

Exploration of Deep Thinking Skills of UW-Stout Students via Examination
of National Survey of Student Engagement (NSSE) and
Additional Institutional Data

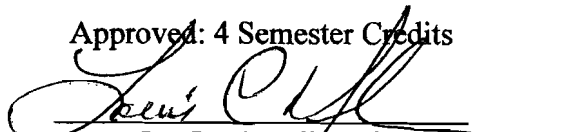
by

Susan Greene

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Dr. Louis Milanesi

The Graduate School
University of Wisconsin-Stout

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Menomonie, WI**Author: Greene, Susan J.****Title: *Exploration of Deep Thinking Skills of UW-Stout Students via Examination of National Survey of Student Engagement and Additional Institutional Data*****Graduate Degree/ Major: MS Applied Psychology****Research Adviser: Louis Milanesi, Ph.D.****Month/Year: May, 2007****Number of Pages: 57****Style Manual Used: American Psychological Association, 5th edition****Abstract**

This paper investigates the critical thinking skills of UW-Stout students by examining their responses to National Survey of Student Engagement (NSSE), and comparing these responses to peer group and national survey results. Survey respondents included first year and senior students. Data from the institutional research reports in 2001 to 2006 were used to perform the analysis. This included data from the National Survey of Student Engagement, Faculty Survey of Student Engagement, ACT-CAAP test, ACT Student Opinion Survey, and UW-Stout's General Education Senior Level survey. Statistical significance was measured at the .05 level; Glass's *delta* effect size was used. Analysis revealed that throughout the survey sample UW-Stout students were on the whole significantly below peer and national samples for critical thinking. Analysis of supplementary data revealed that faculty at UW-Stout perceived higher levels of student critical thinking, and student performance on a national test of critical thinking was on par with peer and national samples. Further investigation revealed low student perception of institutional environment to support critical thinking, in fact and in perception. Recommend

using a learning portfolio intervention for both first year and senior students to facilitate development of deep learning skills and student confidence in these skills.

TABLE OF CONTENTS

Abstract.....	ii
List of Tables	vi
List of Figures	vi
Chapter 1: Introduction.....	1
<i>Problem Statement</i>	2
<i>Importance of the Study</i>	2
<i>Purpose of the Study</i>	3
<i>Assumptions</i>	3
<i>Limitations</i>	3
<i>Methodology</i>	3
Chapter 2: Literature Review.....	4
Chapter 3: Methodology	15
<i>Subjects</i>	15
<i>Materials</i>	17
<i>Procedure</i>	17
<i>Primary Research Question</i>	17
<i>Secondary Research Question</i>	19
<i>Primary Research Question</i>	23
<i>Memorize</i>	23
<i>Analyze</i>	23
<i>Synthesize</i>	24
<i>Evaluate</i>	24

<i>Apply</i>	25
<i>Summary</i>	25
<i>Secondary Research Questions</i>	28
<i>Additional NSSE Questions</i>	28
<i>Faculty Perceptions of Student Performance</i>	31
<i>Additional Student Data</i>	33
<i>Summary of Secondary Research Question</i>	40
Chapter 5: Summary, Recommendations and Conclusion	41
<i>Introduction</i>	41
<i>Summary of Findings</i>	41
<i>Conclusions and Recommendations</i>	43
<i>Suggestions for future research</i>	44
References	46

List of Tables

Table 1: UW-Stout NSSE Sample Characteristics.....	15
Table 2: UW-Stout NSSE “Mental Activity” Average Reponses Compared to Peer Group and National.....	26
Table 3: UW-Stout NSSE “Mental Activity” Effect Sizes of Peer Group and National Comparisons.....	27
Table 4: UW-Stout NSSE Additional Critical Thinking Average Reponses Compared to Peer Group and National.....	29
Table 5: UW-Stout NSSE Additional Critical Thinking Effect Sizes of Peer Group and National Comparisons.....	30
Table 6: UW-Stout FSSE/NSSE Proportion of Respondent Comparisons.....	31
Table 7: NSSE/FSSE Mean Comparison in Mental Activities for 2004.....	32
Table 8: UW-Stout Student NSSE Average Responses and Effect Sizes for Promptness of Faculty Feedback over Time.....	34
Table 9: UW-Stout NSSE Supportive Environment Average Response Scores Comparisons...	36
Table 10: UW-Stout NSSE Average Response Comparisons to the Capstone Question and Effect Sizes.....	39

List of Figures

Figure 1. Core Critical Thinking Skills.....	6
Figure 2. UW-Stout senior general education survey results on deep learning questions, 1999-2006.....	33
Figure 3. UW-Stout student responses to ACT Student Opinion Survey on having a supportive learning environment.	38

Chapter 1: Introduction

The mission and vision of University of Wisconsin-Stout is to help its students become informed citizens, with critical thinking skills and the ability to become lifelong learners. UW-Stout has an additional special mission of providing an educational experience that is focused on applying learning to real-world situations and jobs. Assessment of the successful progress toward fulfilling this mission can be undertaken using several criteria. First, successful institutions have mission/visions that are directly related to program and faculty objectives and to student outcomes. Second, these successful institutions continuously monitor both the saliency and the success of their mission/visions, and use the feedback from the institutional data for strategic planning. Does UW-Stout mission/vision directly translate into faculty and student outcomes? How can this be assessed?

Traditional methods for capturing student learning outcomes such as cumulative GPA and graduation rates describe one aspect of student learning; moreover, this method of assessment is obtained only from the institutional point of view and fails to adequately depict the ability of students to use deep learning/critical thinking skills. As part of the plan to create a broader picture of student learning outcomes, UW-Stout participates in national and local surveys that capture learning from several points of view. Some of the surveys focus on uncovering student perception of their own learning, whereas other surveys focus on uncovering faculty perceptions of student learning. The two primary perception-based surveys employed are the National Survey of Student Engagement (NSSE) for students, and the Faculty Survey of Student Engagement (FSSE) for UW-Stout faculty. These two surveys have the additional benefit of evaluating learning at different levels and depths and inquire directly about students' deep learning and critical thinking.

However, survey results derive meaning through salient comparisons. The level of UW-Stout student learning via the NSSE is assessed by comparing it both a selected peer group and to all students in the nation that participated. Another method for measuring student learning outcomes is to compare faculty and student perceptions. When there are perception gaps between faculty and students, it may imply that if faculty have higher perceptions of student learning students may not “know that they know” – students are not cognitively aware of the knowledge, skills and abilities that they have gained, but the faculty have the perspective to see these gains; or it may imply that student perceptions are accurate and there needs to be pedagogical changes. It is more likely that any student/faculty learning outcome perception gaps are a combination of these two scenarios, and a creative pedagogical change could address both. However, because perceptions may not always be accurate, supporting institutional data can be used to provide further information to triangulate the results.

Problem Statement

Do UW-Stout students lack adequate deep thinking knowledge, skills and abilities?

Importance of the Study

This question is important because it is directly related to the mission and vision of UW-Stout. Furthermore, one of the prerequisites of helping students become life-long learners is to engage students in higher order thinking, utilizing the more complex levels of Bloom’s taxonomy such as analysis, synthesizing and evaluating.

Purpose of the Study

The purpose of this study is to discover if there is a level of deep and critical thinking by UW-Stout students commensurate with the university's mission and vision. This will be accomplished by examining publicly available institutional data and reports. Further, the study will examine the extent of the problem and provide suggestions for future changes/interventions.

Assumptions

This study assumes that student perceptions are important and that they are directly related to student performance.

Limitations

The major limitation of this study is the format of information. The study works from publicly available reports that do not always present needed information. Most of the data is self-report. This study presents only an initial investigation of critical thinking.

Methodology

The research question will be addressed in Chapter 2 by first examining the importance of deep thinking for learning. Chapter 2 also contains a brief history of the NSSE and FSSE surveys to provide a context for the remainder of the paper. Chapter 3 describes the methodology employed to answer the research question. Chapter 4 provides the results of the investigation of the primary research question and the secondary research questions. Chapter 5 provides a summary, concluding remarks with recommendations and ideas for future research.

Chapter 2: Literature Review

In the current workplace environment, it is of utmost importance for employees to have the ability to think critically and reflectively, or to have deep thinking skills. The fast pace, the use of ever changing technology and the ready availability of large amounts of information has required that workers must be skilled at and confidently able to be deal efficiently and effectively with an increasingly more complex workplace. Halpern (2003) states that this new type of worker will need to be able to

...carry out multistep operations, manipulate abstract and complex symbols and ideas, acquire new information efficiently, and remain flexible enough to recognize the need for continuing change and new paradigms for lifelong learning. Workers in almost every job category can expect to face novel problems in a workplace that is changing repeatedly. Familiar responses no longer work, and even newly acquired ones won't work for long. ... If we cannot think intelligently about the myriad of issues that confront us, then we are in danger of having all the answers, but still knowing what they mean. The twin abilities of knowing how to learn and knowing how to think clearly about the rapidly proliferating information that we must select from are the most important intellectual skills for the 21st century. (p. 6-7)

Mezirow (1997) concurs with this analysis, stating that workers in the twenty-first century must be able to “think as autonomous agent in a collaborative context rather to uncritically act on the received ideas and judgments of others. Workers will have to become autonomous, socially responsible thinkers”. Employees also agree that critical thinking skills are vital in today's workplace. Response to a national survey revealed that 81% of the adult workers

reported that critical thinking, literacy and communication skills are *very important*. (Chronicle of Higher Education, 2000).

Developing critical thinking in pre-employees – students – has become a national priority. In 1991, the U.S. National Board of Education Goals Panel established this as an objective to be achieved by 2000; specifically the Board’s objective was that “The proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively, and solve problems will increase substantially.” (The National Goals Education Panel, n.d.). The 2007 report of AACU “College Learning for the New Global Economy” pointed out that on average, only 6% of college seniors are *proficient* in critical thinking skills whereas 77% are *not proficient*. The report further states that “less than 10 percent today’s college graduates have the knowledge and experience to make them globally prepared”. (AACU, 2007). However, Halpern (2003) points out that very few people or students have been explicitly taught how to think critically and become a deep learner. The assumption is that college students already “know how to think”.

What are critical thinking, or deep learning, skills? Facione (1998) provides a comprehensive overview in Figure 1 below. This model was created by a symposium of experts that included scholars from the humanities, sciences, social sciences and education who worked on the project for two years. The resulting sphere of critical thinking includes the mental abilities interpretation, analysis, evaluation, inference, explanation, and self-regulation.

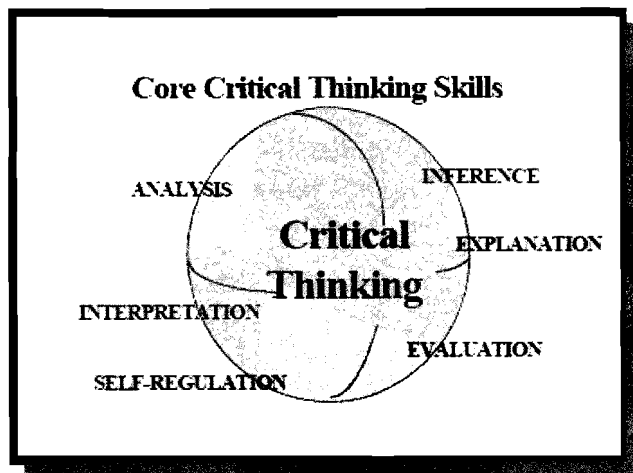


Figure 1. *Core Critical Thinking Skills*
Source: Facione (1998)

Interpretation includes the abilities to categorize, determine significance and clarify meaning of a set of facts, circumstances or experiences. Educational adjectives from Bloom's Taxonomy (Educscapes, n.d., and University of Victoria, n.d.) that describe interpretation (comprehension) are associate, summarize, interpret and differentiate. Analysis is the ability to "identify the intended and actual inferential relationships among statements, questions, concepts, descriptions...". This is expressed by the action words from Bloom's taxonomy analyze, connect, classify, discriminate, and prioritize. Evaluation involves assessing credibility and the logical strength of the "actual or intended inferential relationship[s]". Evaluation requires the thinker to make a value judgment. Action words that describe evaluation include assess, conclude, reframe, decide, judge, and explain. Inference involves the abilities to list evidence, bring up alternatives, and draw conclusions. Explanation and self-evaluation are considered "meta-cognitive" skills. Explanation is stating the results of the critical thinking process and providing a justification for the manner in which the result was arrived at. Self-evaluation is the process of looking back at the personal critical thinking process and evaluating the validity of

this process. Self-regulation creates a feedback loop in the creative thinking process that leads to self-correction.

The expert panel in Facione's project came up with this list of characteristics that describe a person who is well versed in critical thinking.

- Inquisitiveness with regard to a wide range of issues
- Concern to become and remain well-informed
- Alertness to opportunities to use critical thinking
- Trust in the processes of reasoned inquiry
- Self-confidence in one's own ability to reason
- Open-mindedness regarding divergent world views
- Flexibility in considering alternatives and opinions
- Understanding of the opinions of other people
- Fair-mindedness in appraising reasoning
- Honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies
- Prudence in suspending, making or altering judgments
- Willingness to reconsider and revise views where honest reflection suggests change is warranted.

Dewey's presents a similar definition of critical thinking. Dewey (1991) also stresses that reflective thought "alone is truly educative in value", and that true thought is purposeful and is interested in examining the underlying assumptions and consequences of beliefs and actions. So, according to Dewey critical thinking is a value laden experience that involves the complete person, and may be extremely uncomfortable and require a great deal of effort at times.

Overcoming this discomfort requires practice and modeling by others, usually a teacher, but even

more effective if it is modeled at the institutional level. Additionally, the student needs to be an engaged, eager participant in the critical thinking process.

Brookfield (1987) points out that the reflective aspect of deep learning also requires feedback, ideally from the person(s) that are modeling the critical thinking in order to start the self-regulation process and to keep it from becoming either too shallow or too wrapped up in self. This reflective process can take on several forms. The most basic form is for the modeler to act as a “mirror” of the critical thinking of the learner to allow them to see their current critical thinking process, therefore gaining a new perspective. Gaining a new perspective about personal habits of thought initiates the change process for deepening critical thinking abilities. Brookfield points out that a person’s critical thinking abilities is intimately related to their personal assumptions underlying their actions, and unless these assumptions are critically examined no real growth in deeper thinking can occur. Reflection can be further facilitated by encouraging the learner to keep a journal/log of reflections on life experiences that includes personal emotions, actions and assumptions. Maximum benefit from this form of reflection is accrued by receiving feedback from a trusted mentor. (Huba and Freed, 2000).

Mezirow (1997) further emphasizes this need for structured social support for deep learning to occur, or in his terms *transformative learning*. Transformative learning involves changing ones frame of reference which is the sets of cognitive assumptions used to filter everyday experiences and therefore to determine actions. Frames of reference have two dimensions, *habits of mind* that encompass the broad, deeply ingrained cognitive sets and *point of view* that are the articulations of the habits of mind. Transformational (deep) learners continuously move toward a frame of reference that is “more inclusive, discriminating, self-reflective, and integrative of experience” – they become skilled in critical thinking. However,

Mezirow points out that because habits of mind are so deeply ingrained, they can be difficult to change. Therefore, the social setting for learning must be amenable to and promote *discourse*, the dialogue “devoted to assessing reasons presented in support of competing interpretations, by critically examining evidence, arguments, and alternative points of view”.

The importance of social structure for transformational learning was further explored by Baumgartner’s (2001) review of the current state of transformational learning theories. First, this deep learning is acknowledged as a complex, non-linear process that involves both cognitive and emotional aspects that feedback into each other. Second, it is crucial to build a trusting relationship between members engaging in the critical thinking process, and to have a safe and open atmosphere.

Most research on critical thinking agrees that continuous exposure to and practice with critical thinking is the key to making it a part of a student’s deep thinking patterns. Students “head” knowledge of critical thinking components will not create in them the mental habits or cognitive pathways of deep thinking. Mezirow (1997) counsels that merely learning the mechanics of critical thinking will not automatically lead to the ability to be an autonomous, critical thinker. Halpurn (2003) summarizes

Critical thinking does not automatically result as a by-product of standard instruction in a content area. A systematic educational effort to improve thinking is need to obtain these positive effects. Critical thinking instruction needs to focus overtly and self-consciously on the improvement of thinking, and the learning experience needs to include multiple examples across domains in order to maximize transfer. (p. 13)

Developing students who are well-versed and practiced in critical thinking skills and deep thinking capabilities is one of the primary goals of UW-Stout. Further, Stout’s special mission is

to create and provide “programs leading to professional careers focused on the needs of society”. To accomplish this, UW-Stout’s vision is to educate “students to be lifelong learners and responsible citizens in a diverse and changing world through experiences inside and outside the classroom that join the general and the specialized, the theoretical and the practical, in applied programs leading to successful careers in industry, commerce, education, and human services” (UW-Stout, n.d.). This mission and vision are actively pursued by UW-Stout faculty and staff, and efforts to evaluate the success of this strategic plan are also actively pursued. Following the action research/quality improvement model, the evaluation data is used to modify the existing plan to make it more efficient and effective.

One evaluation method employed by UW-Stout is examination of student performance data that has the ability to be compared to a national peer group. One such set of data is the National Survey of Student Engagement (NSSE). Stout has participated in this survey since its inception in 2000, and has used survey results to guide strategic planning.

The NSSE survey was created to fulfill the need that institutions had to assess student learning outcomes that could be meaningfully compared within the institution across time and to be able to compare results to national peer institutions. The NSSE was conceived in early 1998 and supported by a grant from The Pew Charitable Trusts. The survey was piloted in 75 schools in 1999, and 275 colleges and universities participated in the first full deployment in spring of 2000. In spring 2007, 610 colleges and universities participated. The primary purpose of the survey was to directly ask students about their learning experiences; moreover, students were queried at different points in their college careers – in their first year and their senior year.

The survey was developed to be short and to contain

...items directly related to institutional contributions to student engagement, important college outcomes, and institutional quality. The Design Team had three general criteria in mind when selecting items that might be used, including: (1) Is the item arguably related to student outcomes as shown by research?; (2) Is the item useful to prospective students in choosing a college?; and (3) Is the item straightforward enough for its results to be readily interpretable by a lay audience with a minimum of analysis? (NSSE, n.d.)

NSSE is used to gauge student learning because it is believed that engagement is positively related to positive student performance outcomes. (NSSE) assesses “the extent to which first-year students and seniors engage in a variety of good educational practices. ...Most of the items ... represent student behaviors that are highly correlated with many important and personal development outcomes of college” (Cutsforth, 2006). Kuh (n.d.) states that if students are not personally and actively involved, physically and mentally, in their educational process they are less likely to stay in school and to absorb what they are learning. NSSE’s focus on student engagement is meant to provide outcome measures that will allow the institution to evaluate their educational processes that influence these outcomes and to make meaningful comparisons to peers.

Studies conducted by the Center for Postsecondary Research has found a positive relationship between student engagement as measured by NSSE and several important student outcome measures (Kuh, Kinzie, Cruce, Shoup, Gonyea, 2007). They found that for first-year students engagement was positively related grades and retention even after control for pre-college characteristics and other academic variables. Moreover, the greatest engagement benefits accrued to students that were historically “*underserved by postsecondary educational*

institutions” such as first generation students. For seniors, two NSSE engagement measures were positively associated with grades.

Currently, the NSSE is composed of 28 questions, each with multiple sub-questions that comprise 13 sub-categories¹. Kuh (n.d.) reports that the NSSE has good psychometric properties. First, the design team intentionally designed their questions to take into account the general conditions that make self-report instruments valid, and they used questions from other long-running national student surveys. Second, testing was done on the 1999 pilot data and the 2002 data. Kuh (n.d.) reported that reliability was good, as was concurrent validity measured by a significant association with GPA. They ran three different stability tests and found that NSSE was stable. The NSSE team also conducted focus groups in 2000 to test for face validity of the survey. On the whole, students found the questions easy to understand and complete; furthermore, students correctly interpreted the meaning of the questions. Kuh concludes that results of the focus groups indicated that NSSE did indeed possess face validity. The design team continues to use focus groups to check the face validity of the instrument and to make any necessary changes.

An additional study conducted by NSSE in 2006 also examined the validity and reliability of the survey (Kuh et al, 2007). They found that “...*the NSSE survey works equally well for students from different racial and ethnic backgrounds attending different types of institutions*”. Results of this study also confirmed the construct validity and stability of the instrument. Focus group results confirmed that the questions are generally interpreted the same across a variety of student groups and this interpretation is in line with NSSE intent.

¹ The subcategories are: academic and intellectual experiences, mental activities, reading and writing, problem sets, examinations, additional collegiate experiences, enriching educational experiences, quality of relationships, time usage, institutional environment, educational and personal growth, academic advising, and satisfaction.

In 2003 the same group that administers the NSSE group, the Indiana University Center for Postsecondary Research, piloted a parallel faculty survey in order to measure faculty expectations for student engagement in those same educational practices that are known to be empirically linked with high levels of learning and development. 143 schools and over 14,000 faculty members participated in the initial implementation, and over 21,000 faculty members at 131 baccalaureate degree granting colleges and universities participated in 2006. The FSSE also collects information about how faculty spend their time related to professional activities, as well as the kinds of learning experiences emphasized at their institution. The intended purpose of FSSE is to identify areas of strength at an institution, as well as aspects of the undergraduate experience that may warrant attention.

Of particular interest to this paper, both the NSSE and FSSE ask students about the amount of emphasis their classes place on developing deep thinking skills, and how skilled they feel in these areas. A complete description of these questions is in Chapter 3.

How do schools use the NSSE and FSSE data? NSSE offers the following guidelines for institutions when interpreting their survey results.

In particular, three possible uses for the data are now envisioned. First, results are expected to be useful to institutions themselves in improving undergraduate education.

For example, the data will be especially useful to colleges and universities in gauging the degree to which they foster practices consistent with particular institutional characteristics and commitments, in order to improve their performance. Second, results from *The College Student Report* should be helpful to a range of external stakeholders of higher education, including accrediting bodies and state oversight agencies. For example, the data could be used as part of an assessment of "institutional effectiveness";

component of a self-study or to strengthen benchmarking processes. Third, if the results from the NSSE project were made public, they might prove interesting to the media, including news magazines and college guides. (NSSE, n.d.)

However, the NSSE and FSSE results are not meant to be the sole determinants of action. Rather, they are meant to offer “red flags” to institutions for areas of potential weakness and growth. The NSSE and FSSE results are meant to be interpreted by comparing them to other institutional student performance data and to the institutions mission, vision and strategic plan.

In summary, UW-Stout has two primary goals for students. First, to provide an education that leads to viable and fulfilling employment. The second goal is to help students become life-long learners. Acquiring and practicing deep, critical thinking are the key to achieving both of these goals. Current research literature points out this process will involve actions by the student, the instructor and the institution in order to be successful. Feedback and having a social climate that facilitates reflective thinking are important elements in enhancing student knowledge, skills and abilities in deep thinking and critical thinking. The objective of this paper is to examine what the UW-Stout institutional research data can say about student skills in the mental ability area, and to make appropriate recommendations based on the results of this data analysis.

Chapter 3: Methodology

Subjects

To address the primary research question *Do UW-Stout students lack adequate critical thinking KSAs?*, the experimental group consisted of UW-Stout students that participated in the NSSE surveys from 2001 to 2006. The survey was administered in the spring semester by UW-Stout's Budget, Planning and Analysis office. In 2002 to 2006 a standard sample of eligible students was used. In 2002 and 2003 these selected students were given the option of responding by paper or via the web. In 2004 to 2006 the survey was administered exclusively via the web. Student characteristics and response rate are listed in Table 3.1. After 2002, the sample consisted of primarily full-time students, and was answered more frequently by females which was an over representation (from 2001-2005 females represented 48-49% of the undergraduate student population). The first control group for the NSSE consisted of students in peer institutions, defined as institutions that have terminal master level programs, which participated in NSSE surveys in 2001 to 2006. The second control group was all college students in the nation that participated in the NSSE surveys in 2001 to 2006. NSSE is administered exclusively to first year and senior year students. (Cutsforth, 2002, 2003a, 2004a, 2005, 2006).

Table 1
UW-Stout NSSE Sample Characteristics

		All Survey Respondents				
Random						
Sample	Response		%	%		
Size	Rate	% First Year	Senior	Female	% Full Time	
2001			No Data Available			
2002	750	45%	47%	53%	60%	53%

Random Sample Size	Response Rate	First Year			Senior		
		% of Respondents	% Female	% Full Time	% of Respondents	% Female	% Full Time
2003 700	49%	50%	60%	100%	50%	56%	94%
2004 2100	48%	65%	60%	99%	35%	58%	98%
2005 2800	41%	61%	62%	98%	39%	66%	98%
2006 3000	41%	71%	63%	99%	29%	63%	96%

Note: Sources for the numbers were from Cutsforth, 2002, 2003a, 2004a, 2005, 2006

Analysis of secondary research questions involved both faculty and student subject pools. Faculty data was drawn from UW-Stout faculty that participated in the FSSE surveys in 2003 and 2004. The survey was pilot tested in 2003 via online survey and a response rate of 42%. Of the 176 total respondents, 78 were in the lower division and 88 in the upper division. Sample respondents consisted of 54% men and 46% women which is comparable with the overall Stout faculty distribution. 88% were full-time instructors which were slightly higher than the campus-wide 75% full-time; 45% had taught 15 or more years and 22% had taught less than 5 years. The 2004 FSSE was also administered online, and the response rate was 41%. In 2004, there slightly more female respondents (49%) than were representative of the campus on the whole (43%). The sample consisted of primarily full-time faculty and instructional staff (91%) whereas the campus-wide distribution of full-timers was 73%. Faculty control groups were from peer institutions and from national responses to the FSSE in 2003 and 2004. In 2003 “more than 14,000 faculty members at 143 four-year colleges and universities completed the pilot test”; this sample was composed of 55% males, 85% Caucasians and 75% full-time faculty or instructional staff. In 2004 “more than 20,000 faculty members at 132 four-year colleges and universities completed the survey”; this sample was composed of 57% males, 84% Caucasians and 83% full-time faculty or instructional staff. (Cutsforth, 2003a, 2004a).

Secondary student data was drawn from several sources. First, the student subjects were UW-Stout and national ACT-CAAP test participants in 2004. Student participants in the ACT-CAAP include sophomores, juniors and seniors. Faculty members volunteered to have the test administered during their class periods; students had the option of not participating. No information was made available on the number of UW-Stout student participants. (Budget, Planning and Analysis [BPA], 2004a) Second, the student subjects were UW-Stout seniors that participated in the *General Education Senior Level Assessment* survey in 1999 to 2006. No information was made available on the number of UW-Stout student participants.

Third, the student subjects were UW-Stout and national students that participated in the *ACT Student Opinion Survey* in 2004, 2005, and 2006. The survey was “administered in the classroom by teaching faculty/staff in primarily sophomore and junior level classes during the spring semester” (BPA, 2004b). In 2004 the return rate was 56% for a total of 300 completed surveys; in 2005 the return rate was 59% for a total of 287 completed surveys; in 2006 the return rate was 75% with 384 completed surveys. The surveys were turned into ACT for the scanning and reporting process. Survey results were compared to national user sample of four-year, post-secondary institutions. (BPA, 2004b, 2005a, 2006a).

Materials

The analysis in this paper utilized database survey reports written by UW-Stout Budget, Planning and Analysis office and national reports written by NSSE and FSSE organizations.

Procedure

Primary Research Question

The primary research question, do UW-Stout students lack critical thinking KSAs, was addressed by examining differences between UW-Stout student responses on the NSSE and peer

group responses as well as the national responses on the NSSE using existing institutional databases and reports. Specifically, a sub-group of five questions on the NSSE that NSSE designates as “mental activity” were examined. The primary question was “*During the current school year, how much has your coursework emphasized the following mental activities?*” The sub-questions had a four point scale from 1 (*very little*) to 4 (*very much*). The five questions were “**Memorizing** facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form”, “**Analyzing** the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components”; “**Synthesizing** and organizing ideas, ideas, information, or experiences into new, more complex interpretations and relationships”; “**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”; and “**Applying** theories or concepts to practical problems or in new situations”.

Results were compared within each year and each student group (first year and senior) via statistical significance mean difference testing and effect size analysis. No trend analysis was conducted; changes in peer groups and some changes to the survey prohibit this comparison given the source of the data. NSSE does provide re-calibrated data; however, this was not employed for this study.

Effect size was calculated by NSSE using Glass’s *delta* defined

as $\Delta = \left(\bar{X}_{Stout} - \bar{X}_{control} \right) / s_{control}$. Glass’s effect size that standardizes the mean difference in

terms of the control group variance is generally preferred over Cohen’s effect

size $d = \left(\bar{X}_{Stout} - \bar{X}_{control} \right) / s_{total}$, where the pooled variance becomes the standardizing factor,

when the control/comparison group sample size is very large and when there may be large differences in the conditions of the experimental and control. (Vacha-Hasse and Thompson, 2004; Coe, 2000). Generally, effect size significance is measured by using Cohen's rubric where .2 is *small*, .5 is *medium* and .8 is a *large* effect. However, this may not be entirely appropriate for educational data, where changes may seldom approach the medium-sized effect but may nonetheless have a substantial impact on the students and hence the institution. Vacha-Hasse and Thompson (2004) suggest that researchers use their own critical judgment in evaluating the importance of a given effect size, and that results are compared to other existing research. However, if no such research exists they suggest using Cohen's rubric as a guide. Additionally, NSSE recommends using Cohen's guidelines.

Secondary Research Question

Were the results from the *Mental Activity* student comparisons supported by other UW-Stout institutional data? This question was addressed by through multiple avenues. Additional data from NSSE, comparable faculty data from the FSSE, student data from the ACT-CAAP test, student data from ACT Student Opinion Survey, and UW-Stout student data from the *General Education Senior Assessment Survey*. A brief examination of the contribution of other institutional factors was conducted by examining relevant response on the NSSE, FSSE and the *ACT Student Opinion Survey*.

Additional NSSE data. Mean comparisons between UW-Stout, peer group and national average between each student type group on four additional NSSE questions that pertain to critical thinking were conducted. Effect sizes for the statistically significant differences were reported. The data came from two sub-questions from two primary questions. The first primary questions was "*To what extent has your experience at this institution contributed to your*

knowledge, skills, and personal development in the following areas“, and it used a four-point scale ranging from 1 (*very little*) to 4 (*very much*). The two sub-questions were “*Thinking critically and analytically*” and “*Solving complex real-world problems*”. The second primary question was “*In your experience at your institution during the current school year, about how often have you done each of the following?*”; responses ranged from 1 (*never*) to 4 (*very often*). The two sub-questions were “*Worked on a paper or project that required integrating ideas or information from various source*” and “*Put together ideas or concepts from different courses when completing assignments or during class discussions*”.

Faculty comparison data. Examined the faculty responses on the FSSE corresponding questions by first comparing the UW-Stout faculty and UW-Stout student response, and then by comparing UW-Stout faculty responses to national faculty responses for 2003 and 2004. Faculty responses were segmented into two groups according to the primary teaching responsibilities – lower division courses or upper division course. Compared responses on the *Mental Activity* set of questions and the *thinking critically and analytically* question. This analysis was done via significant differences in proportion of responses comparing first year students to lower division faculty and senior year students to upper division faculty. Exact text of student and faculty surveys can be found at NSSE website http://nsse.iub.edu/html/survey_instruments_2007.cfm and FSSE website <http://fsse.iub.edu/html/archives.cfm>.

Additional student data. Differences in the responses of UW-Stout students on the *Critical Thinking* ACT-CAAP test administered in 2004 compared to students across the nation were examined. This test consisted of 32 multiple choice items that measured “students’ skills, in analyzing, evaluating, and extending arguments” (ACT, 2007).

Trend analysis of UW-Stout senior responses to the *General Education Senior Assessment Survey* was conducted on data from 1999 to 2006. This survey was developed by UW-Stout's Faculty Senate *Planning and Review Committee* to evaluate student perceptions of the effectiveness of their general education coursework. The survey consisted of two primary questions, the first had 13 sub-questions and the second had 12 sub-questions. Responses on all sub-questions ranged from 1 (*none*) to 5 (*strong*). Three survey sub-questions were examined. The first general question was "*How much did your general education course-work contribute to your personal development of the following skills and abilities*". The two sub-questions of interest were "*Critically analyze information*" and "*Synthesize information*". The second general question was "*How much did your general education course-work contribute to your knowledge, appreciation and values in the following areas.*"; and the sub-question of interest was "*Value learning as a lifelong process*".

Institutional factors. Three institutional factors were considered: feedback to students from faculty, perceptions of supportive environment, and capstone projects. Levels of feedback were assessed by comparing the two UW-Stout student group NSSE scores to the peer and national average via the question "*Received prompt feedback from faculty on your academic performance (written or oral)*". The magnitude of the differences was assessed via effect sizes. Next, student responses were compared to faculty responses via NSSE/FSSE response proportions comparisons at both the UW-Stout level and the national level.

Influence of perceptions of supportive environment was assessed through two avenues. First, comparisons within the two student groups via two NSSE survey questions to peer and national data was conducted. First, in regards to faculty relationships "*Mark the box that best represents the quality of your relationships with people at your institution. Faculty Members*"

with responses ranging from 1 (*unavailable, unhelpful, unsympathetic*) to 7 (*available, helpful, sympathetic*). Second, in regards to perceptions of academic and social support “*To what extent does your institution emphasize each of the following*” “*Providing the support you need to help you succeed academically*” and “*Providing the support you need to thrive socially*”. The student responses were then compared to faculty responses. Exact text of the student and faculty surveys can be found at the NSSE website http://nsse.iub.edu/html/survey_instruments_2007.cfm and FSSE website <http://fsse.iub.edu/html/archives.cfm>.

Second, UW-Stout student responses on the *ACT Student Opinion Survey* were examined by looking at scores within UW-Stout and by comparing these responses to peer group and national averages. The *ACT Student Opinion Survey* is “conducted to determine the level of satisfaction with certain services or programs, as well as, the overall college environment” (BPA, 2004a). The primary participants are sophomores and juniors. Responses ranged from 1 (*very dissatisfied*) to 5 (*very satisfied*). Overall college environment score (42 item scale) compared to national scores. Faculty relationships were assessed via student ratings of out-of-class availability of your instructor and attitude of faculty toward students.

The use of a capstone project was examined via NSSE question “*Which of the following have you done or do you plan to do before you graduate from your institution?*” ... “*Culminating senior experience (capstone course, thesis, project, comprehensive exam, etc.*”. Responses on this question ranged from 1 (*have not decided*) to 4 (*done*). UW-Stout student group responses were compared to peer and national averages and then to corresponding faculty response on the FSSE. (See NSSE website http://nsse.iub.edu/html/survey_instruments_2007.cfm and FSSE website <http://fsse.iub.edu/html/archives.cfm> for exact survey texts.)

Chapter 4: Results

Primary Research Question

Comparisons of UW-Stout student responses to the NSSE *Mental Activity* questions to peer and national responses over time revealed that UW-Stout appeared to have a deficit for some aspects of *Mental Activity*. Recall that the *Mental Activity* question on the NSSE survey contains the five sub-questions that ask for student's perception of the amount of emphasis in their coursework of memorization, analysis, synthesis, evaluation and application. Table 2 displays the average responses for UW-Stout students and the two comparison groups from 2001 to 2006. Table 3 shows the effect sizes for the significantly different average responses.

Memorize

Neither first year nor senior Stout students rated themselves as using more memorization compared to both the peer institutions and the national sample. In fact, from 2004 to 2006 UW-Stout first year students had significantly lower average ratings than the peer institutions and the national sample.

Analyze

Across all years in the study, first year students had significantly lower average perceptions of the amount of emphasis placed on analyzing compared to peers and national average responses. The effect sizes for the first year mean differences ranged from .15 in 2006 to .31 in 2005; the largest effect size was for the 2004 and 2005 cohorts. According to Cohen's rubric these numbers indicated a small to moderate real difference in first year student perceptions. The effect size of .31 in 2005 meant that on average, UW-Stout first year students were about one-third of a standard deviation below first-year students in the peer institution.

From 2002 to 2006, seniors at UW-Stout also had significantly lower average ratings than their peers and the national sample. Senior effect sizes ranged from .15 to .26, indicating a small to modest real difference. The effect size of .25 in 2005 meant that the average UW-Stout seniors were one-quarter of a standard deviation below average senior responses in the national sample.

Synthesize

Stout first-year students' perceptions of the emphasis placed on synthesis were significantly lower than the peer and national samples for all years but 2001. The first-year mean difference effect sizes ranged from .16 in 2006 to .30 in 2005 when compared to the peer institutions, indicating a small to moderate effect. The first-year mean difference effect sizes ranged from .21 in 2006 to .34 in 2004 when compared to the national sample, indicating a small to moderate effect. In 2006, the average UW-Stout first year student was one-fifth of a standard deviation below the average first year student response at the national level.

Stout senior students' perceptions of the emphasis placed on synthesis were significantly lower than the peer and national samples for 2003 to 2006. The senior mean difference effect sizes ranged from .18 in 2006 to .27 in 2003 when compared to peer indicating a small to modest effect. The senior mean difference effect sizes ranged from .20 in 2006 to .31 in 2003 when compared to national responses indicating a small to modest effect. The effect size of .24 in 2005 indicated that the average Stout student was one-quarter of a standard deviation below the average peer institution senior.

Evaluate

There were no significant differences in average *evaluate* ratings for first year student for 2001 to 2003. From 2004 to 2006, Stout first year students rated themselves as significantly

lower than both the peer institution and national sample first year students. The effect sizes were small, ranging from .16 to .18 for the peer institutions and .12 to .21 for the national sample.

There were no significant differences in average *evaluate* ratings for seniors across all the years when compared to the peer institutions and the national sample, with the exception of the 2005 cohort. For this cohort, the effect size for the mean difference was small -- .16 for peers and .18 for national sample.

Apply

There were no significant differences in UW-Stout first year students' perception of their courses as emphasizing application of theories or concepts prior to 2004. However, there were significant deficits for the 2004 and 2005 first year Stout cohorts. The effect sizes were modest, .28 and .18 for the peers and .28 and .21 for the national samples.

There were no significant differences in average *apply* ratings for seniors across all the years when compared to the peer institutions and the national sample, with the exception of the 2005 cohort. For this cohort, the effect size for the mean difference was small -- .16 for peers and .16 for national sample.

Summary

There were significant differences in UW-Stout students' perceptions of the emphasis placed on their coursework for *Mental Activity*. Examination of the *Mental Activity* components revealed that Stout students are either on par or lower for *memorization*. However, there were significant deficits for both first year and seniors for the *analysis* and *synthesis* questions. First year students also had significant deficits for the *evaluate* question from 2004-2006 and the *apply* question for 2004 to 2005. Overall, from 2004 to 2006, UW-Stout first year students were significantly lower on the five higher order thinking questions when compared to the peer

institutions and the national sample. However, these differences were small to moderate in size when Cohen's rubric to gauge the practical degree of difference was applied.

Table 2

UW-Stout NSSE "Mental Activity" Average Reponses Compared to Peer Group and National

Question	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
2001						
Memorize	2.92	2.98	2.93	2.81	2.82	2.77
Analyze	2.87	3.05**	3.13**	3.17	3.25	3.28
Synthesize	2.60	2.76	2.84**	2.86	3.00	3.04**
Evaluate	2.71	2.76	2.78	2.86	2.91	2.92
Apply	2.84	2.91	2.97	3.25	3.16	3.16
2002						
Memorize	3.00	2.96	2.94	2.84	2.79	2.74
Analyze	3.02	3.11	3.14	3.14	3.26*	3.27*
Synthesize	2.67	2.83*	2.85*	2.92	3.04	3.05*
Evaluate	2.73	2.81	2.80	2.94	2.93	2.93
Apply	2.81	2.94	2.99*	3.19	3.17	3.17
2003						
Memorize	2.98	2.97	2.93	2.61	2.78*	2.72
Analyze	2.92	3.09**	3.15***	3.09	3.25**	3.28***
Synthesize	2.67	2.82*	2.88***	2.81	3.04***	3.07***
Evaluate	2.68	2.80	2.83*	2.83	2.95	2.96
Apply	2.88	2.96	3.01*	3.12	3.18	3.20
2004						
Memorize	2.77	2.93***	2.91***	2.83	2.79	2.74
Analyze	2.87	3.09***	3.14***	3.13	3.28***	3.30***
Synthesize	2.59	2.84***	2.88***	2.90	3.07***	3.09***
Evaluate	2.66	2.82***	2.84***	2.93	2.99	2.99
Apply	2.80	3.00***	3.03***	3.17	3.23	3.23
2005						
Memorize	2.67	2.90***	2.85***	2.81	2.75	2.70*
Analyze	2.79	3.04***	3.09***	3.06	3.22***	3.24***
Synthesize	2.65	2.81***	2.87***	2.83	3.03***	3.06***
Evaluate	2.72	2.82*	2.84**	2.83	2.97**	2.99**
Apply	2.81	2.96***	2.99***	3.07	3.20**	3.19**
2006						
Memorize	2.71	2.88***	2.87***	2.79	2.76	2.74
Analyze	2.89	3.01**	3.06***	3.07	3.20*	3.22*
Synthesize	2.65	2.78**	2.83***	2.84	2.99*	3.01*
Evaluate	2.72	2.82*	2.82*	2.88	2.94	2.94
Apply	2.85	2.94	2.98**	3.14	3.16	3.17

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

Table 3
UW-Stout NSSE “Mental Activity” Effect Sizes^a of Peer Group and National Comparisons

Question	First Year		Senior	
	Peer	NSSE	Peer	NSSE
2001				
Memorize	--	--	--	--
Analyze	-0.23	-0.33	--	--
Synthesize	--	-0.28	--	-0.22
Evaluate	--	--	--	--
Apply	--	--	--	--
2002				
Memorize	--	--		
Analyze	--		-0.16	-0.18
Synthesize	-0.19	-0.22	--	-0.15
Evaluate	--	--	--	--
Apply	--	-0.21	--	--
2003				
Memorize	--	--	-0.17	--
Analyze	-0.22	-0.30	-0.21	-0.26
Synthesize	-0.18	-0.26	-0.27	-0.31
Evaluate	--	-0.17	--	--
Apply	--	-0.15	--	--
2004				
Memorize	-0.19	-0.16	--	--
Analyze	-0.28	-0.35	-0.20	-0.23
Synthesize	-0.30	-0.34	-0.20	-0.23
Evaluate	-0.18	-0.21	--	--
Apply	-0.24	-0.28	--	--
2005				
Memorize	-0.26	-0.21	--	0.12
Analyze	-0.31	-0.38	-0.21	-0.25
Synthesize	-0.20	-0.26	-0.24	-0.28
Evaluate	-0.12	-0.14	-0.16	-0.18
Apply	-0.18	-0.21	-0.16	-0.16
2006				
Memorize	-0.20	-0.19	--	--
Analyze	-0.15	-0.22	-0.17	-0.20
Synthesize	-0.16	-0.21	-0.18	-0.20
Evaluate	-0.12	-0.12	--	--
Apply	--	-0.16	--	--

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

^aEffect size is calculated as the mean difference divided by the comparison group standard deviation.

Secondary Research Questions

Are the results from the NSSE *Mental Activity* sub-questions supported by results from other UW-Stout institutional databases? Are students truly less skilled in *Mental Activity*, particularly in terms of analysis, synthesis, and application or are their perceptions too low? Examination of student responses on other NSSE questions, faculty perceptions of student performance via the FSSE, student performance data, and other student perception data will help to answer this secondary research question.

Additional NSSE Questions

Other pertinent NSSE questions chosen were student perceptions of their *critical thinking* knowledge, skills and personal development, their ability in *solving complex real world problems*, and student perception of the amount of time spent on using *integration* in their coursework. Comparison of the average responses of Stout students and the peer and national comparison groups are shown in Table 4. Mean difference effect sizes are displayed in Table 5.

Critical Thinking. UW-Stout had a consistent deficit across time in *critical thinking* question for first year students. Effect sizes for the first year students compared to the peer institutions ranged from .14 in 2005 to .33 in 2004, indicated a small to moderate difference. Effect sizes for the first year students compared to the national results ranged from .18 in 2005 to .39 in 2004, indicated a small to medium difference. Stout seniors were significantly below the peer group and the national sample for the 2003, 2004 and 2005 cohorts. Effect sizes were small in 2003 and 2004 and moderate in 2005.

Solving complex problems. There were no significant differences when comparing the UW-Stout student groups and both the peer and national comparison groups.

Integration. There were no statistically significant differences for the first year students for both the peer and national averages except for the 2004 and 2005 cohorts. For these two cohorts, Stout first year students rated themselves below on *integrating ideas in the classroom*; however the effect sizes were small. Additionally, the 2005 cohort had significantly lower ratings for *integrating ideas in projects* with small effect sizes. Stout senior students had significantly lower average ratings on *integrating ideas in projects* when compared to both the peer and national groups for 2002, 2003, 2004, and 2005. The effects sizes for the senior students mean differences were small, ranging from .13 in 2004 to .23 in 2003 and 2004.

Table 4
UW-Stout NSSE Additional Critical Thinking Average Reponses Compared to Peer Group and National

Question	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
2001						
Critical thinking	2.92	3.03	3.09**	3.18	3.27	3.31**
Problem solving	not asked			not asked		
Integrate ideas in projects	2.97		3.01	3.28		3.32
Integrate ideas in classroom	na		na	na		na
2002						
Critical thinking	2.82	3.07***	3.12***	3.19	3.29	3.33*
Problem solving	2.41	2.47	2.48	2.72	2.68	2.70
Integrate ideas in projects	3.05	3.05	3.04	3.20	3.34*	3.33
Integrate ideas in classroom	2.39	2.44	2.47	2.83	2.80	2.82
2003						
Integrate ideas in projects	2.94	3.05	3.06*	3.18	3.34**	3.34**
Integrate ideas in classroom	2.43	2.45	2.49	2.83	2.82	2.85
Critical thinking	2.97	3.15**	3.2***	3.11	3.3**	3.35***
Problem solving	2.45	2.49	2.52	2.55	2.65	2.68
2004						
Critical thinking	2.86	3.13***	3.17***	3.21	3.33**	3.37***
Problem solving	2.32	2.47***	2.5***	2.65	2.68	2.69
Integrate ideas in projects	2.99	3.04	3.05	3.26	3.35*	3.35*
Integrate ideas in classroom	2.33	2.44***	2.47***	2.91	2.84	2.86
2005						
Critical thinking	3.04	3.14**	3.18***	3.09	3.34***	3.37***
Problem solving	2.47	2.56	2.58*	2.73	2.72	2.72
Integrate ideas in projects	3.00	3.08*	3.08*	3.20	3.36***	3.37***
Integrate ideas in classroom	2.44	2.54**	2.57***	2.98	2.91	2.93

Question	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
	2006					
Critical thinking	2.99	3.12**	3.16***	3.22	3.30	3.33
Problem solving	2.51	2.55	2.58	2.80	2.68	2.72
Integrate ideas in projects	3.05	3.04	3.03	3.25	3.31	3.30
Integrate ideas in classroom	2.48	2.54	2.57*	2.94	2.89	2.91

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

Table 5

UW-Stout NSSE Additional Critical Thinking Effect Sizes of Peer Group and National Comparisons

Question	First Year		Senior	
	Peer	NSSE	Peer	NSSE
	2001			
Critical thinking	--	-0.21		-0.18
Problem solving				
Integrate ideas in projects	--	--	--	--
Integrate ideas in classroom	--	--	--	--
	2002			
Critical thinking	-0.31	-0.37	--	-0.19
Problem solving	--	--	--	--
Integrate ideas in projects	--	--	-0.18	-0.17
Integrate ideas in classroom	--	--	--	--
	2003			
Critical thinking	-0.23	-0.3	-0.25	-0.32
Problem solving	--	--	--	--
Integrate ideas in projects	--	-0.15	-0.22	-0.23
Integrate ideas in classroom	--	--	--	--
	2004			
Critical thinking	-0.33	-0.39	-0.16	-0.21
Problem solving	-0.16	-0.2	--	--
Integrate ideas in projects	--	--	-0.13	-0.13
Integrate ideas in classroom	-0.14	-0.18	--	--
	2005			
Critical thinking	-0.14	-0.18	-0.33	-0.37
Problem solving	--	-0.12	--	--
Integrate ideas in projects	-0.1	-0.1	-0.22	-0.23
Integrate ideas in classroom	-0.13	-0.17	--	--
	2006			
Critical thinking	-0.16	-0.21	--	--
Problem solving	--	--	--	--
Integrate ideas in projects	--	--	--	--
Integrate ideas in classroom	--	-0.11	--	--

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

^aEffect size is calculated as the mean difference divided by the comparison group standard deviation.

Faculty Perceptions of Student Performance

Comparison of the proportion of faculty and students that responded *very much* or *quite a bit* to the *Mental Activity* questions in 2003 and 2004 is shown in Table 6. Although the gaps are high for most of the questions, there are only a few significant differences. For the first year students, significantly fewer faculty rated themselves as emphasizing memorization than do students in 2003 and 2004. This gap is typical across the national FSSE/NSSE results. For the first year students in 2004, significantly more faculty rated their students as having critical thinking knowledge, skills and understanding compared to student perceptions. For the upper division, significantly more faculty rated courses as emphasizing synthesis than did the students.

Table 6
UW-Stout FSSE/NSSE Proportion of Respondent Comparisons

Question	Proportion of respondents that answered “ <i>very much</i> ” or “ <i>quite a bit</i> ”							
	2003				2004			
	FSSE		NSSE		FSSE		NSSE	
	LD	UD	FY	SY	LD	UD	FY	SY
Memorize	0.38*	0.16*	0.73	0.57	0.30*	0.17*	0.61	0.64
Analyze	0.76	0.98	0.70	0.79	0.91	0.93	0.70	0.83
Synthesize	0.71	0.91*	0.57	0.62	0.93*	0.85	0.52	0.67
Evaluate	0.60	0.83	0.57	0.65	0.71	0.81	0.57	0.71
Apply	0.67	0.94	0.67	0.79	0.84	0.90	0.64	0.80
Critical thinking	0.86	0.96	0.76	0.83	0.95*	0.96	0.69	0.86

Note. LD indicated faculty taught lower division students and UD indicates upper division; FY indicates a first year student and SY a senior year student. The starred numbers indicate a statistically significant difference between the LD and FY or UD and SY proportions at the .05 level. From BPA 2003b, 2004d; Cutsforth 2003b, 2004b. * $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

Using the frequency distribution data from the 2004 FSSE Report to UW-Stout, a mean difference comparison was conducted for the *Mental Activity* questions. The results are displayed in Table 7. There were significant differences on all five sub-questions for the first year and senior students. As noted in the above analysis, faculty underestimated the degree of memorization, and the effect sizes are large.

For the first year students, the largest practical difference occurred for *synthesize* where the effect size was 1.05, indicating that the average lower division faculty member would rate *synthesis* higher than 84% of the first year student group. Effect sizes were also large for *application* and *analysis*. *Evaluation* had a medium effect size.

For the seniors, the practical differences were about the same and medium in size for *synthesize*, *application*, *analysis*, and *evaluation*. The effect size for *application* indicated that the average upper division faculty member would rate *application* higher than 66% of the senior group.

Table 7
NSSE/FSSE Mean Comparison in Mental Activities for 2004

	First Year			Senior		
	FSSE	NSSE	Effect Size	FSSE	NSSE	Effect Size
Memorize	2.07***	2.77	-0.87	1.93***	2.83	-1.11
Analyze	3.32***	2.87	0.60	3.40**	3.13	0.37
Synthesize	3.39***	2.59	1.05	3.27***	2.90	0.45
Evaluate	3.04*	2.66	0.46	3.29**	2.93	0.42
Apply	3.34***	2.78	0.67	3.49**	3.17	0.39

Note: effect size was calculated as faculty minus student which was then divided by pooled standard deviation because there is no clear "control" group. Data source: FSSE 2004 Report for UW-Stout.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

Additional Student Data

ACT CAAP. This test was “designed to measure general educational foundational skills typically attained in the first two years of college”. In 2004, UW-Stout participated in the *Critical Thinking* test. Results showed that Stout was comparable to national scores – Stout scores were 62.7 and the national scores were 62.1. Moreover, there were no differences between sophomores, juniors and seniors scores. (BPA, 2004a).

General Education Senior Level. UW-Stout seniors were asked to evaluate how their general education courses helped to contribute to their personal development of skills and abilities in selected areas. Figure 2 shows that senior students at UW-Stout have consistently rated their General Education (Gen Ed) preparation as above average in the areas of developing skills in critically analyzing information, and in synthesizing information. Moreover, there were statistically significant increases from 1999 to 2006 in these two areas. (Ness, 2007) Seniors consistently gave high marks to Gen Ed for fostering the value of lifelong learning. Note: because the survey originates at UW-Stout there are no peer groups for comparison. (BPA, 2001b, 2004e, 2005c; Ness, 2006, 2007).

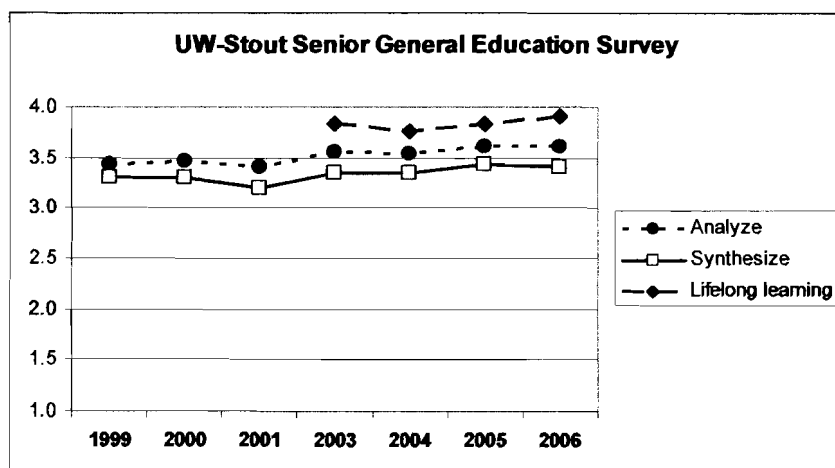


Figure 2. *UW-Stout senior general education survey results on deep thinking questions, 1999-2006.*

Institutional factors

Institutional factors influence both student performance and student perceptions of their learning outcomes. This paper considered the two factors from institutional data that may influence students' deeper thinking. These factors are *feedback* from faculty to students and having a *supportive environment*. The feedback results were from the NSSE and FSSE surveys. The *supportive environment* results include questions/results that pertain to a personal atmosphere that facilitated deeper learning from the NSSE and FSSE surveys and from the ACT Student Opinion Survey, and questions from the NSSE and FSSE pertaining to venues where students displayed the results of their deep thinking.

Feedback. Table 8 shows that UW-Stout students have significantly lower average ratings of the amount of time they get prompt feedback from faculty compared to the peer group and the national sample. Effect sizes for both the first year students and the seniors were small to medium.

Table 8
UW-Stout Student NSSE Average Responses and Effect Sizes for Promptness of Faculty Feedback over Time

Year	Averages					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
2001	2.39	2.56**	2.61**	2.58	2.80**	2.80**
2002	2.40	2.59**	2.62***	2.57	2.80***	2.81***
2003	2.36	2.59***	2.63***	2.67	2.82*	2.83*
2004	2.42	2.59***	2.64***	2.62	2.85***	2.85***
2005	2.70	2.73	2.76	2.75	2.93***	2.94***
2006	2.60	2.58	2.59	2.72	2.79	2.76

Table 8 (continued)

Year	Effect sizes			
	First Year		Senior	
	Peer	NSSE	Peer	NSSE
2001	-.20	-.26	-.28	-.27
2002	-.23	-.27	-.30	-.30
2003	-.27	-.33	-.19	-.20
2004	-.21	-.26	-.29	-.28
2005	--	--	-.24	-.25

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

UW-Stout students also have significantly lower ratings compared to UW-Stout faculty. The NSSE/FSSE comparison in 2003 of proportion of *very much* or *quite a bit* response for first year students revealed a gap of 0.58 and in 2004 a gap of 0.53. The same comparison in 2003 for seniors revealed a gap of 0.39 and in 2004 a gap of 0.40. Examination of the 2004 data also revealed significant differences in the mean scores of students and faculty. The first year student/faculty difference was 1.11 with and a large effect size of 1.47. The senior/faculty difference was 0.85 with and a large effect size of 1.13. (FSSE Report of UW-Stout, 2004). However, having a gap in faculty/student perceptions of *prompt* feedback is true in most universities that participated in the FSSE surveys. In fact, the UW-Stout faculty ratings are in line with the FSSE peer and national results. (BPA, 2003b, 2004d).

Supportive Environment. This component of institutional factors was viewed by looking at three things: additional NSSE/FSSE questions, examining ACT Student Opinion Survey, and use of capstone project.

First, having a supportive environment that facilitated higher order learning was operationalized through three NSSE questions perception of the quality of relationship with

faculty, academic support, and social support. The NSSE results for 2001 to 2006 are shown in Table 9.

The 2004 and 2005 first year and senior cohorts rated their relationships with faculty members significantly lower than their peer groups and the national average. The effect sizes for the peer mean difference was small for the first year students (.20 and .22 for first year and .23 .25 for the seniors for 2004 and 2005 respectively). Additionally, the 2002 first year cohort had significantly lower ratings; however, the effect size was small at .19 for peers.

After 2001, first year students rated themselves as significantly below peers and national results for having adequate academic support. The mean difference effect sizes for first year students compared to the peer institutions were small in 2002 (.20), were of medium size for 2003 (.31) to 2005 (.25), and then were small in 2006(.11). There were no significant differences for the senior year students in 2001, 2002, 2003 or 2006. The 2004 and 2005 cohorts were significantly below both the peer and national average responses, with peer effect sizes of .2 in 2004 and .25 in 2005.

On the whole, first year UW-Stout students rated the level of social support on par with the peer institutions and with the national sample. UW-Stout seniors rated themselves on or above par for the level of social support compared to the peer institutions and the national sample.

Table 9
UW-Stout NSSE Supportive Environment Average Response Scores Comparisons

Question	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
	2001					
Relationship with faculty ^a	5.39	5.39	5.39	5.32	5.56**	5.52
Academic support	2.91	2.98	3.00	2.77	2.85	2.84
Social support	2.35	2.30	2.33	2.24	2.08**	2.08

Table 9 (continued)

	2002					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
Relationship with faculty	5.15	5.38*	5.39*	5.48	5.56	5.55
Academic support	2.81	2.98*	3.01**	2.83	2.87	2.87
Social support	2.36	2.28	2.31	2.29	2.08**	2.10**
	2003					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
Relationship with faculty	5.36	5.54	5.56*	5.65	5.73	5.72
Academic support	2.81	3.05***	3.09***	2.87	2.93	2.95
Social support	2.28	2.31	2.34	2.20	2.07	2.09
	2004					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
Relationship with faculty	5.33	5.56**	5.58***	5.46	5.74***	5.73***
Academic support	2.83	3.07***	3.10***	2.79	2.91*	2.96***
Social support	2.27	2.33	2.36**	2.18	2.10	2.12
	2005					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
Relationship with faculty	5.07	5.35***	5.36***	5.36	5.67***	5.64***
Academic support	2.84	3.03***	3.07***	2.73	2.95***	2.97***
Social support	2.41	2.37	2.38	2.12	2.17	2.17
	2006					
	First Year			Senior		
	Stout	Peer	NSSE	Stout	Peer	NSSE
Relationship with faculty	5.07	5.20	5.19	5.44	5.45	5.42
Academic support	2.87	2.96*	2.99**	2.94	2.86	2.87
Social support	2.64	2.64	2.75*	2.65	2.43**	2.57

Note. From BPA 2001a, 2002a, 2003a, 2004c, 2005b, 2006b.

^a This question was on a 7-point scale, the two support questions were on a 4-point scale.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

Comparison of the UW-Stout student NSSE results and the faculty FSSE results revealed no significant differences in student and faculty proportions in top two ratings for any of these three questions for 2003 and 2004. However, comparison of the student and faculty means for 2004 revealed seniors were significantly lower in their perceptions of both academic and social

support than were the upper division faculty. Further, the effect sizes were large (0.6 for both). (FSSE Report of UW-Stout, 2004).

The second component of the *supportive environment* analysis was the examination of UW-Stout student responses on the ACT Student Opinion Survey. This survey was used to examine how students perceived the learning environment. Overall, students were highly satisfied with the environment at UW-Stout with average overall satisfaction scores of 3.60 to 3.65 and their levels of satisfaction were comparable to peer and national sample scores. Stout students were also very satisfied with the faculty element of the environment, defined as the questions rate the *out-of-class availability of instructor* and *attitude of faculty to students*. (See Figure 3).

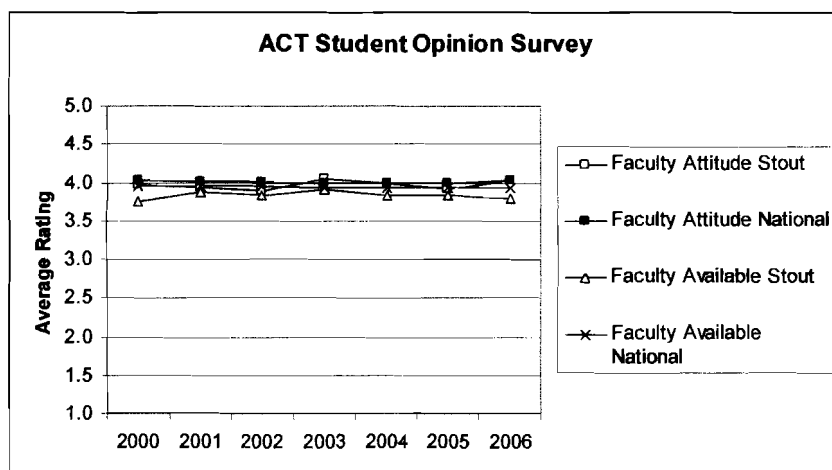


Figure 3. *UW-Stout student responses to ACT Student Opinion Survey on having a supportive learning environment.*

Source: BPA 2000, 2001c, 2002b, 2003c, 2004b, 2005a, 2006a.

In 2006 students were asked additional questions about their learning environment. 58% of the student respondents *agreed* or *strongly agreed* that they would have benefited by a freshman seminar course that included information on study skills, career advisement, software training and campus resources; perhaps indicating that they felt they were starting from a deficit

which can be difficult to make up. Also, 45% indicated they would use an e-portfolio to document their learning.

Capstone project. The senior capstone project is one institutional method for having students apply their higher order learning skills to demonstrate to both the institution and to the students themselves that students know that they know what they know. The NSSE survey asks students about their intention to engage in a capstone project. The survey results showed that Stout senior students' perceptions were low compared to peers and national results (see Table 10) and the effect sizes were medium.

Table 10

UW-Stout NSSE Average Response Comparisons to the Capstone Question and Effect Sizes

Seniors					
Percentage of Responses <i>Plan to Do or Done</i>					
Year	Stout	Peer	Peer Effect		NSSE effect
			Size	NSSE	size
2004	0.08	.31***	-0.49	.35***	-0.56
2005	0.11	.35***	-0.49	.38***	-0.56
2006	0.13	.30***	-0.39	.32***	-0.43

Note. From BPA 2004c, 2005b, 2006b.

* $p < .05$, ** $p < .01$, *** $p < .001$ two-tailed tests.

The UW-Stout senior student results were also significantly lower compared to the faculty perceptions of the intention to use a capstone project. In 2003 at UW-Stout, 73% of the upper division faculty thought that it was *very important or important* for students to undertake a capstone project whereas only 32% of the seniors had either completed or planned to complete a capstone project before they graduated (yes or no question). The responses to this question were

changed in 2004 to allow students additional options of *done*, *plan to do*, *do not plan to do*, and *have not decided*. 74% of the of the upper division faculty thought that it was *very important or important* for students to undertake a capstone project whereas only 40% of the seniors had either completed or planned to complete a capstone project before they graduated. UW-Stout faculty perceptions were on par with national FSSE results; the FSSE national data average for upper division in 2003 was .70 and in 2004 was .72. (BPA, 2003b, 2004d; Cutsforth 2003b, 2004b).

Summary of Secondary Research Question

Additional research data from the NSSE survey revealed that UW-Stout students rated themselves significantly below the peer and national samples for critical thinking, especially for first year students. Student perceptions were also significantly lower than faculty perceptions for the *mental activity* questions, and some of the effect sizes were large. However, data that directly measured Stout students' critical thinking abilities showed that they were on par with peer institutions. Furthermore, senior students rated their foundational coursework as above average in critical thinking training. There were some problems with institutional factors that foster critical thinking. In particular, Stout students perceived significantly lower levels of feedback than peer institutions and Stout faculty did. Further, first year students felt that they did not have adequate academic support and had sub-par ratings of their relationships with faculty members. Finally, UW-Stout students rated their use of a capstone project significantly lower than peer institutions and faculty expectations.

Chapter 5: Summary, Recommendations and Conclusion

Introduction

The mission and vision of UW-Stout is to prepare students to become productive citizens and employees, and to develop the habits of life-long learners. A cornerstone to reaching this goal is to teach students how to develop deep thinking skills that includes the ability to think critically. Successful learning institutions persistently evaluate the achievement of their primary mission goals. Due to the nature of goals, it can be difficult to directly measure their achievement. However, by using a combination of institutional research data, a broad picture of students' abilities in these areas can be formed.

The purpose of this study was to discover if the level of deep and critical thinking by UW-Stout students was commensurate with the university's mission and vision. This was accomplished by examining publicly available institutional data and reports to uncover the extent of the problem.

Chapter Five of this research paper will summarize the study findings and present conclusions and recommendations. It will also provide suggestions for future research.

Summary of Findings

Overall, the results of UW-Stout student responses on the NSSE surveys showed that perceptions of deep thinking as represented in the *Mental Activity* questions was lower than the peer and national comparison groups. This was a particular problem for both student groups the areas of analysis and synthesis. Additionally, more recently the first year students were lower for all four of the sub-questions (*analyze, synthesize, evaluate, and apply*). Although the effect sizes were small to moderate, these consistent deficits raise a red flag that suggests further investigation is needed.

The examination of supplementary institutional data on UW-Stout students' deeper thinking skills revealed mixed results. Student perceptions of skills related to *Mental Activity* revealed that for *critical thinking* abilities, first year and senior students consistently rated themselves below the comparison groups; however, they were on par for *ability to solve complex real world problems*. There were mixed results for students' perceptions of using integration; first year students were on par with the comparison groups and the seniors were significantly lower for *integrating ideas in projects*. This deficit for seniors was reinforced by results of the senior capstone project, where significantly fewer Stout seniors plan to do a capstone project when compared to the two comparison groups.

UW-Stout faculty had higher perceptions than the students. This was especially true for *synthesis*, where mean comparison analysis of the 2004 NSSE/FSSE data revealed a large effect size for the first year students and a medium effect size for the senior students.

Investigation of current real skills and a retrospective look at gains in skills throughout their time at UW-Stout indicate that Stout students do not lack in deeper thinking skills. UW-Stout students' performance on national critical thinking test was on par with peer and national results. Moreover, Stout seniors' highly rated their General Education courses in developing their ability to critically analyze and synthesize information and to value life-long learning.

Investigation of institutional factors that provide the structure and support of deep thinking also revealed mixed results. Stout students had consistently lower ratings of receiving prompt feedback from faculty when compared to the peer institutions and when compared to Stout faculty ratings. Although this feedback gap is also present for the national student/faculty comparisons, the size of the Stout gap is large and should be seen as a red flag. Overall, students felt that UW-Stout had a supportive environment. However, the first year students in the NSSE

indicated a degree of insufficient academic support that was reinforced by findings in the ACT Student Opinion survey. First year students also indicated sub-par ratings of relationships with faculty. Although seniors did not indicate a lack of academic support, they did indicate on the NSSE that they significantly fewer had done or planned to do a senior capstone project compared to the peer institutions and the national sample. Stout faculty rated the senior capstone as highly important to a student's educational experience. This result also raised a red flag.

Conclusions and Recommendations

There appears to be a problem with student perceptions of deep thinking, especially for the skills of analysis and synthesis. However, when student test scores in critical thinking are examined, UW-Stout scores are on par with the peer and national groups. Therefore the question becomes one of perceptions versus fact – is the difficulty that Stout students do not realize the deep thinking knowledge, skills and abilities that they have instead of having an absolute deficit in these areas. This view is somewhat supported by the faculty perceptions data, where faculty rate student abilities higher than students do. Further suggestive evidence was the other student survey data where students rated their overall critical and analytic skills as high, and were highly satisfied with their educational experience at Stout.

Why might students have these low perceptions? One finding offers a potential answer – lack of prompt feedback from faculty may strongly influence a student's lack of confidence in their deep thinking skills. Another potential factor supported by the data was lack of support for academics. For the first year students, they indicated a desire for additional formats for starting out their college career with the needed skills to be successful. For the seniors, their lack of participation in a capstone project showed that they need a venue to display, to themselves and to the institution, the deep thinking skills that the faculty believes they have gained over their

educational experiences as UW-Stout. In both of these areas the lack of institutional structure and support can hold students back from “knowing what they know”. Furthermore, current research emphasized the importance of the learning environment in fostering deep learning skills – if students do not perceive that this environment exists, they may be taught the necessary skills but fail to actually learn and internalize them.

Although the data are not 100% clear cut, the evidence does seem to point to a deficit in Stout students deep thinking perceptions if not actual abilities. However, these deep thinking skills are only effective when they are put into repeated practice and this is where the data is suggesting that Stout may be falling short. However, UW-Stout is fortunate that it is replete with talented faculty and staff that care deeply about the students and the effectiveness of the students’ learning experiences. Creative use of current resources, both human and capital, can go a long way to tackling this issue.

Suggestions for future research

One possible intervention that could address the low perceptions and the possible low actual knowledge, skills and abilities in deep thinking is a learning portfolio. Learning portfolios established at the institutional level have the ability of creating in students the habit of thinking and physically recording their learning progress throughout their educational career. Effective implementation of the learning portfolio requires students to consistently and effectively use their deep thinking skills of analysis, synthesis, valuation and application and allows them to build their reflection skills. (Ericksen and Greene, 2006). The learning portfolio can be started in the freshman year and be used to assist the first year students to begin to build their academic skills. The learning portfolio, when correctly implemented, is an excellent senior capstone project. (Labissiere and Reynolds, 2005) However, to be truly effective the learning portfolios

require both reflection by the students, and prompt feedback from the faculty to the student. Fortunately, several universities have found creative methods for overcoming this potential stumbling block. Future research could examine these methods for applicability at UW-Stout.

Examination of how successful universities promote deep thinking in their students would also be an area of future research. UW-Stout has an excellent Teaching and Learning Center that has a focus on the scholarship of teaching and learning, and these talented faculty and staff may have many creative and innovative solutions to this issue.

This paper represents an initial study of deep learning and critical thinking skills of students at UW-Stout. Future work could include examination of all aspects of critical thinking as outlined in the Facione study.

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