FOODS TECHNOLOGY
EDUCATIONAL IMPLEMENTATION TO THE STUDENTS TEACHING

Dumitrescu M. Florin – „Technology and Food Expertise" to Technical College „General David Praporgescu"
town Turnu Măgurele, postal code 145200 district Teleorman (Romania)

Introductory

In many states is a great deal of interest in university-industry interaction to enhance the education of students. Such reported interactions include industry-university cooperative research centers, the use of student portfolios to encourage industrial consulting engagements and faculty externships and specific courses incorporated into curricular areas. The literature on this topic is heavily focused on the value of student internships and largely tied to the education of engineers (Bradburn 2001; Neumann 2001) Riis (2001) reported how student creativity and innovation could be stimulated when engineering students in Denmark were asked to solve industrial problems presented by industry partners, the literature is lacking in reports of industry linkages for the classroom education of food science students. The current report of an industry linkage in food science education is targeted to the topic of food analysis, which related to product quality. Ensuring high product quality involves specification of raw ingredients, process control, and final product quality. Students taking a food analysis class would ideally be taught the realities of these aspects of the food industry. However, even in engineering literature, for the topic of process control there is reported inconsistency in what is taught to students compared to the current practices industry. The current paper describes a project that helps ensure consistency between the analytical methods covered in a food analysis class and what is used in foods technologies industry (Dumitrescu Fl. 2009, 2010)

Methods

Students received detailed written instructions for the project the first day of class, including the project report format. They immediately complete a questionnaire with categories of food product (for example, dairy products, meat products, cereal products), identifying any category for which they already have experience in quality assurance and ranking their top 3 choices of food categories for their project. The instructor uses this questionnaire to help assign each student a specific product assigned are ideally fairly simple, having a small number of ingredients and a standard of identity (table1); also, the products need to be common enough so that the industry contact can communicate with the student without risk of divulging confidential information. Making the project assignment to the students within the 1st wk of class allows students most of the rest of the semester or quarter to complete the project. While the student begins gathering information about the product as described below, the instructor needs to contact a "resource person" from the food industry to be assigned to each student. This contact is done by e-mail each year when students are ready to be assigned products, since the appropriate contact person can change often within a company. The instructor should assure the resource person at the initial contact that the student will not need to be given any confidential information, but will be seeking input on typical quality assurance for that specific product. The industry resource person is ideally very familiar with typical quality assurance for specific product assigned. The resource person must commit the time to communicate with the student, which is typically done by e-mail, phone. Each student is given the resource person's name, position, address, phone, e-mail address. The job of the resource person is to confirm or information generated by the student, and help "fill in the holes" to make the report complete. The resource person may provide such missing information by asking pointed questions, directing the student to other resources, or directly providing the answers. The students start by gathering information about the standard of identity, nutrient composition, raw ingredients, processing steps, and the

likely, typical quality assurance tests on raw ingredients during processing and final product. To gather this information, the student is told to use books and other materials that describe the processing and quality assurance of that type of food product, books of standard methods of analysis, the student must try to identify characteristics and their appropriate methods of analysis for specifications on Certificate of Analysis for the raw ingredients. As soon as the student has put together his or her "best guess" of this information (that is, typical raw ingredients, processing scheme, quality assurance tests on raw ingredients, in process, and final product), the student sends the information to the resource person with a copy to the instructor (reviewed by instructor prior to sending, if student requests). Contact continues between the student and the resource person until all the information required for the report is complete. At the end of the project, the student completes an evaluation of the resource person to help the instructor determine if that resource person should be contacted in another year. The student prepares and submits to the instructor a written report, following the format specified (table 2). An outline-format summary page on the product prepared and submitted (table 3). The assistant makes overhead summary for student use in making a short in-class presentation.

Table1
Products assigned for students

Dairy Fruits
- Cheddar cheese and grape jelly
- Parmesan cheese and strawberry jam
- Nonfat dry milk canned pears
- Yogurt and lemon juice
- Buttermilk frozen concentrated
- Light whipping cream orange juice

Meat and Fish Vegetables
- Bologna frozen peas
- Bacon catsup
- Frankfurters canned corn
- Canned tuna and tomato paste

Cereal and Bakery Egg Products
- Corn meal and dried eggs
- Enriched flour
- Macaroni nuts
- Whole wheat bread peanut butter

Food Dressings and Flavorings Cacao Products
- Vanilla extract in milk chocolate
- French dressing and cocoa
- Mayonnaise and margarine

Table 2
Project finishing format

I. Title
Course number, Year, Student's Name, Name of Food Product
II. Summary

1-p text-type summary of the following:
Standard of identity
Raw ingredients and tests done
Processing of product and tests done
Test on final product

III. Summary of Standard of Identity

Summary of compositional requirements food product, tests to check composition or characteristics

IV. Nutrient Composition

Table in nutrition label format, with amount per serving … % daily value

V. Product Description

Specific description of food product

VI. Raw Ingredients

List of raw ingredients
Tests on raw ingredients:
1. Name of ingredient; component/property measured
a. test
b. reference:
c. purpose for measuring:
d. choice of method:
e. principle of method:
2. Repeat 1. above for next ingredient and component/ property measured

VII. Processing of Product

Schematic diagram of processing steps
Description of processing scheme
Tests during processing (same format as above)

VIII. Tests on Final Product

Tests for quality assurance (same format as above)

XI. References

Follow format for Journal of Food Science

Table 3
Outline for summary page used for presentation and distributed to students cursus

Student's Name - Name of Product
Compositional Specification in Standard of Identity (only specifications to justify tests below)
Ex: „Yogurt" - not less than 3.25% milk fat; not less than 8.25% milk solids; Thorner acidity not less than 0.9%, expressed as lactic acid
Tests on Raw Ingredients: component/ property; ingredient being measured - name of test
Tests During Processing: component/ property being measured - name of test
Tests on Final Product: component/ property being measured - name of test

Results discussions

A survey regarding the value of the project was completed in June 2010 by 21 level students who did the project between 2008 – 2010 years with rate relevance/usefulness of the project relating both current position scale (1 = not, 2 = somewhat, 3 = moderately, 4 = very, 5 = extremely useful). Usefulness was rated even higher by the smaller number of students who said the project was directly related to their initial and /or current position, more than 60% of the total students who completed the survey indicated that the project related directly their initial position after graduation, and 1/3 said it related directly to their current position. Position titles of former students who reported that the project did relate to their job included: quality/ process control, quality assurance supervisor, product and process technologist, technical support for ingredients. Mean usefulness results did not seem to vary much by year, but sample size was too small to make this

analysis meaningful, examples from former students of how the project related their initial or current position (table 4). Of the 21 students who completed the survey, 6 indicated that they had referred back to their project report since they graduated, for reasons including example of applying rules of nutrition labeling, process flow diagrams, analysis methods. The most common additional comments made by former students about benefits of the project were the following: created opportunity to interact with industry professional, introduced to testing procedures industry showed entire process for a product regarding quality tests; as noted in the survey, they view contact with a resource person from the food industry as one of the best experiences related to the project, because food industry employees often change positions and locations, it is necessary each time you want to use them as a resource person to call or send e-mails to check their availability and more contact information (table 5)

Table 4
Examples of how project related to initial or current positions reported by former students

- project was same as how company's in-process specifications are written
- dealt with process flow and identifying relevant quality assurance tests
- made me familiar with assays used when I started my first job
- helped me compare quality parameters of company product to those of competitive products
- helped with identifying on-line salt test
- made me aware of testing used to ensure product meets specifications
- helped me learn analyses used for new ingredient specifications
- made me better able to interact with quality assurance department
- taught me about raw ingredient and finished product testing on a product
- learned quite a lot on unit operations and manufacturing of a product
- gave me a better sense of how to begin to solve processing problems
- helped me create a checklist of specification information for raw materials
- learned what resources to use to find analytical tests
- helped understand why certain attributes are tested and best method to use most resource persons
- responses to the question about what surprised the resource person working with the students

Table 5
Responses by resource persons to survey about project

1. What is the typical position title and/or background of the person in your organization most qualified to assist a student with this type of project?
- Primary Recommendation: Quality Assurance Manager background in the Food Science; needs to understand production processes and test method (managers knows "big picture," as well as tests typically done
- Secondary Recommendation: Product Developer—familiar with specifications and experience with commercial processes; with access to testing and processing methods

2. How much time, on average, did you spend helping each student put in contact with you to do the project?
- Average response was 2 to 3 h (range: 1 to 6 h)
- Responsibilities: Read draft information and questions sent by student; gather information needed by student and communicate information back and reading revised draft from the student

3. Why were you willing to be involved in helping students with these projects? What did you gain from your involvement?
- Took the same class as a student, and project was valuable to me
- Returning the favor, when a student, of getting help from a professional

- Industry perspective by sharing knowledge and experience, networking, helps identify interesting and hardworking students, which is of benefit in company's recruiting efforts
- Refreshes knowledge base, keep to date (ex: manufacturing process changes), and helps me learn new things about the company, reminds of the level of understanding knowledge of college students
- Makes me see what current learning resources are available and has made remember the difficulty associated with talking in acronyms to persons outside the area

4. What surprised you most about working with the students on the projects?
- How much easier it is to work on this project with students who have had the experience of a summer internship in the food industry
- How students can identify the processes used, but not necessarily connect them
- How much I learned along with the student, because of the need to contact others in the company to answer questions. That students think, from reference texts and so forth, that much testing is done compared to the amount actually done, they've think expensive and sophisticated tests are done for quality assurance
- How quickly students grasp the value of getting the right raw material specifications, formulations, and process to get good quality product and limited need for testing on final product, they've strong sense of "black and white" answers, as compared to a real world having interest in the project, work hard on the project to obtain accurate information want to know more about the communication

Conclusions

Results showed that the project outlined in this paper was more than moderately useful to former students in food industry positions. The project was directly related to the initial and /or current positions of 2/3 of survey respondents. While making contact with resource persons and grading reports are quite time-consuming for the instructor (that is to phone calls or e-mails for each resource person to be given as contact for a students; 30 minutes average grading times per report), former students identify numerous benefits of the project related to their positions in the foods industry.

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