Research Brief

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An Examination of Learning Strategies Related to Indirect Measures of Critical Thinking Skills

Introduction

Deep approaches to learning refer to strategies that encourage a thorough understanding of ideas and concepts rather than simple rote memorization (Biggs, 2003; Matron and Säljö, 1976). Students who engage in deep approaches to learning seek to grasp underlying meaning of what is being taught. They think of ways in which the material being learned relates to knowledge in other disciplines and look for direct applications to their own lives.

The Principles of Undergraduate Learning (PULs) are a particularly useful framework for studying the impact of deep approaches to learning, mainly because of the conceptual similarity between the skills emphasized in the PULs and typical DAL strategies. For example, Intellectual Depth, Breadth, and Adaptiveness is defined as a students' ability to "examine and organize disciplinary ways of knowing and to apply them to specific issues and problems" (Academic Affairs, 2007). Integration and Application of Knowledge is defined as "The ability of students to use information and concepts from studies in multiple disciplines in their intellectual, professional, and community lives". Several learning theorists, such as Biggs (2003) and Ramsden (2003) contended that students who engage in deep approaches to learning jump to these skills automatically when attempting to learn new material. In addition, IUPUI also includes critical thinking amongst the PULs. Existing evidence on the impacts of deep approaches suggests that students who use them may make gains in areas such as higher-order reasoning and problem solving (e.g. Chapman, 2001). In addition, though tenuous, there is evidence to suggest that a relationship exists between engagement in DAL and critical thinking abilities, especially for high ability students (Nelson Laird, Garver, Niskodé-Dosset, & Banks, 2008).

This study uses data from IUPUI's 2009 administration of the National Survey of Student Engagement (NSSE) and the 2010 and 2011 administrations of the Continuing Student Survey (CSS) to explore the relationship between engagement in deep approaches to learning and an indirect measure of critical thinking used for PUL assessment. The results demonstrate how encouraging students' to use deep approaches can contribute to the types of gains emphasized as part of an IUPUI undergraduate experience.

Methods

A total of 105 students who responded to both the NSSE in 2009 and to the CSS in either 2010 or 2011 were used in this analysis. The dependent variable in this analysis was the Critical Thinking scale imbedded within the CSS. Five items from the Knowledge and Skills section of the CSS comprised the three scales which serve as an indirect measure of students' attainment of the PULs (Graunke & Brown, 2010). It should be noted that this scale constitutes an indirect measure, in that it assesses students'

perceptions of what they have learned (Palomba & Banta, 1999). A full list of items included in the Critical Thinking (CT) scale can be found on the right. For more information about the methodology behind the CSS, please see the survey section of the IMIR website (imir.iupui.edu/surveys).

PUL Items in the Continuing Student Survey
Critical Thinking (α = 0.920)
Analyze different ideas and proposed solutions
Systematically review your own ideas about how to approach an issue
Generate new ideas about how to approach an issue
Generate new ideas about how to improve things
Discuss challenging problems with peers to develop a solution

Scale: 4 = "Very Effective", 3 = "Effective", 2 = "Somewhat Effective", 1 = "Not at all Effective"

The independent variables included a measure of students' engagement in Deep Approaches to Learning (DAL) obtained using NSSE. The DAL scale is a composite of three subscales that represent the extent to which students generally engage in practices that encourage a more thorough understanding of the material. More information about the DAL scale is available in Appendix A. Only respondents who had completed every item associated with all three DAL scales as well as every item associated with the PUL critical thinking scale were used. Three additional variables were obtained from student records: Sex, class level, and enrollment in a soft discipline. Additional information about how these variables were coded can be found in Appendix B and Appendix C. Standard errors were adjusted in order to account for the full population of students eligible to complete NSSE in 2009 (10,748 students).

Results

Appendix D displays the means, standard errors, and correlations between the variables included in the critical thinking model. Sixty percent of respondents in this model were female, 36% were seniors, and 63% were enrolled in a soft discipline.

Also included in Appendix D is the model for critical thinking, which was statistically significant at the $p \leq 0.05$ level ($F = 6.17$). The R^2 value (0.175) suggests that the combination of variables accounted for about 18% of the variance in the critical thinking scale. The only variable found to have a statistically significant relationship with students perceptions of their critical thinking ability would be their DAL score ($\beta = 0.415$, $p \leq 0.05$).

Discussion

The results of this study suggest that students who engage in deep approaches to learning are more likely to provide higher self-reports of their critical thinking skills. These results support the results of other studies (e.g. Chapman, 2001; Nelson Laird, Garver, et. al, 2008) which suggest a relationship between engagement in deep approaches to learning and gains in higher order thinking skills. Several teaching and learning theorists (e.g. Biggs, 2003, Ramsden, 2003) have suggested ways in which faculty can promote deep learning approaches in their courses. Some suggestions include connecting class activities with learning objectives, developing students' study skills, and encouraging students to learn from each other via active discussions or peer lectures. Faculty seeking to increase students' level of critical thinking might consider adopting some of these practices. It may also be useful to compare these results with results from other critical thinking assessments, including those that account for direct measure of the PULs, in order to better understand the relationships between student performance and student self-ratings.

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Appendix A

The overall DAL scale represents a composite of three subscales which assess students' general approach to learning. These scales can be conceptualized as the extent to which students' generally engage in a process that would encourage a more thorough understanding of the material being learned. The first scale, higher order learning (HOL), describes the extent to which students engage in more complex thinking skills, such as making judgments or synthesizing ideas. Integrative learning (IL) was designed to assess the extent to which students transferred ideas or knowledge across different contexts, while reflective learning (RL) was designed to measure respondents' tendencies to gauge the relative strengths and weaknesses of their opinions and considered alternative explanations. Total DAL score was obtained by taking the average of the composite scores of the three DAL subscales. A full list of the items that comprise each subscale as well as Cronbach's alpha for the entire scale can be found in table 1A.

Table 1A.

Deep Approaches to Learning (DAL) scale items

Overall Deep Approaches to Learning Scale	**α = 0.653**
Higher Order Learning subscale	**α = 0.821**
Coursework emphasized: ANALYZING the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components [a]	
Coursework emphasized: SYNTHESIZING and organizing ideas, information, or experiences into new, more complex interpretations and relationships [a]	
Coursework emphasized: MAKING JUDGMENTS about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions [a]	
Coursework emphasized: APPLYING theories or concepts to practical problems or in new situations [a]	
Integrative Learning subscale	**α = 0.601**
Worked on a paper or project that required integrating ideas or information from various sources [b]	
Included diverse perspectives (different races, religions, genders, beliefs, etc.) in class discussions or writing assignments [b]	
Put together ideas or concepts from different courses when completing assignments or during class discussions [b]	
Discussed ideas from your readings or classes with faculty members outside of class [b]	
Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.) [b]	
Reflective Learning subscale	**α = 0.863**
Examined the strengths and weaknesses of your own views on a topic or issue [c]	
Tried to better understand someone else's views by imagining how an issue looks from his or her perspective [c]	
Learned something that changed the way you understand an issue or concept	

Note. [a] Respondents are asked "During the current school year, how much has your coursework emphasized the following mental activities?" Scale is 4 = "Very much", 3 = "Quite a bit", 2 = Some", 1 = "Very little". [b] Respondents are asked "In your experiences at your institution during the current school year, about how often have you done each of the following?" Scale is 4 = "Very often", 3 = "Often", 2 = "Sometimes", 1 = "Never". [c] Respondents are asked "During the current school year, how often have you done each of the following?" Scale is 4 = "Very often", 3 = "Often", 2 = "Sometimes", 1 = "Never".

Appendix B

Sex was coded as a dummy variable for female (female = 1, male = 0). Class level was included in order to account for the differences between first-year and senior students' perceptions of engagement (NSSE is only given to first-year and senior students). Students who had obtained senior status by the time of the 2009 NSSE administration were dummy coded as 1 and first-year students were coded 0 for these analyses. Finally, Nelson Laird, Schoup, Kuh, and Schwartz(2008) found that students who were enrolled in soft disciplines reported using DAL approaches more often than students who were enrolled in hard disciplines. Students were coded into soft (1) or hard (0) disciplines based on their 2009 major reported to NSSE using the coding scheme employed by Nelson Laird et. al. A full list of majors and how they were coded for this analysis can be found in Appendix C.

Appendix C

Hard Disciplines	Soft Disciplines
Biology	Accounting
Biomedical engineering	Art Education
Biomedical engineering technology	Art History
Chemistry	Business
Clinical Lab Science	Business Management
Computer graphics technology	Elementary Education
Computer information technology	English
Computer Science	English Education
Electrical Engineering	Finance
Exercise Science	Fine Art
Forensic and Investigative Science	Fine Arts
Geology	French
Health Education Technology	Health Administration
Health information administration	Health Information Administration
Information technology	History
Mechanical Engineering	Informatics
Occupational therapy	Interior Design
Physics	Journalism
Pre-Pharmacy	Nursing
	Organizational Leadership and Supervision
	Philosophy
	Physical Education
	Political Science
	Pre-Law
	Pre-Occupational Therapy
	Psychology
	Social Studies Education
	Sociology

Note. Categorizations based on Nelson Laird, Shoup, et. al, 2008.

Appendix D

Table 1D

Correlation matrix of Critical Thinking with independent variables

	N	1	2	3	4	5	Mean	Standard Deviation	Standard Error
1) Critical Thinking	105	--	0.019	0.148	0.061	0.401*	3.22	0.629	0.061
2) Female	105		--	-0.072	0.338*	0.147	0.60	0.492	0.048
3) Senior	105			--	0.087	0.150	0.36	0.482	0.047
4) Soft discipline flag	105				--	0.328*	0.63	0.486	0.047
5) Deep Approaches to Learning	105					--	2.75	0.521	0.050

Note: Standard error adjusted using population correction factor for a population of 10,748. Asterisk (*) represents statistically significant at $p \leq 0.05$.

Table 2D

Critical Thinking model (N = 105)

	B	β	Standard Error	t
Intercept	1.870		0.369	5.06 *
Female	-0.010	-0.008	0.115	-0.09
Senior	0.120	0.092	0.131	0.92
Soft discipline flag	-0.104	-0.080	0.137	-0.76
Deep Approaches to Learning	0.501	0.415	0.141	3.56 *

F = 6.17

[a] Standard error of the estimate = 0.582

$R^2 = 0.175$

Note: [a] Standard error adjusted using population correction factor for a population of 10,748. Asterisk (*) represents statistically significant at $p \leq 0.05$.