On the right side, the order is as follows, with (1) being on top:

(1) Notes from visits and phone calls
(2) Biographical and family data
(3) A senior check sheet (when available)
(4) Test scores and entrance details
(5) Correspondence

Conclusion

This article has described one advisor's attempt to gather and organize relevant information about an advisee, needed as a basis for advising that student. The privilege of counseling students in regard to personal and educational matters is precious. We must approach the task with dedication by offering the very best advice possible. As a prerequisite for giving that advice, we should insist having the necessary background information.

References

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USE OF UNDERGRADUATE TEACHING LABORATORIES TO CONDUCT RESEARCH

John S. Avens and Byron F. Miller

Abstract

A case study reporting success in learning behavior when students become a part of original ongoing experiment to solve a real world problem. Student preference for such involvement reported.

Direct contact with hundreds of undergraduate students at Colorado State University through teaching and advising over the past 7½ years, leads us to believe many undergraduate students want to do something real, meaningful and useful as part of their educational experience. That is, they want to supplement their lecture/text book learning with real experiences they can participate in firsthand rather than watch or just hear about. They want to contribute to the welfare of mankind and they want to do it now. They don't want to wait until they graduate. They want to get their hands dirty, learn by direct experience and be a useful part of what is going on in the real world.

Teachers of agriculture who are also involved in agricultural research have an excellent opportunity to provide this "learn by doing something real" experience for some of our undergraduate students, while at the same time accomplishing the objectives of their research interests and programs. Why not allow students, through undergraduate laboratory courses, to conduct useful research to help solve "real world" problems? Thus, they can learn by contributing and getting directly involved.

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One Case Study

A teaching laboratory experience was provided in which undergraduate students participated directly in conducting an original ongoing research experiment to help solve a real problem concerning microorganisms and poultry meat.

The students' challenge was to determine the effect of thawing method on the number of microorganisms on frozen turkey carcasses after thawing. Their work was done as part of the food microbiology unit of a course, "Poultry Products Technology". Many students had not previously had a microbiology course. This laboratory exercise helped them to visualize and experience bacteria in food and thus provided reinforcement to the classroom learning sessions on food microbiology.

The experiment had seven treatments (thawing methods for frozen turkey carcasses), as listed in Table 2, with seven replicates of each treatment. The experiment was conducted by four different classes over a 4 year period 1968 to 1971 (Table 1). The measurement was number of aerobic microorganisms (bacteria and molds) on the skin of the thawed carcasses.

Each student analyzed one replicate turkey carcass, thawed by one of the seven methods (Table 1). The analysis involved removing skin samples, four from each thawed carcass, blending them separately in diluent fluid and dispensing alliquots of the dilution into petri dishes. Melted agar growth medium was then poured into the petri dishes and swirled to mix with the sample. When the medium had solidified, the petri dishes were incubated until each bacterial cell from the turkey skin sample had multiplied into a visible colony which could be counted. Aerobic microorganism counts were multiplied by the dilution factor and an average microorganism count per cm^2 of carcass skin was calculated for each of

Table 1 APC per cm^2 Skin (Thawed Turkey Carcasses)[a]

	Replicates						
	1	2	3	4	5	6	7
Thawing method	1968	1969	1970	1970	1971	1971	1971
1	1500	650	280	300	1100	890	2500
2	1300	560	750	410	570	1100	280
3	1100	1600	390	390	690	390	1000
4	2000	540	380	890	580	930	1000
5	1100	330	840	280	1500	480	1100
6	560	1200	260	280	1000	2000	850
7	32,000	150,000	230,000	84,000	8900	76,000	110,000

[a] These values are the geometric means of four skin samples per carcass. Values represent total aerobic plate count (APC) per square centimeter of carcass skin.

four samples per carcass. The geometric mean of the four skin sample counts per carcass was used in comparing the thawing methods.

The students were instructed and directed in laboratory procedure but independently conducted the experiment, calculated data, and wrote results, discussion and conclusions to the **combined** experiment. Statistical analyses were conducted by some students in the class.

Results and Discussion

Analysis of variance indicated thawing frozen turkey carcasses at 10°C and leaving them at that temperature for seven days resulted in significantly ($P<0.05$) greater aerobic microorganisms per square centimeter of carcass skin than the other six thawing methods, which were not significantly different.

Since all students realized they were conducting research in an attempt to solve a "real world problem" which would eventually be reported and published, they took special care with their work and showed unusual enthusiasm. The microorganism count data, aerobic plate count (APC)/cm^2 carcass skin, each value determined by a different student, showed no more variation within treatments than would be expected among seven different turkey carcasses (Table 1). Laboratory technique was carefully observed by the instructor to assure valid data.

Most students indicated a preference for this type of laboratory over the "busy work" type of laboratory exercise. Undergraduate students say they want more "relevance" in their courses. Let's stop and listen to them and provide them a chance to do something worthwhile. They are intelligent and surprisingly capable of conducting meaningful research with proper motivation and guidance. We have found, given the opportunity, undergraduate college students will enthusiastically accept the challenge of a **real** problem and successfully work to solve it. Thus, the learning process is enhanced while productive research is being conducted.

Summary

The food microbiology laboratory of a "Poultry Products Technology" class consisted of an ongoing research experiment in which undergraduate students participated directly. The experiment had seven treatments with seven replicates and was conducted by four different classes over a 4-year period. Statistical analyses were conducted by students in the class.

Many students had not previously taken a microbiology course. This laboratory exercise helped them to visualize and experience bacteria in food and thus provided reinforcement to the lecture unit on food microbiology. The students were instructed and directed in laboratory procedure but independently conducted the experiment, calculated data, and wrote results, discussion and conclusions to the combined experiment. Since they all realized they were conducting research in an attempt to solve a "real world problem" which would eventually be reported and published, they took special care with their work and showed unusual enthusiasm. Most of them indicated a preference for this type of laboratory over the "busy work" type of laboratory exercise.

Many undergraduates want more relevance in their courses and, given the opportunity, they will enthusiastically accept the challenge of a real problem and successfully work to solve it. Thus, the learning process is enhanced while productive research is being conducted.

Table 2 Packaged Frozen Turkey Carcasses

Thawing			Skin
Method	Temp (°C)	Time	Av APC/cm^2[a]
Tap water	10	12 hr	700
Cooler	10	24 hr	790
Paper bag	25	24 hr	800
Room temperature	25	24 hr	1,000
Refrigerator	4	48 hr	900
Refrigerator	4	7 da	880
Cooler	10	7 da	99,000

[a] These values are the geometric means of four skin samples per carcass. Values represent total aerobic plate count (APC) per square centimeter of carcass skin.