groups are overworked and underpaid. (4) To stop being so focused on ourselves—there are a lot more people with bigger problems than us. Finally. (5) although volunteer work is neither glamorous nor challenging—it does make you feel like you are doing something to help another person—and that makes all the difference.

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Determination of Learning Styles in an Introductory Food Science Course

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Abstract

Student learning styles and preferred instructor type were determined in an introductory food science course to facilitate curricular planning and provide direction for implementation of teaching techniques. The predominant learning styles in the course were common sense and analytical learners. Students indicated that the preferred instructor type was an interactive instructor. Student perceptions of study skills and ability to remain attentive in class ranked higher for common sense and analytical learners than for dynamic learners (p 0.05), while student perception of time management skills, note-taking skills, making classroom contributions, and academic aptitude were not different among learning styles ($p>0.05$). No differences were identified for any of these categories among preferred instructor type ($p>0.05$).

Introduction

Hartel (1995) and Iwaoka et al. (1996) argue that university food science education could be improved by incorporating a range of teaching and learning techniques into course curriculum to accommodate the variety of learning styles present among students. This article

demonstrates an application of recommendations of Hartel (1995) for addressing different student learning styles using an system developed by McCarthy (1987) to help teachers provide a range of classroom activities encompassing all major learning styles. The importance of integrating student learning styles into teaching strategies has received increased attention in university undergraduate education. Sorensen (1998) demonstrated the inherent differences among college students and the need to address different personality types in development of high quality educational programs. Accommodation of different learning styles through a variety of teaching methods can be an important element for improving college curricula and strengthening teaching effectiveness (Barrett et al., 1987; Claxton and Murell, 1987). Hartel (1993) successfully introduced a variety of teaching strategies into a food engineering course to address different student learning styles. Team assignments, classroom demonstrations, and problem solving activities were combined with traditional lectures with the specific intention of presenting a variety of learning experiences to improve student learning.

According to Hartel (1995), students can be classified by their predominant learning style as either innovative, analytical, common sense, or dynamic learners. This classification is based on a four quadrant schematic developed by McCarthy (1987) that describes how students perceive and process new information. Perception of information occurs over a range from concrete experience to abstract conceptualization, while processing of information occurs over a range from active experimentation to reflective observation. Individual students fall between the extremes of each of these two scales, which determine a predominant learning style category. A predominant learning style does not mean that students use only one learning style. In fact, students use all learning styles but favor the predominant learning style. It is important to remember that Hartel (1995) suggests that optimal learning occurs when students are given opportunities to develop and use all learning styles.

Even though it is paramount to develop instructional methods to accommodate all learning styles, it is believed that most college professors do not strive to teach to innovative or dynamic learners (Hartel, 1995). Using appropriate teaching strategies, it should be possible to develop the less common learning skills (e.g. those favored by innovative and dynamic learners). Innovative learning could be encouraged with classroom demonstrations and real-world applications of course material, and dynamic learning could be achieved though cooperative learning practices. Hartel (1995) proposed that optimal learning occurs when students are provided with opportunities to use all four learning styles. This requires the instructor to teach to each style. An understanding of different learning styles can help teachers choose proper teaching styles to benefit as many students as possible, not just those students with a predominant learning style that is compatible with instructor teaching style. Details concerning learning styles can be found in McCarthy (1987), Kolb et al. (1971), and Lawrence (1979). The objectives of this study were to identify student learning styles in an introductory food science course, and to determine if specific skill perceptions were related to learning styles. Identification of learning styles would facilitate future curricular planning and implementation of teaching techniques to improve student learning.

Materials and Methods

Student learning styles were assessed in a 3 credit hour introductory food science course at Texas A&M University. On the first day of lecture, one hundred and twelve students completed individual in-class questionnaires assessing self-perceived learning style, preferred instructor type, and eight individual student attributes. Based on the descriptions of learning styles summarized from Hartel (1995), students classified themselves as either innovative, analytical, common sense, or dynamic learners. Also, each student indicated a preferred instructor type based on descriptions developed by the instructor of a traditional researcher, traditional lecturer, innovative instructor, and interactive instructor. Eight Likert-type responses used a 5 point scale (1=poor, 2=ok, 3=good, 4=outstanding, 5=superior) to evaluate student self-perception of academic aptitude and related skills.

In order to ascertain if individual student attributes were different among learning styles, mean responses for self-perception of individual student attributes were compared among different learning styles using analysis of variance procedures (SAS Institute Inc., 1995). If significant differences were identified, the Tukey-Kramer multiple comparisons test was used to determine which learning styles were different (SAS Institute Inc., 1995). Significant difference was defined at p 0.05.

Results and Discussion

Student questionnaires revealed that a variety of learning styles were present in the class. Nearly three-quarters of students perceived themselves as either common sense or analytical learners, while just over one-quarter identified themselves as dynamic or innovative learners (Table 1).

Table 1. Student self-perception of learning style.

Learning style	Student responses (%)
Common sense learner	40.4
Analytical learner	33.9
Dynamic learner	17.4
Innovative learner	8.3

Although students are composites of learning styles, they usually favor one in particular. The fact that common sense and analytical learners were representative of the majority of students in our class was not surprising. Hartel (1995) suggested that these learning styles typically dominate in university classrooms. If students need to develop as many learning styles as possible to achieve optimal learning, then it is more likely to occur when teachers use a varied approach to address all learning styles in the classroom. Our approach was through interactive group work, open question and answer discussion time in class in addition to lecture, use of the reverse Socratic method, and hands-on involvement of students in writing quiz and exam questions.

The way in which the course was administered resulted in the highest percentage of students thinking and learning in a common sense rather than in an analytical manner. Common sense learners are typically concerned with practical application of ideas and concepts and look beyond just facts, while analytical learners ordinarily rely on fact memorization. Common sense learners view the instructor as a learning facilitator, while analytical learners regard instructors primarily as information providers.

In our study, learning style appeared to cause a significant difference in course grade among students. It is important to note that while analytical learners tend to excel in the typical university classroom lecture format, in this course, they scored lower overall than common sense learners when presented with testing situations requiring application of higher learning skills. Common sense learners earned higher scores in the course than analytical learners, as determined by Tukey-Kramer analysis (p 0.10). Despite the marginal level of significance, this is encouraging since the course attempted to challenge students to develop higher level thinking skills. Curiously, although few of the students were classified as innovative learners, nearly all preferred interactive or innovative professors instead of the traditional lecturer or traditional researcher professor types (Table 2).

Table 2. Student preferred instructor type.

Instructor type	Student responses (%)
Interactive instructor	70.9
Innovative instructor	27.3
Traditional lecturer	1.8
Traditional researcher	0.0

These preferences are in agreement with Garco et al. (1994) who suggested that students desired active roles in learning and valued efforts made by professors to provide a high quality instruction that will benefit them in their careers. These results are in contrast to what is typical at a university: traditional lecturer and traditional researcher instructor types that teach to lower cognitive levels (Hartel, 1995).

To determine whether student perceptions of individual attributes were in any way related to student learning styles, mean comparisons were obtained for self-rankings of specific student attributes among learning styles (Figure 1). Study skills and ability to remain attentive in class were found to be different among learning styles. The means for these 2 attributes among common sense and analytical learners were higher than for dynamic learners. Means of student skills in time management, note-taking, and making classroom contributions were not different among learning styles ($p>0.05$). In addition, academic ability in verbal, math, and science aptitude were not different among learning styles. We suggest that study skills and ability to remain attentive in class were more developed for common sense and analytical learners than dynamic learners. No differences for these attributes were identified among preferred instructor type. This suggests that preferred instructor type was not important in student perception of attributes.

Summary

Student questionnaires indicated that common sense and analytical learners were the predominant learning styles in an introductory food science course. As a result of this finding, teaching strategies that encourage innovative and dynamic learning should be included in course curriculum to strengthen teaching and learning in the classroom. Common sense learners scored higher than analytical learners, indicating that the course encouraged use of higher level thinking skills. Student evaluations also suggested that study skills and ability to remain attentive in class were different between learning styles. These attributes could contribute to students' perception of learning style. Based on the large preference for an interactive instructor, students indicated a desire for an active role in the learning process. From the authors' perspective, students also valued efforts to improve teaching methods that enhance the quality of education.

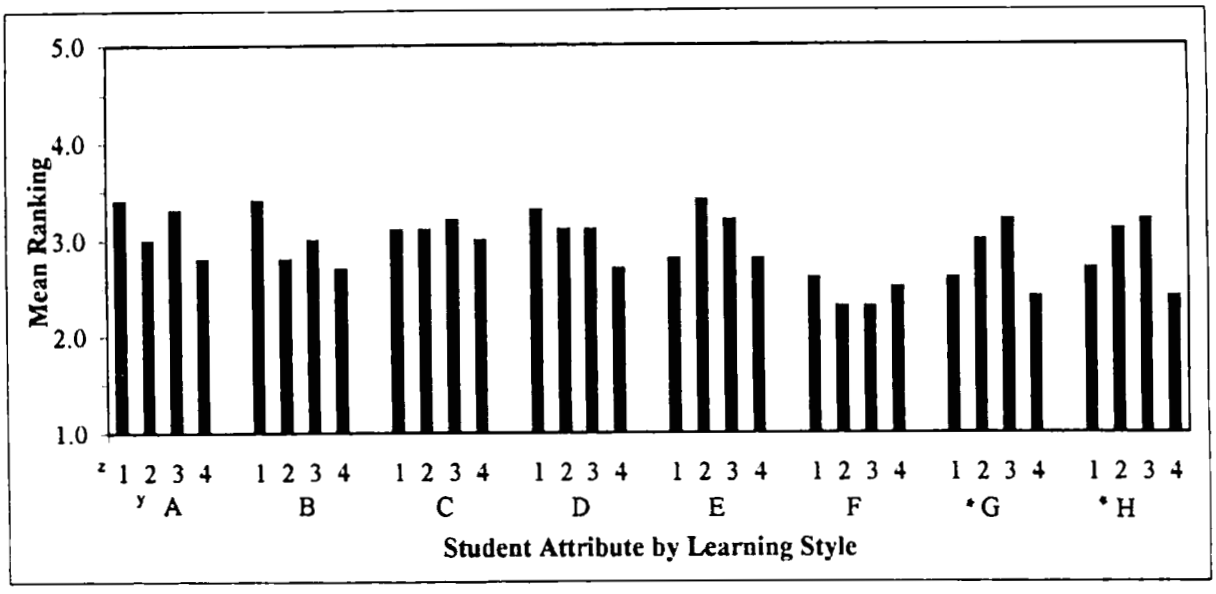

Figure 1. Self-perception of student attributes by learning style

[z] 1= Innovative learner, 2= Analytical learner, 3= Common sense learner, 4= Dynamic learner

[y] A=Science aptitude, B=Math aptitude, C=Verbal aptitude, D=Time management skills, E=Note-taking skills, F=Making classroom contributions, G=Study skills, H=Ability to remain attentive in class

* Significant differences between learning styles by Tukey-Kramer multiple comparisons test, $p \leq 0.05$.

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