

Utah Teachers' Perceptions of Teaching Genetic Engineering in the Classroom

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Introduction and Need for Research

A shortage of skilled college graduates exists in agriculture to fill agricultural career areas (Goecker, Smith, Fernandez, Ali, & Theller, 2015). Changes in agriculture influence an educator's ability to effectively teach agricultural topics, and variable beliefs about agriculture in the school community (i.e., students, parents, counselors) influence the number of students interested in agricultural careers (Boone & Boone, 2007; Thompson & Russell, 1993). Agricultural educators need to be trained with up-to-date information about issues and careers in agriculture, in order to attract more students to pursue careers in agriculture and to better prepare them for today's job market (Perkins, Sorensen, Hall, Dallin, & Francis, 2017). This study determines agriculture teachers' perceptions and intentions regarding the teaching of genetic engineering, addressing Research Priority Area Three by preparing individuals to work in a global agriculture and natural resources workforce (Roberts, Harder, & Brashears, 2016).

Theoretical Framework, Purpose, and Objectives

The theory of planned behavior (Ajzen, 1991) was utilized within the questionnaire to measure attitudes toward the behavior, subjective norms, and perceived behavioral control. All three elements contribute to intention, which ultimately leads to an individual's behavior. Based on this framework, the objectives of this study were to (1) determine if a professional development workshop on genetic engineering in agriculture produced gains in the teacher's knowledge, confidence/ability, and importance of genetic engineering; and (2) determine teacher behavior related to incorporating genetic engineering into their classroom curriculum.

Methodology

The professional development workshop was held on Utah State University's campus with 19 teachers from Utah within science or career and technical education (CTE). They participated in a one-day workshop about genetic engineering, hearing lectures on various topics and going on tours. Teachers were also provided resources, including agricultural curriculum in genetic engineering. At the end of the workshop, participants received a retrospective pretest posttest questionnaire to measure level of knowledge, confidence/ability, and importance before and after the workshop, as well as their attitude, subjective norms, perceived behavior control, and intention to integrate genetic engineering into their curriculum. Table 1 shows information about the constructs utilized in the study, including post-hoc reliability estimates for each construct. All 19 teachers responded to the survey.

Table 1
Survey Construct Reliabilities for the Study

Construct	Cronbach's Alpha	# of Items	Sample Items
Attitude about Genetic Engineering	.95	8	As an educator, I enjoy integrating genetic engineering concepts into the curriculum I teach.
Intention to Integrate Genetic Engineering	.91	8	I want to integrate genetic engineering concepts into the curriculum I teach.

PBC Related to Genetic Engineering Integration	.92	8	It is mostly up to me whether or not I integrate genetic engineering concepts into the curriculum I teach.
Subjective Norms about Genetic Engineering	.89	6	Stakeholders in my classroom expect me to integrate genetic engineering concepts into the curriculum I teach.

Results

Most participants were female ($n = 17$, 89.5%). For highest level of education, most only had a bachelor's degree ($n = 10$, 52.6%), six had a master's degree, and three had "some graduate work". A majority held a traditional teacher certification ($n = 17$, 89.5%), and two were alternatively licensed. Eight individuals taught in urban communities, seven taught in urban cluster communities, and only three taught in metro urban communities. None of the participants taught in rural communities. Mean age was 43.06 years. Years of teaching ranged from two to 28 years, with a mean of 11.24 years.

For objective one, analyzing the pre-test and post-test items using a paired samples t- test, each showed significant gains in knowledge ($\Delta M = 1.41$, $t(18) = 6.921$, $p = .000$), importance ($\Delta M = 1.71$, $t(18) = 7.870$, $p = .000$), and confidence ($\Delta M = 1.37$, $t(18) = 5.229$, $p = .000$) regarding the topic of genetic engineering. For objective two, participants were in some level of agreement with each construct (see Table 2). Participants had a positive attitude toward genetic engineering as a whole and a high intention to integrate genetic engineering in their classroom. They were slightly lower in their perceived behavior control related to integrating genetic engineering into their classroom and the subjective norms about genetic engineering.

Table 2

Attitudes, Subjective Norms, PBC, and Intentions of Genetic Engineering Instructional Integration among Educational Professionals

Constructs	<i>M</i>	<i>SD</i>
Attitude about Genetic Engineering	5.18	0.83
Intention to Integrate Genetic Engineering	5.09	0.62
PBC Related to Genetic Engineering Integration	4.72	0.77
Subjective Norms about Genetic Engineering	4.32	0.77

Note. Real limits: 1.0-1.5 = Strongly disagree; 1.5-2.5 = Disagree; 2.5-3.5 = Somewhat disagree; 3.5-4.5 = Somewhat agree; 4.5-5.5 = Agree; 5.5-6.0 = Strongly agree

Conclusions, Implications, and Recommendations

Participants had significant gains in knowledge, importance, and confidence through their participation in the genetic engineering professional development workshop. Professional development workshops should be used in the future, as they could be an effective way to disseminate information about emerging technology in agriculture. Because teachers agreed that they have control related to genetic engineering integration and have a higher level of intention to integrate, educational materials should be disseminated not only to agricultural educators but also to science and CTE teachers. Once equipped with updated information, agriculture teachers can relay this new level of knowledge and importance to their students and attract more students to the field of agriculture.

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