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Insights from using the Approaches to Studying as an Evaluation Tool for Educational Resource Development

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INSIGHTS FROM USING THE APPROACHES TO STUDYING AS AN EVALUATION TOOL FOR EDUCATIONAL RESOURCE DEVELOPMENT

Strictly as per the compliance and regulations of:

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Carol A. Speth [α] & Donald J. Lee [σ]

Abstract - Over the past 12 years, an awareness of student characteristics has informed the design and interpretation of a series of research and evaluation studies in the Student Approaches to Learning (SAL) tradition. Instructors and developers of on-line learning objects have used the results to encourage active learning and implement better strategies. Addition of content learning items to the survey questions (along with evaluation questions and the 18-item ASSIST short form) made the questionnaire long enough to discourage completion. On some studies, two items ask about students' conceptions of- and motivations for learning have served as proxies for Approach scores, because they can be interpreted in the context of previous research. Non-conventional ways of analyzing the data have evolved because approaches are not evenly distributed. Significance tests based on assumptions of treatment groups, each randomly sampled from a population, are not always appropriate in real course settings.

Keywords : assist, approaches to studying, student learning, distance education, resident education, life science teaching, higher education, classroom assessment, authentic assessment, metacognition.

I. Introduction

A series of educational research and evaluation studies were conducted in Genetics, Plant Sciences and Soil Sciences classes in a College of Agriculture and Natural Resources at a Land Grant University during the last twelve years. These studies were implemented to guide the courses toward student-centered teaching and active learning strategies that were appropriate for the student population. Gradually, instructors have learned how to help students make optimal use of online materials and how these materials can be incorporated into both resident and distance classes.

Teaching strategy and on-line resource development interact with student learning styles to culminate in the final learning impact. Consequently, these studies have been inspired by an international body of scholarship in what Biggs (1993) called the Student Approaches to Learning (SAL) tradition. This article describes how the Approaches and Study Skills Inventory for Students (ASSIST) helps teachers understand student characteristics and how data collected with it can be used to guide course and educational resource development. This article will also describe how SAL analyses can be streamlined and focused in educational research. When necessary, a two-item proxy measure focusing on conceptions of learning and motivations was substituted for the ASSIST to capture its essence without making the total number of questions enough to discourage students from participating or completing. Finally, the next phase of the research program, planned for next year, will be described.

During the late 1990's, a series of scientific breakthroughs in the areas of genetics and crop technology, including genetic modification of major crops, and cloning of livestock animals (the most famous being Dolly the sheep) created a demand for publicly available information and online teaching materials that, unlike textbooks, could keep up with the rapid changes. This led to development of the Library of Crop Technology, later called the Plant and Soil Sciences library (http://passel.unl.edu). These online lessons were developed with learning objectives, images, animations, and quizzes. Teachers and self-directed learners from dozens of countries were finding and using these resources (Byrne, Namath, Harrington, Ward, Lee and Hain (2002). But when students in a junior-level genetics course were asked to use and evaluate lessons on crop genetic engineering, the results were baffling (Hain, 1999). A subset of students used all the features of the on-line environment, quizzes, hyperlinks and animations and reported a preference for their integration into their own learning. Most students in this genetics class did not use them or put minimal time and effort into it. This uneven use of on-line resources contrasted with national and international interest in use of these resources via their distribution on the Internet.

The developers had evidence from Byrne et al. (2002) that the animations and on-line learning environment would help students understand the concepts better and wondered how to make the online lessons more inviting and/or motivate students to view them, both by persuasion and reward. The developers and teachers decided they needed more insights on their students' approaches to learning, which set the stage for several studies including a measure of individual differences.

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II. Previous Literature

Biggs (1993) reviewed the development of what he calls the Student Approaches to Learning (SAL) tradition of research and how it compares to the Information Processing (IP) tradition. The ASSIST came out of a long research program on post-secondary student learning by Noel Entwistle and others, mainly at the University of Lancaster and University of Edinburgh, always benefitting from insights of similar research programs by John Biggs at the University of Newcastle in Australia and the University of Hong Kong. After years of testing with thousands of students in Great Britain and several other countries, the Approaches to Studying Inventory developed at the University of Lancaster in England (Ramsden and Entwistle, 1983) evolved into the ASSIST at the University of Edinburgh (Tait, Entwistle, and McCune, 1998).

Each approach includes (1) A type of motivation, which might be interest, achievement as measured by grades, or trying not to fail; (2) an intention to either understand the material or just memorize it for the test; (3) Either organized or disorganized study methods. Students' approaches can be influenced by kinds of instruction they receive and the kinds of assessment they expect.

Students whose ASSIST responses suggested they are using a Surface Approach have the following characteristics: An intention to cope, not reflecting on purpose or strategy, treating the course as unrelated bits of knowledge and having trouble making sense of new ideas. Students in this group often find tests very threatening, lack self-confidence and feel anxious. By definition, the intention of students with a Strategic Approach is to excel on their graded work. They gear their work to instructors' preferences, manage their time and effort and put consistent effort into studying. But if they focus on the grade rather than the content, they may miss deeper meanings and connections, unless they are rewarded for looking for them. Students using a Deep Approach intend to understand and are motivated by interest in the content. They may tend to focus more on the bigger picture and relationships among ideas or on the components or logical structure. They can get into trouble if they don't find the content interesting or meaningful or if they do not focus enough on what the *instructor* values. Many students manage to fuse Deep and Strategic Approaches and do quite well. Other students aspire to understanding but do not know how to go about reaching it. Their survey responses often indicate that they *intend* to understand, but their learning processes make that unlikely and their anxiety about assessment is a distraction rather than a motivation.

In several of the classes studied, at least half the students were in the Surface Approach Group for that subject. This might be because the course is not in their major. The same students might respond like a Deep Approach learner in their own fields of study.

Using the Revised Approaches to Studying Inventory (RASI) an intermediate version between the ASI and the ASSIST), Entwistle, Tait and Speth (1996) developed software and manuals to administer the questionnaire, use the scores to diagnose student characteristics and provide personalized advice on learning and studying for students with different patterns of responses. Another part of that same British Higher Education Funding Council project developed software to help instructors (even with no training in educational measurement or research) to analyze course level data from the questionnaire and visualize the data in two- or three-dimensional space.

The idea of looking at the *relationships among the three approach scale scores* can be operationalized in different ways. For example, there have been studies in the U.S. using first the Approaches to Studying Inventory later called the ASSIST (with a small change in wording to make it more appropriate for U.S. context) to evaluate how students with different characteristics react to different kinds of teaching and assessment. Speth and Brown (1990) used cluster analysis to assign students to groups with a similar pattern of Approaches to Studying Inventory (ASI) scale scores and then compare these groups on their answers to questions about how they would prepare for two different kinds of exam: essay or multiple-choice.

a) First Generation of Studies

Another way of grouping the students before analyzing their evaluation results was used in a study published in 2006. All students in a junior-level college genetics course were asked to use relevant lessons in the Library of Crop Technology (an earlier version of what became the Plant and Soil Sciences library). They answered ASSIST questions about their learning in general and questions about their use of these online lessons. On-line resources were assigned as homework and grading was based on the scores from a pool of questions based on the content of each lesson. In effect, students choose their own levels of treatment.One purpose of this study were to understand what kinds of students were most likely to use the online resources and how much they believed they benefitted. To analyze the results, Speth, Lee and Hain (2006) assigned students to groups based on their highest of three Z scores on the three ASSIST scales: Deep, Strategic, and Surface, in order to compare the three groups' responses to new online lessons in genetics and crop technology. This study included a question on what percent of their total learning they attributed to the online lessons, as compared to lectures, labs or recitations.

Why sort students into groups after they all receive the same instructional "treatment" to compare their responses? It has been extremely useful to

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instructors and developers of online learning resources to draw some generalizations about how future students will react, based on how current students with similar characteristics respond. Why use Z scores? It is common for students to have equal total raw scores on two scales, so sorting them into groups simply by their highest scale score can lead to all sorts of confusing combinations. But if one looks at the *distributions* of those scale scores, a total of 20 (out of 30 maximum possible points) on the Strategic Scale might be more or less extreme than the same score on the Deep Scale, or vice versa. Z scores take account of how far an individual score is from the mean, whether plus or minus.

In the study published in 2006, while most students had used the online lessons and thought they were useful, the 54 students whose highest Z score was on the Surface Approach Scale were more likely to say they learned a great deal from the Internet lessons and they helped them a lot in the course. They attributed significantly more of their learning to the online lessons (21%) than the 30 students whose highest Z score was on the Deep Approach Scale (15% of their learning) or the 32 students whose highest Z score was on the Strategic Scale (14% of their learning). It was encouraging to lesson developers to find their work benefitted students who most needed help, while apparently causing no harm to more confident students who could learn from other sources.

Adding the ASSIST to the evaluation of the online lessons, animations and quizzes helped developers understand that students struggling to learn these difficult scientific concepts were finding them helpful and then prioritize changes for that large group (often half the class). The developers had always included practice quiz questions to help motivate students to use the lessons, but now they realized that many students valued those questions as a learning tool, or as a way to determine how much time and effort they needed to invest. The developers worked to write more and better graded quiz items, ever more closely tied to the objectives, so students would get a sample of items from a pool that tested their knowledge or application ability for a specific concept.

Open-ended responses as well as the item responses showed students whose highest Z score was on the Strategic Approach Scale were particularly conscious of how much time the lessons took. The animations were made much quicker to access, in the learning environment and the images were integrated into the text without additional clicking.

Speth, Namath and Lee (2007) reported on an evaluation of lessons from the Library of Crop Technology by a sample of students taking courses in colleges of agriculture at several universities and in several states (n=446). This larger, more diverse sample permitted factor analysis of the 18 items and determination of the internal consistency of the three scales. To continue using the ASSIST as part of the ongoing research program related to the developing Plant and Soil Sciences library, it was essential to verify that the three approach scale scores for individual students do convey meaningful information even though the decisions being made were about the lessons and features rather than about individual students. In this study, Cronbach's alphas for the three scales were 0.65 for the Deep, 0.75 for the Strategic, and 0.70 for the Surface. The Strategic items measure organization and achievement motivation. There are two different ways to be Deep, one more holistic with an emphasis on understanding relationships among ideas and one more process-oriented or analytic. Ideally, a student could do either or both, but not many do. This duality often holds down the reliability of the Deep Scale.

The student sample from Speth et al, (2007) included nine first year, 105 second year, 146 third year, 158 fourth year and 28 graduate students. Their major fields of study included 61 Agronomy, 88 Animal Science, 82 Biology and/or Chemistry, 62 Diversified Agriculture or Mechanized Systems, 20 Range Science and 68 Veterinary Science majors. The specific objectives of this study were to find out if the items emerge on factors as expected and if the reliability coefficients for the scales were high enough to support using scale scores to identify groups of students with similar characteristics. Based on their highest z score, of the 446 students, 133 were assigned to the Deep, 125 to the Strategic, and 188 to the Surface group. These proportions have been fairly consistent across several semesters of data collected in one Genetics course at one university. Finally, as a test of the validity of the scales and scoring procedure, student comments were sorted into the three groups to see if they made more sense than the list of unsorted comments.

b) Second Generation Studies

Application Lessons and Conceptions of Learning

The on-line environment offered the potential to customize instruction to students based on their interests. Four new "application" lessons were developed and added to the PASSEL to demonstrate to students how the concepts being taught are used in occupations, and make them more aware of these occupations. These lessons consist of text, photos and practice quiz questions. One of these lessons, called "Greening up the Greens: Transpiration Application Scenario,"http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1126892811 was the focus of another inquiry.

The teachers and developers wanted to learn how much students were learning and whether their levels of use could be related to levels of content learning. They wanted some measure of student approach, but 18 ASSIST items, plus evaluation items to assess intensity of use, plus the content items would make the survey rather long, perhaps discouraging student participation or completion.

The longer version of the ASSIST (Centre for Research on Learning and Instruction, 1997) includes two questions that provide additional insight about individual students' experience of learning in higher education. Rather than using all 18 ASSIST questions, the Learning and Motivation questions were used as a proxy for the ASSIST short form for this study. The first of these two questions was, "When you define learning, what does it mean to you?" Students could choose one of five definitions or write their own. The percentages of students who chose each definition of learning were as follows:

1. Building up knowledge by acquiring facts and information, 23.5% of the students in this sample.
2. Being able to apply the information you learn, 38.3%
3. Understanding new material for yourself, 21.5%
4. Seeing things in a different and more meaningful way, 5.4%
5. Making sure you remember facts well, 7%
6. Own definition, 10.7% of the students in this sample.

Tables 1-4 show how students were unevenly distributed into groups based on their answers to the learning or motivation questions. Table 1 shows students' responses to the Conceptions of Learning question cross-tabulated with the question on the value of the application lesson coupled with the more conventional lesson on the principles of transpiration. The application lesson was valued by all kinds of students. No one said the application lessons made the topic less interesting than the principles lesson alone.

The Conception of Learning question included a space for an open-ended comment. One student wrote: "All of the above in concert, in my view, provide the spectrum of results essential to learning." Several wrote some version of the following idea: "Learning is acquiring knowledge, facts, and experience to understand material or a concept,[and] then being able to apply the information/skills." One wrote: "For me to learn something, it sometimes needs to be explained in a simpler term since I have a learning disability." Sad to say, this particular student gave a rather tepid rating of the value of the application lesson, which relies a lot on the written word. Later additions to the library, such as the video-based resources evaluated in the Gene Segregation resources study mentioned below, might have had more appeal to this particular student.

A second question from the ASSIST long form that was included in this data gathering was: "What motivates you to learn?"

1. I just don't want to fail or do badly, chosen by 14.8% of the students in this sample
2. I am always striving to compete and be successful in all my courses, chosen by 23.5%
3. I am interested in this subject and want to learn as much as I can about it, 16.8%
4. This course will help me get a degree and qualifications so I can get a good job, 15.4%
5. I need to understand this subject to be good at the kind of work I hope to do, 24.8%
6. I want to live up to the expectations of others, such as my family or teachers, 4.7% of the students in this sample.

Table 2 shows how students with different motivations for learning answered the question about whether the application lesson made the topic more interesting. In retrospect, it was unfortunate that questions did not measure how much interest students had in the topic *before* they consumed the application lesson. If their interest was fairly high beforehand, and remained about the same, that is not bad news.

Both the Conception and Motivation for Learning Variables were also cross-tabulated with an item on intensity of student use of the lessons. Table 3 shows how intensively students who chose different conceptions of learning used the practice question feature, and it suggest almost half the students who chose being able to apply what they had learned made optimal use of these questions by taking time to check if they got them right or not. Table 4 does the same for students who chose different motivations for learning. One generalization from Table 4 is that a fairly large proportion of each motivation group used the most intensive strategy of answering the questions and checking their answers. Sadly, in this study, students just trying not to fail didn't always use this easy strategy to increase their learning.

Analyses of this data set gave teachers evidence to assure such students that higher levels of interaction with the lessons did indeed pay off in how many practice questions they would get right, especially on the more difficult items, and since the exam questions would be similar, these practice questions were indeed good preparation for the exam. A manuscript on analyses of the "Greening up the Greens" Application Lesson research data has been submitted to another journal. That manuscript highlights the content learning items of varying difficulty and how intensively students used the lesson. Those who used the most intensive strategy were rewarded for their efforts, especially on the more difficult items. But the analyses submitted to that other journal will not include the conceptions of learning or motivation variables discussed in this article.

c) Third Generation Studies: Metacognition or Learning Strategies Training

It has long been known that if they have sufficient skills, some students can adapt their approaches to the subject and, most importantly, their perception of assessment demands. A project was undertaken to offer students course-specific training and practice in thinking about their own thinking, integrated with courses rather than in a stand-alone workshop. In Soil Sciences and Plant Sciences classes taught at the freshman level in a College of Agriculture and Natural Resources, students are given assignments to practice thinking about their learning and studying processes, in other words, "metacognition."

Data was collected at mid-semester by administering the ASSIST short form plus the learning and motivation questions mentioned above. The ASSIST results yielded information about the nature of the student samples in each course. The Plant Sciences course has a higher proportion of first-year students and a smaller proportion of sophomores, juniors and seniors than Soil Sciences. Some of the students are taking both Plant Sciences and Soil Sciences while others are taking one or the other. As shown in Table 1, the proportions of students whose highest Z scores was on either the Deep, Strategic or Surface Approach were remarkably similar in the two courses in spite of demographic differences in terms of students' year in school and the academic majors. There is a tendency for students to become more Strategic as they go through their college years, which might account for the higher proportion of Strategic (and lower proportion of Deep) in the Soil Science 153 course. Keep in mind that this way of categorizing students forces a choice between Deep and Strategic. The best students tend to be high on both of those scales.

A second data collection in the same classes at the end of the semesters did not include the ASSIST or the Conception of Learning variable and the data from the two questionnaires could not be linked. The researchers had thought that students who already have a Deep or Strategic Approach might find the emphasis on learning strategies was not necessary. But the percentage of all students who said the emphasis on learning strategies was useful was so high it must have included most students in all three Approach groups. In the spring 2012 Plant Science, 81.1% said they were useful, 7.4% said they were not useful, and 11.6% were unsure. In fall 2012 Plant Science, 60.8% said they were useful, 20.3% said no, and 18.9% were unsure. In the Soil Science course in fall 2011, 69.5% said the emphasis on strategies was useful, 18.9% said they were not, 11.6% were unsure. Obviously, not being able to link the two data sets was a design flaw, as that information would have been very useful.

d) Next Generation Study: Multi-Institutional Evaluation of Resources to Teach Gene Segregation and Make Students Aware of Plant Breeding

A current project will impact genetics and plant science teaching locally and test a strategy for impacting life sciences learning and professionalism. Education and extension resources are being developed to teach key concepts and create an awareness of plant breeding as a career. The seven educational resources students will be asked to evaluate include:

1. Genetic Variation and the Story of Stem Rust (video).
2. Plant Breeder's Mission (video).
3. Segregation of Genes: Wheat Stripe Rust Inheritance Quiz Activity.
4. Segregation of Genes: Reading on Wheat Breeders' Work with Herbicide Resistance.
5. Segregation of Genes: Reading on Mendel's Experiments with Peas.
6. Segregation of Genes: Short Instructional Videos.
7. Segregation of Genes: Steps in Wheat Breeding Activity.

Courses that serve a variety of student audiences from multiple institutions will take part in this study. The content of the educational resources is relevant to both introductory biology courses and genetics courses. By using on-line resources and answering questions in the course management system used at their university, they can receive extra credit points, which increase students' motivation to participate and show them how much the instructor's value participation. Students access the resources by links in their course management systems to the Plant and Soil Sciences library (PASSEL). Individual students can choose which and how many resources to use, and how intensely to go about their use. Survey questions will reveal differences among classes that serve different student populations in the mean number of resources used and self-rated growth in awareness, knowledge, interest in plant breeding as a career for themselves, and willingness to invest time and effort in using the resources.

Cross-tabulations of usage data with the Conceptions and Motivations for Learning questions will indicate if there are differences between students who choose different conceptions of learning in the number of resources used, whether they think the resources would help them in their career or help them in the course they are taking at the time.

Results will help us accept or reject the hypothesis that learning genetics concepts in a plant breeding context can elevate the mastery of concept application and help students explore potential career interests. This is of particular importance in STEM fields such as Plant Breeding that are under-subscribed by students.

III. Conclusions

Gradually, we are designing research strategies to collect worthwhile data while following U.S. federal guidelines for protecting students' confidentiality and freedom from coercion.

We have also sought to make these studies authentic and realistic for classroom conditions. Traditional research methods emphasize random samples from large diverse populations, significance testing and treatment effects. These emphases have little to do with improving teaching of specific students in specific courses, each bringing his or her needs, abilities, motivations and beliefs about learning. Significance testing is not always appropriate when non-normally distributed populations of students assemble into courses. Significance differences can be reported, but SPSS always warns that your data contains unequal cell sizes and suggests your results are suspect. Teachers must teach students as they are, not pretend they are random samples from a general population.

The demand for high scale reliability as measured by Cronbach's alpha favors large samples from diverse populations, not classrooms where students have similar culture and experience. One way of testing the validity of categorizations based on the ASSIST is to sort their open-ended comments into groups. With a few exceptions, individual's comments show the categorization was accurate.

The three-part nature of each approach tends to muddy the waters in terms of scale reliability, though with enough students and a diverse enough sample, Cronbach's alphas can be coaxed higher. But many instructors do not deal with large or pluralistic groups of students. For them, the advantage of SAL is for describing and understanding the real students they are dealing with in classes.

While all these studies had flaws, understanding students' approaches has been extremely useful in helping developing better ways to teach them.

Beginning with the first generation of local studies, instructors realized how much students can learn from well-written quiz questions closely tied to the objectives if there is timely feedback, and if they take advantage of that feedback (by checking their answers). This helped inspire a teaching strategy of having students answer quiz questions after almost every lecture. They do not have to leave class wondering if they learned anything that day. A quick evaluation (rather than a research study) in the genetics course, helped instructors realize how much students valued being able to work with classmates on those quizzes, and that helped motivate them to attend class, even on a Friday afternoon. Students even said they felt like active learners rather than passive recipients of the lecture content. As indicated above, a large proportion of students in each class find big exams threatening, lack confidence and feel anxious, but the frequent quizzes can build up confidence and give guided practice at answering questions. It also gives students an incentive to prepare for each class, because they know they will be tested right afterward. These small, quick assessments that go directly to the university's course management system have reduced the load of hand-grading.

As mentioned earlier in this article, students whose highest Z score was on the Surface Approach may also have fairly high scores on Deep Approach, which only makes sense if you realize that seeking understanding and actually finding it are two different things. If their learning and studying processes are deficient and they are distracted by their anxieties they are not likely to find the understanding they seek. Adding an emphasis on Meta cognition to the Plant and Soil Sciences classes guided the at-risk group whose highest Z score was on the Surface Approach toward higher order thinking and learning activities that the Strategic or Deep Approach groups might be using already. There were only two students in the Soils class who said they didn't need this, they already knew how to study, but a high percentage of students were grateful for the help.

The best evidence of SAL analysis impact on teachers in the Genetics, Plant Science and Soil Science courses has been their response to student learning revelations. Genetics and Plant Science courses have implemented more intensified structure to their course with authentic on-line assessment and on-line resource use that is integrated into lecture learning strategies. Realization that the student populations in these courses consist of a high proportion of surface learners and relatively low frequencies of deep learners motivates and justifies this teaching strategy. The benefits of instructional intensification for students from low income demographics in large enrollment life science courses with a history of low performance and retention levels has been documented (Hauk, Halle Rips Limbers, Pitter, and Freeman, 2011) SAL analysis refines our understanding of students and on-line resource development and integration further advances our capacity to improve life science learning success in higher education.

References Références Referencias

1. Biggs, J. (1993) "What do inventories of students' learning processes really measure? A theoretical review and clarification." *British Journal of Educational Psychology*, vol. 63, pp. 3-19.
2. Centre for Research on Learning and Instruction (CRLI), University of Edinburgh. (1997)"Scoring Key for the Approaches and Study Skills Inventory for Students."Available:www.etl.tla.ed.ac.uk/questionnaires/ASSIST.pdf (accessed 22 May 2013). University of Edinburgh, Scotland.
3. Entwistle, N. (2000) "Promoting deep learning through teaching and assessment: Conceptual frameworks and educational contexts." Paper

presented at the TLRP Conference, Leicester, and November 2000.

4. Entwistle, N., Tait , H. and Speth, C. (1996) "Identifying and advising students with deficient study skills: An integrated computer-based package for staff and students." In: Barenboim, M. and Duchy, F. *Alternatives in assessment of achievements, learning processes and prior knowledge.* Boston: Lower Academic Publishers, pp.365-380.
5. Hauk, D., Halle Rips Limbers, J., Pitter, E., and Freeman, S. (2011) "Increased structure and active learning reduce the achievement gap in introductory biology," Science, vol. 332, June, pp. 1213-1216.
6. Hain, P. (1999) *Designing and evaluating Internet-based lessons to teach crop genetic engineering.* Unpublished master's thesis, University of Nebraska, Lincoln, Nebraska.
7. Hain, P. and Gaussoin, R. (2005) "Greening up the greens: Transpiration application scenario."Plant and Soil Sciences library [On-line]. Available: http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1126892811 (Accessed 4 June 2013).
8. Ramsden, P. and Entwistle, N. (1981) "Effects of academic department on students' approaches to studying."*British Journal of Educational Psychology,* vol. 51, pp. 368-383.
9. Speth, C. and Brown, R. (1990) "Effects of college students' learning styles and gender on their test preparation strategies."*Applied Cognitive Psychology,* vol. 4, pp. 189-202.
10. Speth, C., Lee, D. and Hain, P. (2006) "Prioritizing improvements in Internet instruction based on learning styles and strategies."*Journal of Natural Resources and Life Sciences Education,* vol. 35, pp. 34-41.
11. Speth, C., Namath, D., Lee, D. (2007) "Using the ASSIST short form for evaluating and information technology application: Validity and reliability issues."*Informing Science Journal,* vol. 10, pp. 107-119.
12. Tait. H., Entwistle, N, and McCune, V. (1998) "ASSIST: A reconceptualization of the Approaches to Studying Inventory." In: C. Rust (Ed.), *Improving students as learners.* Oxford: Oxford Brookes University, Centre for Staff and Learning Development, pp. 262-271.

Table 1 : Second Generation of Studies: Level of Interest by Conception of Learning

Concept of Learning	A lot more	Somewhat more	Same interest
Acquire facts (n=33)	12.1%	48.5%	39.4%
Apply (n=57)	17.5%	35.1%	47.4%
Understand (n=30)	26.7%	43.3%	30.0%
Meaning (n=8)	50.0%	12.5%	37.5%
Remember (n=1)	100%	0.0%	0.0%
Own definition (n=16)	6.3%	62.5%	31.3%

Table 2 : Second Generation of Studies: Level of Interest by Motive

Motive	A lot more	Somewhat more	Same interest
Not fail (n=22)	9.1%	40.9%	50.0%
Striving (n=34)	23.5%	38.2%	38.2%
Interest (n=25)	35.0%	44.0%	20.0%
Qualifications (n=22)	13.6%	36.4%	50.0%
Be good at job (n=35)	11.4%	45.7%	49.2%
Live up to expectations (n=7)	28.6%	42.9%	28.6%

Table 3 : Second Generation of Studies: Intensity of Use of the Practice Questions By Conception of Learning

Concept of Learning	Answer checkers	Answer but not check	Scan but not answer
Acquire facts (n=33)	29.0%	35.5%	35.5%
Apply (n=57)	49.1%	24.5%	26.5%
Understand (n=30)	36.7%	56.7%	6.7%
Meaning (n=8)	37.5%	37.5%	25.0%
Remember (n=1)	100%	0%	0%
Own definition (n=16)	81.3%	0.0%	18.8%

Table 4 : Second Generation of Studies: Intensity of Use of the Practice Questions by Motive

Motive	Answer checkers	Answer but not check	Scan but not answer
Not fail (n=22)	38.1%	38.1%	23.8%
Striving (n=34)	46.9%	31.3%	21.9%
Interest (n=25)	48.9%	36.0%	16.0%
Qualifications (n=22)	40.0%	25.0%	35.0%
Be good at job (n=35)	50.0%	32.4%	17.6%
Live up to expectations (n=7)	42.9%	14.3%	42.9%

Table 5 : Meta-Cognition Study Distribution of Approaches to Studying among Students Taking Plant Science, Soil Science, or Both

Approach	In 131 Only	In 153 Only	In Both
Surface	38.4%	39.0%	35.5%
Strategic	27.4%	33.9%	35.5%
Deep	34.2%	27.1%	29.0%