2 as a result of adding IL knowledge into the equation. More than half of the variation in scores on the digital technology test can be accounted for in Model 2 with the addition of only 1 variable.

Results for model 3 indicate the additional contribution of perceived competence in information skills to digital technology knowledge, above demographic variables. For model 3, perceived competence in information skills contributes significantly to the model further reducing the contribution of the demographic variables and slightly reducing the contribution of the IL variable. The $R^2$ change increases to .35 more than model 1, and the results are statistically significant: $F(4, 862) = 235.43$, $p < .001$.

In model 4, we added reading enjoyment and see that reading enjoyment contributes significantly (though not as much as the other variables), but there is no change in $R^2$.

It is important to note that information and digital literacy knowledge are correlated at an R of .72; we need to consider the extent to which these indices may co-vary. Indeed while some of the standards align, many are divergent, with the information literacy standards emphasizing text, information credibility, and sourcing to a much larger extent. Greater explication is needed of these two broad educational constructs, and the overlaps and distinctions among the standards that serve as learning objectives for cultivating the literacies in students.

# Discussion

According to SDT, enhancement of perceived competence in any domain can lead to enhancement of learning outcomes and affectiveness in the same domain; one’s perceptions of competence are causal contributors to actual effectual performance. Our findings support this theory in both the information skills and digital technology domains.

Our results support the hypotheses that in both the information skills and digital technology domains, curiosity, perceived competence in information skills, perceived competence in digital technology activities, perceived competence in reading, and reading enjoyment contribute to actual information skills and digital technology knowledge in eighth-graders. Curiosity appears to have a smaller influence on information and digital skills than perceived competence in these domains. Curiosity emerges out of a need for competence, and this same need underlies the perceived competence measures. It follows that the more specific skill–oriented perceived competency measures were better able to predict actual knowledge. The strong correlations of perceived competence and curiosity in both domains suggest that stimulating and having opportunities to act on curiosity are essential to building perceived and actual competence. Strategies for fostering curiosity are offered under "Implications for Instructional Design."

The model including perceived competence in information skills, perceived competence in reading ability, reading for enjoyment, and demographics accounts for about 30 percent of the variation in information skills achievement as measured by the knowledge test in our sample of eighth-graders. This represents an increase in 12 percent points in the variance accounted for by the nondemographic variables. In the digital literacy domain, the model including perceived competence in digital technology activities, and perceived competence in reading ability, reading for enjoyment, and demographics explain 34 percent of the variation in digital literacy knowledge. When controlling for demographics, the main independent variables explain 17 percent of the variation. It appears that the demographic variables of student grades and parent education each contribute at a similar level to both actual information skills and actual digital technology knowledge.

Our findings support AASL's inclusion of support for affective qualities (i.e., dispositions in action) in the new Standards for the 21st Century Learner (2009b). On the technology standards side, the findings also support the future inclusion of affect and motivation as dimensions of ISTE's influential NETS standards for students' technology learning (2007).

Our findings also are important because they highlight the extent to which perceived reading ability and reading enjoyment contribute to information skills. The AASL standards suggest that reading is a foundational skill for all learning and a key indicator of success in school and in life, and that reading ability is also required for personal growth and enjoyment (2007). The relationships between reading and information skills may signal that the broad construct of IL also plays a role in the outcomes of learning, personal growth, and enjoyment because reading is one facet of the constructive and dynamic application of information skills. The findings also empirically support the important role that reading plays in IL, which has implications for SLMSs' information skills pedagogy. These hypotheses require further exploration.

Similarly, the results for reading and digital technology knowledge are notable, and future research into DL should address perceived and actual reading skills as a key underlying contributor to digital technology knowledge in young people. While virtual technology environments reflect an ever-growing range of multimedia beyond text, it appears that perceived reading ability plays a role in achieving the abilities reflective of the range of ISTE's NETS standards. Socioeconomic status also appears to contribute to both digital and information skills of eighth-graders as far as student-reported parent education level is an indicator of socioeconomic status.

Finally, this study provided some initial evidence that multiple literacies are becoming integrated in today's youth, which we expect is occurring through both their naturalistic home information and technology uses along with their prescribed school uses because as we know technology is still going largely underused in the school setting. Students who have strong skills in one literacy may be expected to have strong skills in a related literacy. The fact that IL was the best predictor of digital technology knowledge is an important finding. While we may intuitively suspect that such a relationship is strong because both constructs reflect a test-taking scenario (and fittingly, information skills pulls from parent education and self-reported grades when added to the model—suggesting it may partially reflect overall school achievement), this is the first study in the library media field to demonstrate such a connection between traditional information skills and technology knowledge. This finding also substantiates the "6th common belief" that provides the foundation for the new AASL standards: "Multiple literacies have now joined information literacy as crucial skills for this century" (2009, 13). More research is needed to further explore the redundancies of various literacies, possibly culminating in the creation of one measure with several subfactors that captures multiple literacies.

## Strengths and Limitations of the Study

A strength of the study was its large sample size. Additionally, the sample was distributed widely across the United States. A limitation was that a convenience sample was used. Librarians' self-selection as volunteers in participating may have led to responses from more advantaged, engaged participants. This may have been a factor in our study's over representation of middle-needs schools, overrepresentation of whites and under-representation of blacks, Hispanics, and Native Americans.

Additionally, all survey items besides the knowledge tests were based on self-reported student perceptions, which is always a limitation in survey research of this kind. Furthermore, the technology knowledge test that was developed in 2005 may now be out-of-date as its items do not address social media uses. However, by adding 5 new items related to newer media such as social networking, we attempted to reduce this limitation.

A strength to external validity is that we conducted the study in a natural school setting with students' own school librarians as opposed to in a lab environment, and we clearly communicated that responses were anonymous and confidential to their school officials, teachers, and librarians (and the researchers). Furthermore , we derived the measures for the predictor variables from validated instruments. The measures for the dependent variables were reasonably reliable and received construct validity when correlated to existing validated instruments. Strengths to the study's internal validity included careful procedure development and an online training website to facilitate continuity of the administration process across the forty-seven sites. Additionally, none of the researchers participated in administering the surveys across any of the sessions, protecting against inadvertent researcher bias. Finally, the study's instruments had the opportunity to be refined through the incorporation of a pilot study of 279 students in 9 schools prior to the administration of the main study in 2008.

## Implications for Curriculum Design

The study demonstrated a close relationship between curiosity and perceived competence in information skills. This result supports the inclusion of curiosity-arousing strategies in an IL curriculum. In an article on instructional design strategies that foster curiosity, Arnone (2003) suggests the following list. After each strategy is included a specific example.

### Curiosity as a Hook

Use curiosity as a primary motivator at the beginning of a lesson by starting, for example, with a thought-provoking question or surprising statement (Small and Arnone 2000).

**Conceptual Conflict**

Introduce a conceptual conflict when possible. Learners will feel compelled to explore the conflict until it is resolved. When the student has resolved the conceptual conflict, he/she will sense a feeling of satisfaction.

**An Atmosphere for Questions**

Create an atmosphere where students feel comfortable about raising questions and where they can test their own hypotheses through discussion and brainstorming. Not only does this foster curiosity but it helps to build confidence.

**Time**

Allow adequate time for exploration of a topic. If the teacher has been successful in stimulating curiosity, then learners will want to persist in that exploration.

**Choices**

Give students the opportunity for choosing topics within a subject area.

**Curiosity-Arousing Elements**

Introduce one or more of the following elements into a lesson to arouse curiosity: incongruity, contradictions, novelty, surprise, complexity, uncertainty. Learners will desire to explore the source of the incongruity, contradiction, novelty, uncertainty, etc., and the resulting information will satisfy their curiosity.

**The Right Amount of Stimulation**

Be aware of the degree of stimulation that is being entered into the learning situation. Remember, there are individual differences when it comes to curiosity. Some learners will become anxious if the stimulus is too complex, too uncertain, too novel, etc. (Gorlitz 1987). They may quickly leave what Day (1982) refers to as the Zone of Curiosity and enter the Zone of Anxiety.

**Exploration**

Encourage students to learn through active exploration.

**Rewards**

Allow the exploration and discovery to be its own reward. "Exploration is self-rewarding (Day 1982, 19)." Use external rewards judiciously as some studies have shown that extrinsic rewards given for a task that a learner finds intrinsically motivating may dampen future interest in the activity.

**Modeling**

Model curiosity. Ask questions. Engage in specific exploration to resolve a question posed, and demonstrate enthusiasm.

To instill curiosity in students is to encourage their disposition to learn. To ignore its importance is to risk diminishing, if not losing, the endowment of curiosity conferred upon all at birth. (Arnone 2003)

The results of this study highlight the need for interventions that integrate both reading (basic literacy) and IL and DL objectives. The study also highlights the role the SLMS may play in supporting positive student affect toward IL and DL. SLMSs can play a role in observing certain affects and dispositions in students (higher or lower) in anticipation that these qualities will be partially predictive of corresponding information skills performance. Providing a supportive learning environment and clarifying the expectations for IL and DL tasks associated with research projects can help. Kulthau's research (1985) demonstrated that at the beginning stages of research, students are often apprehensive about what is expected of them, which affects their confidence. Clearly defined parameters, reassurance, and encouraging reflection are among the strategies that educators can employ to build students' perceived competence in their skills. Small and Arnone (e.g., 2000) suggest that building a motivational "toolkit" with strategies that target each phase of the research process is helpful to educators.

Studies based on SDT have shown that student performance worsens the more pressured they feel (e.g., Grolnick and Ryan 1987). One researcher and family therapist makes an important connection between the escalating pressure on children and adolescents because of high-stakes standardized testing and an increase in her child and adolescent patients presenting anxiety symptoms, including test anxiety (Schroeder 2006). Our research may support using the scales of perceived competence in information skills and perceived competence in digital technology activities to identify gaps in knowledge areas at the *beginning* of the year (instead of using an actual knowledge pretest), before the students have been introduced to an IL and DL curriculum. A perceived competence test that has no right or wrong answers and for which students are informed will *help their teacher-librarian and classroom teachers plan instruction* seems more humane in this era of test bombardment and more conducive to establishing a supportive, less stressful learning environment. A survey of student self-perceptions at the start of the year may help the educator identify target areas for improvement while reducing the risk in testing anxiety and a possible reduction in their perceived competence as a result of being tested on skills they have not yet been introduced to adequately in the curriculum. Educators could identify students who have low confidence in their skills without the embarrassment of scoring poorly on yet another "test"—especially one presented as a pretest, which may be unnecessary with the availability of a shorter, affective proxy. This may allow SLMSs to develop and implement customized interventions more creatively and apply them on an individual basis at the student level, which may affect improvements in IL and DL in the context of the curriculum.


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## Table 1. School Level Geographic Distribution, Socioeconomic Situation, and Location

| Variable | Percent | N of schools |
|---|---|---|
| Region | West, 19 | 9 |
| | Mid-West, 38 | 18 |
| | South, 6 | 3 |
| | North East, 36 | 17 |
| Socioeconomic level (self-reported by school librarian) | Low needs, 9 | 4 |
| | Average needs, 72 | 34 |
| | High needs, 19 | 9 |
| School Location | Rural, 19 | 9 |
| | Suburban, 72 | 34 |
| | Urban, 9 | 4 |

## Table 2. Student Race/Ethnicity

| Race/ethnicity category | N of students | % of total | National percentage* |
|---|---|---|---|
| Native American | 14 | 1.10 | 1.20 |
| Asian and Pacific Islander | 54 | 4.30 | 4.60 |
| Black | 86 | 6.80 | 17.20 |
| White | 927 | 73.70 | 57.10 |
| Other | 34 | 2.70 | - |
| Hispanic/ Latino | 138 | 11.00 | 19.80 |

*National percentage figures reflect all students enrolled in U.S. elementary and secondary schools in 2005. (http://nces.ed.gov/pubs2008/nativetrends/tables/table_2_1a.asp).

## Table 3. Student Gender

| Gender | N | % |
|---|---|---|
| Male | 677 | 46.2 |
| Female | 582 | 53.8 |

## Table 4. Reliability of Study Constructs

| Reliability | Cronbach's alpha |
|---|---|
| Perceived competence in information skills: 17 items | .93 |
| Perceived competence in digital technology activities: 11 items | .92 |
| Read for enjoyment: 3 items | .80 |
| Curiosity: 5 items | .79 |
| Information skills: 25 items | .81 |
| Digital technology: 43 items | .86 |

**Table 5. Descriptive Statistics of Measures Used in the Analyses**

| Variable pist | Project participants | | |
|---|---|---|---|
| | **M** | **SD** | **N** |
| Parent education | 3.65 | 1.35 | 993 |
| Self-reported grades | 3.78 | .98 | 1209 |
| Perceived competence in reading | 4.06 | .99 | 1204 |
| Enjoyment of reading | 3.51 | 1.14 | 1266 |
| Perceived competence in information skills | 3.89 | .67 | 1259 |
| Perceived competence in digital technology activities | 4.04 | .72 | 1156 |
| Curiosity | 3.68 | .72 | 1268 |
| Information skills knowledge | 13.71 | 4.98 | 1204 |
| Digital technology knowledge | 27.03 | 7.40 | 1156 |

**Table 6. Pearson Correlation Coefficients for Variables Used in the Analysis**

| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|---|
| 1. Parent education | 1 | | | | | | | | |
| N | 993 | | | | | | | | |
| 2. Self-reported grades | .27** | 1 | | | | | | | |
| N | 921 | 1209 | | | | | | | |
| 3. Perceived competence in reading | .13** | .22** | 1 | | | | | | |
| N | 917 | 1204 | 1204 | | | | | | |
| 4. Enjoyment of reading | .17** | .18** | .49** | 1 | | | | | |
| N | 955 | 1208 | 1203 | 1266 | | | | | |
| 5. Perceived competence in information skills | .28** | .35** | .41** | .48** | 1 | | | | |
| N | 952 | 1209 | 1204 | 1258 | 1259 | | | | |
| 6. Curiosity | .22** | .25** | .33** | .41** | .58** | 1 | | | |
| N | 954 | 1207 | 1202 | 1264 | 1258 | 1268 | | | |
| 7. Perceived competence in digital technology activities | .18** | .16** | .28** | .33** | .58** | .46** | 1 | | |
| N | 926 | 1078 | 1073 | 1118 | 1115 | 1116 | 1159 | | |
| 8. Information skills knowledge | .27** | .39** | .43** | .40** | .41** | .30** | .32** | 1 | |
| N | 918 | 1200 | 1195 | 1203 | 1204 | 1202 | 1071 | 1204 | |
| 9. Digital technology knowledge | .30** | .38** | .42** | .37** | .38** | .29** | .41** | .72** | 1 |
| N | 926 | 1074 | 1069 | 1114 | 1111 | 1112 | 1141 | 1069 | 1156 |

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

### Table 7. Ordinary Least Squares Regression Predicting Actual Information Skills Knowledge

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Variable List** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** |
| Curiosity | | .16*** | | .004 |
| Perceived competence in information skills | | | .10** | .10** |
| Enjoyment of reading | | | .15*** | .15** |
| Perceived competence in reading | | | .21*** | .21** |
| Parent education | .17*** | .15*** | .12*** | .18** |
| Self-reported grades | .34*** | .31*** | .24*** | .34** |
| Intercept | 7.5 | 2.2 | -2.2 | -2.17 |
| n | 911 | 911 | 908 | 906 |
| $R^2$ | .18 | .20 | .30 | .30 |
| Adjusted $R^2$ | .18 | .20 | .30 | .30 |

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

### Table 8. Ordinary Least Squares Regression Predicting Actual Digital Technology Knowledge

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Variable List** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** |
| Curiosity | | .16*** | | -.01 |
| Perceived competence in technology skills | | | .22*** | .22** |
| Enjoyment of reading | | | .09** | .10** |
| Perceived competence in reading | | | .26*** | .26*** |
| Parent education | .20*** | .18*** | .14*** | .15*** |
| Self-reported grades | .31*** | .29*** | .22*** | .22*** |
| Intercept | 14.17 | 7.09 | -.512 | -.351 |
| n | 870 | 870 | 862 | 860 |
| $R^2$ | .17 | .20 | .34 | .34 |
| Adjusted $R^2$ | .17 | .19 | .34 | .34 |

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

**Table 9. Ordinary Least Squares Regression Predicting Actual Digital Technology Knowledge Based on Information Skills Knowledge and Perceived Competence in Information Skills**

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| **Variable List** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** | **Standardized Beta** |
| Information literacy knowledge | | .65*** | .62*** | .61*** |
| Perceived competence in information skills | | | .11*** | .08** |
| Enjoyment of reading | | | | .07** |
| Parent education | .20*** | .09*** | .08*** | .08** |
| Self-reported grades | .31*** | .08*** | .06*** | .06** |
| Intercept | 14.15 | 11.96 | 5.77 | 5.63 |
| n | 864 | 863 | 862 | 861 |
| $R^2$ | .17 | .51 | .52 | .53 |
| Adjusted $R^2$ | .17 | .51 | .52 | .52 |

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