
The Effect of Early Adolescents' Psychological Needs Satisfaction upon Their Perceived Competence in Information Skills and Intrinsic Motivation for Research

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The American Association of School Librarians' Standards for the 21st Century Learner make clear that information skills alone are not sufficient for student success; students must also value those skills, use them in a productive and responsible manner, and have the motivational "dispositions in action" to support successful research and independent lifelong learning. Self-determination theory highlights perceived competence and autonomy as two basic psychological needs that support intrinsically-motivated behavior. This study investigates the extent to which context factors inherent to the school library influence students' perceived competence in the domain of information skills (PCIS), and their intrinsic motivation for research (IMR). The study explores this relationship among 1272 eighth grade 13-year old students in 20 states. Findings indicate that student perceptions of their school librarian's autonomy supportiveness and their perceptions of the librarian's technology competence contribute significantly to PCIS and IMR. These findings are important in that they highlight the important role that the school librarian may play in influencing student affect towards the activity of information uses and research, and likely their consequent learning outcomes.

Introduction

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 effectively use that information for the problem or issue at hand" (National Forum on Information Literacy, 2008, main page). That information literacy is the "ability to find and use information" was also the basic definition put forth by the American Association of School Librarians (AASL) for many years in what had become a bible of sorts for school library media specialists in the United States, *Information Power: Building Partnership for Learning* (American Library Association, 1998, p. 1). New updated standards were announced in 2007 and further refined in 2008. AASL's new *Standards for the 21st Century Learner* (2008) encompass not only skills that contribute to multiple literacies but also their affective and motivational counterparts. A number of researchers have been arguing the critical importance of such issues

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in information seeking behaviors for years (see, for example, Bilal, 2002; Bilal & Kirby, 2002; Bilal, 2005; Ke & Zhang, 2008; Kuhlthau, 1993; Nahl, 1993; Nahl, 2007; Small & Arnone, 2000; Wang, Hawk & Tenopir, 2000).

The new standards make clear that information *skills* alone are not sufficient for student success; students must also value those skills, use them in a productive and responsible manner, and have the motivational “dispositions in action” to support successful research and independent lifelong learning. AASL defines dispositions as “the learning behaviors, attitudes, and habits of mind, that transform a learner from one who is *able* to learn to one who actually *does* learn” (AASL, 2008, p. 2). Katz defines a disposition as “a tendency to exhibit frequently, consciously, and voluntarily a pattern of behavior that is directed to a broad goal” (1994, What are Dispositions, para. 2). Dispositions include students’ perceived competence in their information skills (PCIS)—their confidence in information-seeking abilities; they also include students’ intrinsic motivation to use these skills to engage in research (IMR) for either school or personal interests.

Recent research provides support for the finding that students’ disposition of perceived competence in their information skills (PCIS) contributes positively towards their actual information knowledge, as measured by a validated information skills knowledge test (Arnone, Reynolds & Marshall, 2008). Further, Farmer (2004) found significant correlations between students’ self-perceptions of their research ability and students’ social and emotional student attributes including emotional resilience, getting along, and persistence.

In the school library, the librarian plays an important role in supporting student dispositions and affects, such as perceived competence in information skills. Self-determination theory (Deci & Ryan, 2000) suggests one effective way for adult guides (whether they be parents, educators or others in a learner’s environment) to support learners’ intrinsically motivated behavior is to support students’ feelings of autonomy—that is, their feeling of having choice and control.

This study applies the tenets of self-determination theory to the domain of information skills learning, exploring the variables that contribute to student dispositions for information literacy, including students’ perceptions of the autonomy-supportiveness of their school librarian. The study is part of a larger investigation on digital and information literacy and 21st Century dispositions for learning among early adolescents (average age of 13 years), supported by a U.S. National Leadership Grant from the Institute of Museum and Library Services (IMLS).

Literature Review

A social-contextual relationship less studied in the school library field is the effect of the autonomy-supportive style of the school librarian on student perceived competence and quality of motivation (intrinsic, as opposed to extrinsic). As an outcome of findings on relationships among various student affects, Farmer (2004) suggested that library media specialists and classroom teachers need to pay special attention to these affective and motivational factors which Farmer suggests are also “key skills.” Studies in general classroom contexts have found support for the contribution of teachers’ autonomy-supportiveness to students’ perceived academic competence (Deci, Schwartz et al., 1981), intrinsic motivation (Deci, Nezlek & Sheinman, 1981) and achievement (Flink, Boggiano, Main, Barrett & Katz, 1992). This article

expands on that work and explores autonomy as one of several basic psychological needs, the improved support of which in other domains has yielded stronger student outcomes.

Self-Determination Theory

One of the most prominent and tested theories of motivation is self-determination theory (SDT). SDT is the result of many decades of work by Edward Deci, colleague Richard Ryan and others from the University of Rochester, and a wide community of scholars. This theory contends that need for competence (to be effective), autonomy (to have choice and control over one's life), and relatedness (to feel connected to others, loved, and cared for) underlie human behavior, are innate needs, and are essential to psychological growth and well-being (Deci & Ryan, 2008; Deci & Ryan, 2000; Deci & Ryan, 1985). All three needs must be fulfilled for optimal psychological health. Individuals will generally pursue goals which allow for these needs to be met. When these needs are satisfied, they contribute to intrinsically motivated action. SDT builds on the earlier work of researchers who have explored need for competence and autonomy (e.g., White, 1959) and has been used in hundreds of studies and in educational contexts as well as clinical settings (e.g., Deci, Koestner & Ryan, 1999; Ke & Zhang, 2008; Reeve & Deci, 1996; Vansteenkiste, Simons, Lens, Sheldon & Deci, 2004).

According to self-determination theory, perceived competence as a basic psychological need is critical to goal achievement. Other studies from the information science literature have also found that student confidence can be tied to actual performance (e.g., Cheong, 2008; Nahl, 1993). Applying this concept to the domain of information literacy skills, a student who does not feel competent, for example, to ask good research questions, to refine a topic, to locate and access appropriate resources, and so on, is less likely to have successful outcomes in the research process and resulting products. In fact, perceived competence in information skills (PCIS) has been shown to contribute to actual information literacy performance as measured by a knowledge and skills test of the domain (Arnone, Reynolds, & Marshall, 2008).

Intrinsic motivation occurs when an individual engages in a particular task or behavior because it is enjoyable and satisfying in itself (as opposed to reward-bearing) and because it is optimally challenging. Generally-speaking, SDT specifies that, via their contribution to basic psychological needs, feelings of autonomy along with perceived competence and relatedness contribute to intrinsic motivation and to overall well-being.

Intrinsic motivation resides within the individual, but the environment plays an important role in supporting an individual's feelings of self-determination and motivation. The educational environment plays an important role in the lives of youth in creating a context that might or might not be conducive to self-determined behavior. For instance, in a prior study in an educational setting, students who perceived their teachers to be uncaring or cold were observed as less intrinsically motivated (Ryan & Grolnick, 1986).

One way to meet student needs for autonomy is through instruction that offers an autonomy-supportive learning climate. Further, the very activities that students engage in within the library context (informally searching, finding and using resources to support unique individual information needs and interests) may contribute quite strongly towards their overall feelings of autonomy. The climate of the library media center and the approach of the school librarian, in addition to other social influences such as family, friends, school teachers, members

of one's church, and so on, all contribute to both perceived autonomy support and a sense of relatedness. Within the school setting, the school library may be uniquely suited to doing so, because it is one of the few locations in schools where informal, self-determined, intrinsically-motivated inquiry and learning can occur (and is in fact encouraged). The school librarian plays a key role in shepherding students towards using library resources in a beneficial way that supports their individual interests. This study explores students' perceived autonomy support (PAS) of their school librarian, as a contributor to their perceived competence and motivation to engage in research.

In addition to PAS, we also explore students' perception of their school librarian's technology competence as an indicator of the students' own perceived competence for information seeking and motivation for research. This construct provides an added dimension of supportiveness of the school library context. In this case, the student perception of her/his librarian's technology competence may indicate that the school librarian is not only autonomy-supportive, but also knowledgeable and active in using technology in the library context and encouraging of its use by students. In this regard, 2008 policy brief from ISTE states that "When schools, community leaders, and families demonstrate the effective use of technology for learning, communication, and project management, student motivation and interest in using technology in their own work is positively affected" (p. 8). If student perceptions of her/his school librarian's technology competence contribute to PCIS and IMR, this finding has important implications because it draws a potential line between librarian technology competence and student outcomes. Such a finding would provide empirical evidence for the importance of school librarians keeping current with technology and encouraging technology uses by students as ways to engender confidence and motivation.

The Research Model

Two major variables in the analyses represent needs satisfaction as conceptualized in SDT: 1) the basic psychological needs satisfaction in life, and 2) perceived autonomy-support in the specific social context of the school library. Other factors that may contribute to perceived competence and intrinsic motivation in a research context were also added to the model. These variables include student perceptions of their school librarian's computer competence, and two frequency variables: 1) the frequency of using non-Internet-based library resources for research (specific context of school library), and 2) the frequency of students' conducting online research to satisfy their curiosity about something (broad context including home or school). We expected that frequency of engagement in research, while a self-report, would more fully round out the contextual constructs, contributing in the model as a proxy for students' actual behavior. We expected that students' self-reported frequency of engagement in these activities would also be contributors. We anticipated that this relationship would be bi-directional.

To test the robustness of the above model, we then added two more demographic/education variables that might account for some of the variation in the dependent variables: parent education and self-reported grades.

Hypothesis 1. Relationships between main predictor variables and perceived competence in the domain of information skills

H1a: The more autonomy-supported a student feels in the school library context, the greater the perceived competence will be in the domain of information skills.

H1b: The higher the satisfaction of basic psychological needs in life, the greater the perceived competence will be in the domain of information skills.

H1c: The more a student perceives that their school librarian has a strong understanding of computers, the greater the perceived competence will be in the domain of information skills.

H1d: The more often a student uses library resources for research, the greater the perceived competence will be in the domain of information skills.

H1e: The more often a student searches online to satisfy curiosity about something, the greater the perceived competence will be in the domain of information skills.

Hypothesis 2. Relationships between main predictor variables and intrinsic motivation to engage in research.

H2a: The higher the satisfaction of basic psychological needs in life, the more likely it is that the student will be intrinsically motivated to engage in research.

H2b: The more autonomy-supported a student feels in the school library context, the more likely it is that the student will be intrinsically motivated to engage in research.

H2c: The more a student perceives that his/her school librarian has a strong understanding of computers, the more likely it is that the student will be intrinsically motivated to engage in research.

H2d: The more often a student uses library resources for research, the more likely it is that the student will be intrinsically motivated to engage in research.

H2e: The more often a student searches online to satisfy curiosity about something, the more likely that the student will be intrinsically motivated to engage in research.

METHODS

Sampling and Procedures

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

The main study data collection was conducted in the spring of 2008 with a large convenience sample of US 8th grade students (N=1272) and their school librarians (N=46). Main study schools were recruited during January and February 2008 from open invitations posted to the mailing list of the American Association of School Librarians Forum (AASL Forum) and to the listserv of a knowledge and skills assessment of information literacy called Tools for Real-Time Assessment of Information Literacy Skills (TRAILS-9) (Schloman & Gedeon 2007). Interested individuals completed an initial online interest questionnaire which provided information about the study and collected demographics and contact information. A small gift of \$200 to be used in the school library was provided as an incentive for participation in the full study since participation was somewhat demanding of both the students and the school librarian.

School librarian participation in the study both as administrators and participants was an important aspect of the study. Evidence-based practice by school librarians has been encouraged in the past several years in the literature (e.g., Loertscher & Todd, 2003). Evidence-based practice is accomplished through action-based research in which the school librarian collects data in order 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 the listserv solicitations, but some determined the schedule of participation would be too demanding (given 3 survey sittings). Ultimately, 47 schools fully participated in all three sessions of the study. The 47 schools included 46 school librarians. An average of 27 adolescents (average age of 13) participated from each school. Twenty U.S. states were represented in the sample. The geographical distribution, socio-economic status, and setting of the schools sampled are indicated in Table 1. The data source for Table 1 is the pre-screening participant recruitment survey for the 47 school librarian participants. Each school librarian and student guardian was requested to complete a consent form for participation, providing permission and assuring participant anonymity and privacy.

Table 1. School level geographic distribution, socio-economic situation, and location

Variable	Percent	Total N of schools
Region	West 19%	9
	Mid-West 38%	18
	South 6%	3
	North East 36%	17
Socio-economic 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

Protection of Minors

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 signed parental/guardian permission forms were acquired for student participation for all 1272 students with copies of permission forms residing both at Syracuse University and with the

participating schools. Additionally, the administrator protocol required school librarians to orally inform students 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. Participants were also made aware that their responses to the survey would remain anonymous. No limitations were placed on time allocation, and students' time to complete each of the surveys ranged from 25 to 35 minutes.

Training

The school librarians were trained to implement the surveys through their study of the online instructions provided on the project training website. Participants did not know the specific content of the questionnaires prior to administration. School librarians 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 as a whole. Each participant was emailed an Excel spreadsheet for his/her school, providing unique participant ID numbers. A survey administration script, the online survey links, and two support phone numbers were also provided. Participating schools carried out a hardware and software compatibility test to ensure browser compatibility when linking to surveys. School librarians had flexibility in determining the most convenient times for them to access and administer the sessions; however, all three surveys were completed within an 8-week timeframe at each location, as requested. The development of the instruments used in both the pilot and main studies are discussed in a separate article currently in production.

The ethnic backgrounds and gender of the student participant sample are given in Tables 2 and 3 below, derived from the full study student survey as data source. The convenience sample appears to over-represent white students and under-represent black and Hispanic/Latino students.

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%

Constructs and Measures

A number of measures were used to test the stated hypotheses. For the independent variables, they included the following five measures.

Basic Psychological Needs Satisfaction (BPNS). BPNS can be defined as the extent to which a student's needs for autonomy, relatedness, and competence are satisfied in general in her life. It encompasses in part a student's relatedness with others. The original version of this scale (Gagne, 2003) included 21 items but sometimes the scale has been used with fewer items. We used 14 of the items most applicable to the age group of our sample. Even with a reduction in items, reliability at .79 was still reasonable for an exploratory study. Students responded to statements on a 5-point Likert scale ranging from *not at all true* to *very true*. Sample items from this scale are below:

- I generally feel free to express my ideas and opinions.
- I feel like I can pretty much be myself in my daily life.
- People in my life care about me.

Learning Climate Questionnaire (Perceived Autonomy-Support). This measure from the SDT questionnaires has been used in a number of studies across different domains including children's education (Gagne, 2003; Grolnick & Ryan, 1987). Perceived autonomy support indicates the degree to which an individual perceives others who are in leadership or authority positions to be supportive of their autonomy or independence. Some studies have addressed autonomy support from the perspective of the educator (e.g., Reeve, Bolt & Cai, 1999). In this case, we address student perceptions of the autonomy-supportiveness of their school library media specialist. There is both a long and short form of the questionnaire. We chose the shorter 6-item version of the instrument to help protect against survey fatigue. The reliability coefficient of this measure as used in the present study was also high at .94. A 5-point Likert scale ranging from *not at all true* to *very true* was used. Sample items from this questionnaire include:

- My school librarian shows confidence in my ability to learn research skills in the library.
- I feel understood by my school librarian.
- My school librarian encourages me to ask questions.

Student perception of school librarian's technology competence. This variable was measured using a single item with a 5-point Likert scale, ranging from strongly disagree to strongly agree. The item reads "I have a school librarian who has a strong understanding of computers."

Frequency of using non-Internet-based library resources. This variable is a complement to the next, and both measure students' self-reported frequency of using resources for information-seeking and research. We separated the frequency variable into web searching,

and non-Internet-based uses of library resources. This variable was assessed with an item using a 7-point Likert scale (7=Several times a day, 6=About once a day, 5=A few times a week, 4=About once a week, 3=A few times a month, 2=Less often, but sometimes, 1=Never) asking "About how often do you seek out information resources like the encyclopedia, atlas, reference books, CD-ROMS, etc., to satisfy an information need? (NOT the Internet)."

Frequency of engaging in online research when curious. This self-report variable complements the non-Internet-based frequency of research question. The variable was assessed with a single item using a 7-point Likert scale (7=Several times a day, 6=About once a day, 5=A few times a week, 4=About once a week, 3=A few times a month, 2=Less often, but sometimes, 1=Never) asking "Frequency of searching online when you are curious about something?"

To measure the dependent variables, the following instruments were used.

Perceived competence in information skills. Perceived competence in information skills is defined as students' confidence in their ability to define an information need, to find, use, and evaluate information to resolve the need and communicate with others. This instrument was refined from the pilot study conducted in 2007 and included 17 items related to specific information skills. The instrument had high reliability (Cronbach's alpha =.93). Students responded to statements on a 5-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, the PCIS was correlated with a validated and widely used instrument from the family of SDT questionnaires, the 4-item Perceived Competence in Learning (PC) scale applied to the domain of general research ability ($r = .74, p < .01$). The more specific PCIS measure also correlated significantly ($r = .41, p < .01$) with actual IL knowledge and skills using the validated and tested *Tools for Real-time Assessment of Information Literacy Skills* (TRAILS) used with permission and assistance from the Kent State University researchers who developed the instrument. The significant relationship between a motivational measure and a measure of achievement was important and added concurrent validity to the PCIS scale.

Intrinsic Motivation to Engage in Research (IMR). This brief 5-item scale was labeled *Feelings About Doing Research* on the student survey. Intrinsic motivation is described by Ryan and Deci (2000) as "the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore and to learn" (p. 70). The purpose of this measure was to determine whether students would engage in research for intrinsic motives as a source of positive affective experiences (i.e., enjoyment, value, curiosity, choice and freedom, and competence). Researchers in the present study selected five indicators of the latent variable of intrinsic motivation. The items are as follows, measured on a 5-point Likert scale:

- I am CONFIDENT in my ability to do research for school and my own interest.
- I ENJOY doing research on interesting topics.
- I VALUE having the skills to do research.
- Being able to do research allows me to explore things I am CURIOUS about.
- Knowing how to do research gives me more CHOICES and FREEDOM in life.

The items were factor analyzed using principal component analysis. All loaded satisfactorily on one factor. Further, reliability was reasonable at Cronbach's alpha = .85.

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

Table 4. Reliability of study constructs

Measure	Cronbach's alpha	Number of items
PAS	.94	6
BPNS	.79	14
PCIS	.93	17
IMR 5 items	.85	5

In addition to our main independent variables, we have added two demographic contributors to our models, which are standard variables likely to impact perceived competence in any academic domain. These are parent level of education (which may stand in as a proxy for socio-economic status), and self-reported grades. If our motivational and frequency variables contribute to our dependent variables, over and above the demographic variables, the findings are highly indicative of the unique contribution of the main independent variables to perceived competence in information skills and motivation for research.

Parent Education. Parent education was measured 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. Self-reported grades was operationalized 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).

Results

Table 5 presents the descriptive statistics for all variables used in the study.

Data Analysis

Ordinary least squares (OLS) regression was used to analyze the hypotheses. The two dependent variables analyzed (PCIS and IMR) represent interval level data making OLS an

appropriate method. The correlations between these independent variables were not so high as to suggest covariance. Table 6 indicates the Pearson correlation coefficients for all variables.

Table 5. Descriptive Statistics of Variables Used in the Analyses

Variable List	Project Participants		
	Mean	Standard Deviation	N
1. Basic Psychological Needs Satisfaction	3.82	.48	1216
2. Perceived Autonomy-Support of SLMS	3.59	1.08	1214
3. Perceived SLMS Technology Understanding	4.03	1.01	1122
4. Frequency of Use, Non-Internet-based library resources	3.36	1.67	1208
5. Frequency of Online Research when Curious	4.77	1.79	1108
6. Parent Combined Education	3.64	1.34	992
7. Self-reported Grades	3.77	.950	1212
8. Perceived competence IS	3.86	.66	1216
9. Intrinsic Motivation to Engage in Research	3.90	.85	1259

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

	1	2	3	4	5	6	7	8
1. Basic Psychological Needs Satisfaction								
2. Perceived Autonomy Support of SLMS	.17***							
3. Perceived SLMS Technology Understanding	.15***	.40***						
4. Frequency of Use, Non-Internet based library resources	.09**	.11***	.10***					
5. Frequency of Online Research when Curious	.007	.05	.10**	.11***				
6. Parent Combined Education	.20***	.10**	.05	.09**	.06			
7. Self-reported Grades	.26***	.05	.11***	.04	-.05	.31***		
8. Perceived competence IS	.45***	.31***	.29***	.14***	.10***	.29***	.36***	
9. Intrinsic Motivation to Engage in Research	.36***	.30***	.30***	.17***	.14***	.15***	.22***	.69***

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

Two-tailed

OLS Regression was used to test several models of the independent variables' contribution to the two hypotheses.

Hypothesis 1. To test Hypothesis 1, we measured the effect of PAS and BPNS on students' perceived competence in their information skills (PCIS), along with student perceptions of their school librarian's own computer competence, and two variables related to frequency of research behaviors. We first explored just the contribution of parent education and self-reported school grades to PCIS. We then measured the contribution of the main independent variables over and above the other explanatory variables. Results are presented in Table 7.

Table 7. Ordinary Least Squares Regression Predicting Perceived Competence in Information Skills

Variable List	Project Participants	
	Model 1	Model 2
	Standardized Beta	Standardized Beta
Basic psychological needs satisfaction		.26**
Perceived autonomy support		.18***
Perceived SLMS Technology Understanding		.10*
Frequency of Use, Non-Internet based library resources		.08***
Frequency of Online Research when Curious		.10**
Parent education	.18***	.12***
Self-reported grades	.30***	.23***
Intercept	31.75	5.18
n	906	906
R ²	.15	.32
Adjusted R ²	.15	.32

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

Results for Model 1 indicate the contribution of the demographic variables of parent education and self-reported grades on their own, to perceived competence in information skills. For Model 1, the R² results are statistically significant, $F(2, 904) = 80.57$, $p < .001$ with these variables accounting for 15% of the variance.

Results for Model 2 indicate the additional contribution of the motivational and frequency variables (basic psychological needs satisfaction, perceived autonomy support from the school librarian, perceived school library media specialist computer technology understanding, frequency of use of non-internet based library resources and frequency of use of internet for research) to student perceived competence in information skills – over and above

the education/demographic variables. For Model 2, the R^2 change is .17 over and above Model 1, and results are statistically significant, $F(7, 899) = 60.59, p < .001$.

Overall, results support the first five hypotheses posed by this study:

H1a: The more autonomy-supported a student feels in the school library context, the greater the perceived competence will be in the domain of information skills.

H1b: The higher the satisfaction of basic psychological needs in life, the greater the perceived competence will be in the domain of information skills.

H1c: The more a student perceives that their school librarian has a strong understanding of computers, the greater the perceived competence will be in the domain of information skills.

H1d: The more often a student uses library resources for research, the greater the perceived competence will be in the domain of information skills.

H1e: The more often a student searches online to satisfy curiosity about something, the greater the perceived competence will be in the domain of information skills.

Hypothesis 2. To test Hypothesis 2, we measured the contribution of the same independent variables on students' intrinsic motivation to engage in research (IMR). We first explored the contribution of parent education and self-reported school grades on IMR. Then, we measured the contribution that our main predictors would make to IMR over and above the self-reported demographic variables. If the main predictors contribute significantly to IMR over and above the additional variables of parent education and student grades, the result would lend empirical evidence to the important role that these possible predictors play in fostering students' motivation to engage in research. Results are presented in Table 8.

Table 8. Ordinary Least Squares Regression Predicting Intrinsic Motivation to Engage in Research

Variable List	Project Participants	
	Model 1	Model 2
	Standardized Beta	Standardized Beta
Basic psychological needs satisfaction		.22***
Perceived autonomy support		.17***
Perceived SLMS Technology Understanding		.16***
Frequency of Use, Non-Internet based library resources		.11***
Frequency of Online Research when Curious		.16***
Parent education	.19***	.01
Self-reported grades	.07***	.13***
Intercept	25.27	2.02
n	906	899
R^2	.05	.25
Adjusted R^2	.05	.24

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

Results for Model 1 indicate the contribution of the demographic/education variables of parent education and self-reported grades, on their own, to intrinsic motivation. For Model 2, the R^2 results are statistically significant, though the relationship is weak, $F(2, 904) = 22.63$, $p < .001$.

Results for Model 2 indicate the additional contribution of the motivational variables (basic psychological needs satisfaction, perceived autonomy support from the school librarian, perceived school librarian technology understanding, frequency of use of non-Internet based library resources and frequency of use of Internet for research when curious about something), on the motivational variable of intrinsic motivation to engage in research—over and above the self-reported demographic variables. For Model 2, the R^2 change is .20 over and above Model 1, and results are statistically significant, $F(7, 899) = 41.66$, $p < .001$.

While the strength of the above relationships to intrinsic motivation for research appear less pronounced than for perceived competence, they are highly significant and demonstrate the role that these social contextual variables play in intrinsic motivation to engage in research. The results support the second five hypotheses of the study:

H2a: The higher the satisfaction of basic psychological needs in life, the more likely it is that the student will be intrinsically motivated to engage in research.

H2b: The more autonomy-supported a student feels in the school library context, the more likely it is that the student will be intrinsically motivated to engage in research.

H2c: The more a student perceives that their librarian has a strong understanding of computers, the more likely it is that the student will be intrinsically motivated to engage in research.

H2d: The more often a student uses library resources for research, the more likely it is that the student will be intrinsically motivated to engage in research.

H2e: The more often a student searches online to satisfy curiosity about something, the more likely that the student will be intrinsically motivated to engage in research.

Discussion

Previous studies have already shown the impact of qualified school librarians on student academic achievement (e.g., Baughman, 2002; Lance, Rodney & Hamilton-Pennell, 2000; Small, Synder & Parker, 2007; Todd, Kuhlthau & OELMA, 2004). Studies also have reported the significant relationship between intrinsic motivation and overall academic achievement (Pintrich & Schunk, 2002), and some researchers report as much or more than a quarter of the variance in achievement in the information skills domain as attributable to motivation (e.g., Arnone, Reynolds & Marshall, 2008). Few, if any studies have investigated school librarians' impact on student intrinsic motivation. The research reported here provides empirical evidence that school librarians play a key role in building students' confidence in their information skills and in their intrinsic motivation to engage in research. It may be that students' confidence in information skills and intrinsic motivation to engage in research are mediators for information skills knowledge (achievement). School librarians who address motivation as they plan lessons and experiences for students in their libraries may be creating a primary way to impact achievement. Future research might involve more complex statistical analysis, such as structural equation modeling, to address the possibility of such mediation.

Further, students' perceptions of their school librarian's technology competence also contribute to PCIS and IMR. This perception is likely predicated upon: (a) the librarian's active use of technology, and (b) their demonstrated technology competence. It also may belie the actual library technology infrastructure present in the school setting. More research is needed to further explore and pinpoint the underlying bases of students' perceptions in this case; however, this result is important because it draws a direct line between technology attributes of the school library context and overall student affect for information seeking and research.

The frequency results are also important in as much as they reveal that the more frequently students engage in online and non-internet based research, the more positive is their affect in this domain as a whole.

Strengths and limitations of the study.

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

Additionally, all survey items were based on self-reported student perceptions which is always a limitation in survey research of this kind. Self-reports by students may have been a limitation particularly for the frequency items measured on an interval scale and for the context variable of perceived technology competence of the librarian. Further research is needed to identify the extent to which perceived autonomy support from students is correlated with librarians' own perceptions of their autonomy supportiveness, and actual supportiveness.

A strength to external validity is that the study was conducted in a natural school setting with students' own school librarians, as opposed to in a lab environment, and it was clearly communicated that responses were anonymous and confidential to their school officials, teachers, and librarians (and the researchers). Further, the measures for the predictor variables were derived 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 development of procedures and an online training web site to facilitate continuity of the administration process with 46 administrators across the 47 study 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 with 279 students in 9 schools prior to the administration of the main study in 2008.

Conclusion and Recommendations

Overall, the findings indicate that the relationship between the school librarian and the student is clearly an integral contributor to student affect towards information skills, uses, and research. Students require social contextual supports for all their basic psychological needs, which include not only autonomy but relatedness and competence. These are innate human

psychological needs that must be met for optimal human functioning and growth (Deci & Ryan, 2000). When these needs are not met, danger awaits in the name of de-motivation and reduced performance. The school library is a social, interactive environment with immense possibilities for nurturing these needs, and for encouraging students' self-determination and intrinsic motivation towards inquiry and engagement with traditional and technological information resources.

By supporting autonomy, school librarians can help students to better self-regulate, addressing one of the major goals of the American Association of School Librarians, preparing students to become independent lifelong learners. By building student confidence, librarians can help them develop actual competence in their information literacy skills. By creating opportunities for relatedness, librarians can support fulfillment of students' inherent need to belong and to organize themselves within a larger social group. The following are several recommendations to use as a springboard for making the library an environment which supports all these needs.

1. Supporting Autonomy

- a. Help increase student's sense of independence by providing choices in assignments. Choices can be in the form of selecting a topic within a larger research project or choosing the format in which to present the results of research.
- b. Allow some freedom within the library environment for students to study, discover new materials, or just find relaxing places to just read on their own.
- c. Gently guide students who appear very dependent on you to begin searching and discovering on their own.

2. Supporting Perceived Competence

- a. Build student competence by breaking down information tasks into smaller chunks
- b. Provide easily accessible learning aids for routine library tasks such as bookmarks with common procedures that students can keep with them.
- c. Provide opportunities for peer tutoring
- d. Use diagnostic measures such as the PCIS to identify gaps in confidence and target those with specific instructional interventions. To reduce anxiety, present the PCIS as a way to help you plan out your instruction rather than as a test. (Note: by publication time, the PCIS will be available to school librarians as an electronic instrument through the Center for Digital Literacy Web site at <http://digital-literacy.syr.edu>.)
- e. Provide informative feedback in a positive manner. This goes beyond mere praise which acts as an extrinsic motivator but rather tells the student exactly what they did right and where they can improve. When you praise, it must be sincere and specific.
- f. Be aware of behaviors that suggest negative self-perceptions of student ability to do research. When you see them, act promptly to provide the

learning and emotional support that will result in small but regular success opportunities.

- g. Model enthusiasm and self-confidence in your own computer/technology abilities. This study showed that students' perception of their school librarian was significantly related to their own perceived competence.

3. Supporting Relatedness

- a. Provide opportunities for frequent interactions with others such as team projects, special time with you, and opportunities to showcase products of research with the whole school or parents. This also serves to build confidence.
- b. Be aware of interactions between friends or even classroom teachers that may signal relationship problems. Do what you can to help resolve issues before they become major, if you can.
- c. Relatedness can be nurtured by expanding social bonds beyond the library media center itself by experimenting with online school projects that connect local students with students from distant locations.
- d. Tie research to a community activity that supports a cause increasing students' sense of being related to something important and vital.

At the level of the individual, the self-determination qualities of perceived competence, autonomy, and social relatedness "refer to innate and life-span tendencies toward achieving effectiveness, connectedness, and coherence" (Deci & Ryan, 2000, p. 227). One who is intrinsically motivated is active and constructive and participates in growth-oriented activities in a given domain. By supporting students' autonomy, perceived competence, and relatedness in the domain of information and technology skills in the school library setting, teacher-librarians can play an important role in students' intrinsically-motivated, self-driven inquiry, use of both technological and traditional information resources and materials, and active, constructive learning.

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