

Effectiveness of a Decision-making Unit: Agriculture Education at the High School Level



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Abstract

The purpose of this study was to examine the impact a decision-making unit within the Integrated Resource Management (IRM) High School Curriculum Aid had on the decision-making approach of high school students. An objective instrument was developed to assess students' approach to problem solving.

While significant interactions between pre and post test administrations were not detected on the objective portion, self report by students indicated their approach to decision-making had changed after completing the decision-making unit. Student and instructor feedback indicated there is not one right or best way to develop curriculum or deliver instruction. Within one class there are students with diverse learning styles, levels of skill, interests, and prior knowledge. Curriculum packages should be developed and delivered in a manner which addresses multiple learning styles simultaneously and provides instructors with a variety of materials.

Additionally, the research revealed that within the student sample, over 90% were from rural areas. Researchers hypothesized that the background of these students impacted their ability to have significant knowledge gains in the domain areas.

Introduction

Decision-making skills are required in every area of life. However, an effective decision-making process is seldom formally taught (Hammond et al., 1999). It is often expected that students who comprehend content information will inherently have the ability to assimilate information and apply it in making decisions. According to Perkins (1984), "students function primarily as consumers of products of inquiry, not producers," (p. 24). Ennis (1987) indicated that pilot curricula which teach thinking skills are necessary. "If students are challenged to critically evaluate, communicate, and defend their ideas, knowledge retention and understanding will increase even more," (Peters et al., 2002, p. 862).

Agriculture encompasses many disciplines that traditionally have been taught as separate subjects, for example animal science, range science, and agriculture economics. Knowledge of one area alone leaves a decision maker or manager ill-equipped to make optimal decisions. An integrated approach,

which considers all domain areas cooperatively, is more reflective of real life and will enhance the decision-making process.

According to Williams and Dollisso, technological advances are changing the way in which food and fiber are produced (1998). Technical skill alone is not enough to address challenges faced by leaders in agriculture; quick and careful thinkers and communicators are needed who can dynamically address changes in market structure and demands of consumers (Grant et al., 2000). Today's agricultural leaders require content knowledge from multiple subject areas combined with higher order thinking skills to make informed decisions. The Integrated Resource Management High School Curriculum Aid CD (Batchelder et al., 2003) was designed to present content knowledge through an integrated format and build higher order thinking skills through questioning, content, practical scenarios, and problem solving activities. Jacobs (1989) supports this approach by stating, "it is critical that students see the strength of each discipline perspective in a connected way" (p. 5).

Purpose and Objectives

The IRM curriculum presented students with discipline specific information but went beyond traditional discipline boundaries by connecting content to other disciplines. It also challenged students to consider how decisions interact and interrelate with other resource areas. The purpose of this study was to examine what impact a decision-making unit taken from the IRM High School Curriculum Aid CD had on the decision-making approach of high school students. Specific objectives included:

1. Assess students' domain integration scores on pre and post tests
2. Describe students' feedback regarding the decision-making unit
3. Compare students' performance on the objective portion and students' responses to self-report questions

Significance

An increase in integrated approaches to instruction in agricultural education is occurring (Fields et al., 2003). However research which

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analyzes individual thought process with regard to how decisions are made is lacking. Understanding the connections between decision-making approaches and the formulation of the decision made would be helpful to those desiring to impact student decision-making ability. More specifically, there is a need for an objective instrument which would quantify a student's decision-making ability. Such an instrument would allow for the comparison of various types of educational approaches in order to determine which methods are the most effective.

No scientifically tested instrument is available that measures student decision-making skills (Mincemoyer & Perkins, 2003). Research on students' thought process and decision-making ability has been conducted on individual steps within the decision-making process such as defining goals, assessing options, and selecting an alternative. However, there is not a comprehensive instrument that collects information providing evidence of the thought process students followed to formulate their decision. The thought process assessments which are available ask participants to provide a self-report of their perceived increase in skill level (Mincemoyer & Perkins, 2003). A self-report instrument alone does not provide objective evidence of changes within participant thought process.

Methods

This research followed a unique approach as the researcher was examining potential trends in student thought related to decision-making. The researcher was interested in identifying which domain area(s) -- animal science, environmental stewardship, financial considerations, and human-received the primary consideration when students made decisions. Assuming a student primarily utilized an animal science perspective before the decision-making unit, then a successful completion of the decision-making unit would encourage the student to utilize more information from the other disciplines. A "more balanced" score would indicate that student was using an integrated approach when making decisions.

The challenge arises in quantifying how individuals make decisions. It was assumed that if an individual was utilizing an integrated approach after exposure to the decision-making unit, weights for the Likert scale statements would be more evenly distributed between domain areas on the posttest than on the pretest for the same respondent.

This research followed a quasi-experimental approach. All agriculture education instructors in the state of Colorado were invited to participate along with their classes. The actual sample consisted of 14 out of 63 high school agriculture education programs. There were 54 students from nine schools in the experimental group and 29 students from five schools were in the control group.

Treatment group instructors received training in the delivery of the decision-making unit. Training

was delivered by the researcher at a workshop. The unit was taught through three days of instruction between the pre and post tests. Control instructors did not participate in training. They taught their normal pre-planned curriculum between administrations of pre and posttests.

Decision-Making Instrument

The decision-making portion of pre and posttests was developed specifically for this research. In order to measure the desired variables, six decision-making scenarios were created. Four scenarios were specific to agriculture and two addressed life decision relevant to high school students. Each scenario consisted of supporting information, a decision to be made, and potential decision options. Open-ended questions followed the decision-making scenarios. The questions asked which option they chose, what factors weighed most heavily in their selection, and why the factor was perceived to be important.

Several Likert scale statements were listed on the page following the scenario and open-ended questions. Respondents were asked to indicate how important each statement was in regards to the decision being made. The Likert scale next to each statement contained nine options ranging from "extremely important" to "not at all important." Likert statements represented each of the four domain areas. Means were calculated for each domain area.

Validity of the instrument questions was examined carefully to provide quality responses. Verification of face validity was illustrated by the types of scenarios provided. Scenarios were relevant to high school agriculture students. Questions asked following the scenarios required students to exercise their decision-making skills and provide evidence of that process. High school instructors, research, and content experts provided content validity. They reviewed testing materials for accuracy, appropriateness for the sample, and ability to collect the desired data. Measurement validity was rated high, internal validity overall was rated medium, and external validity was rated medium-high (Gliner & Morgan, 2000).

In addition to the objective section, students responded to open ended questions where they provided individual feedback regarding the decision-making unit. Instructors were also given the opportunity to provide feedback regarding their instructional methods and perceptions of the decision-making unit.

Data Analysis

Both the Likert-scaled and open-ended responses were analyzed. Likert-scaled items were used to calculate two different types of integration scores (Integration 1, Integration 2). Integration 1 calculated the variation among domains for the pre and post tests, providing a level of integration among domains. Students that had similar domain area

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averages would have a low level of variance, therefore a high degree of integration. A low variation would indicate that the students used information from all domain areas in the decision-making process. Likewise, students that had very diverse domain area averages would have a high level of variance, indicating less integration of the domain areas in their thought process. High variance between domains would mean that the student depended primarily on his/her knowledge of one domain area to make the decision.

The second method, Integration 2, considered both variation within and variation among domain areas. When variation between is used alone, as in Integration 1, a student who gave the same response for every Likert-scaled item would have a perfect score. Use of an approach that considers both types of variation would penalize a student who gave identical responses for every item. A student that gives identical answers is not responding to differences in scenarios and situations, and may be giving thoughtless responses. Therefore a second method, Integration 2, was used for calculating student integration score.

Integration 2 was calculated by dividing variation within domain areas by variation between domain areas. A higher score would indicate a low variation between each domain but a variety of responses within each domain area. Variation within each domain indicates the student is responding to differences in scenarios and situations. A lower score would indicate a higher variation between domain areas than variation within each domain area, showing a low level of overall integration. Integration 2 provided a more objective reflection of students' decision-making processes than Integration 1 as Integration 2 included variation within and variation between domain areas. Including both types of variation penalized students who gave careless answers by responding the same to each question and rewarded those who considered each scenario, adjusting the level of importance placed on each statement accordingly.

Means for each measure from the pre and post tests were compared using repeated measures analysis of variance in the SPSS program. Subject variability was used for random error estimates rather than school or instructor variances as there were so few instructors/schools. Significance was set at $p \leq .05$. Both groups completed both forms and approximately half of the students in each group took form A as a pre, with the other half taking form B as a pre exam.

Results and Discussion

Likert-Scaled Responses

No significant period by group interactions were found (see Table 1). Results of repeated measures analysis on the Likert scaled agriculture scenarios did not indicate significant changes in student domain integration scores. Students showed a low level of variation between domain areas, which indicates the student's ability to integrate the domain areas, but when a low level of variation was present on the pretests there was little room for improvement on the posttests. A likely explanation for the low variance was due to the background of the students. The demographic results from the students revealed that 90% of the students were from rural areas which would indicate an agricultural background. Agriculture is inherently multidisciplinary and it is possible that these students have been conditioned by their upbringing to think in an integrated manner when confronted with a decision.

Table 1 Agriculture Likert Scaled Repeated Measures Analysis

Source	Measure	Degrees Freedom	Mean Square	Significance
Integration Score 1 at pre and post	period	1	.170	.425
	error (period)	81	.264	
	period*group	1	.009	.852
	group	1	.018	.806
	error (group)	81	.289	
Integration Score 2 at pre and post	period	1	.349	.147
	error (period)	79	.163	
	period*group	1	.056	.558
	group	1	.031	.667
	error (group)	79	.166	

Results of Agriculture Open-Ended Questions

Open-ended responses following the decision-making scenarios were coded then evaluated quantitatively. While students gave each domain area a similar level of importance on the Likert statements, when they were asked to explain their choice they were more likely to mention financial reasons than animal science, environmental stewardship, or human reasons.

The two questions which required a student response following each scenario were, "what factors weighed most heavily in your selection?" and "why are these factors important?" Financial reasons were listed most often ($\approx 65\%$ of the time) followed by animal science and environmental reasons ($\approx 51\%$ of the time) and then human ($\approx 16\%$ of the time). Open ended responses may have provided a more accurate indication of the level of importance students placed on each domain area as students were not prompted on the open ended responses.

IRM Decision-making Unit Feedback

Students who completed the IRM decision-making unit also responded to three questions regarding the unit:

1. What did you like about the decision-making unit?
2. What would you change about the decision-making unit?
3. How will you use the information from the decision-making unit when making decisions in your own life?

Fifty-four students responded to the first question. Responses to this question were reviewed and then grouped into four categories: learning, format/approach, applicability, and other. Ninety-five percent of the students had a positive response to the format and content of the unit (see Table 2). Forty-three percent of the students said their learning had been impacted in a positive way.

Fifty-four students also responded to question two. Five categories were required to group the responses to this question (see Table 3). Thirteen (24%) students wanted the unit tougher and/or longer while 6 (11%) wanted it shorter and/or easier, and 15 (28%) desired no change. Seven students (13%) stated they wanted more activities or interaction in the learning process. The last 13 (24%) provided responses that did not fit the previous categories. These responses included statements such as, “have it once a week,” “apply it more to agriculture,” “incorporate a little more non-agriculture situations.”

Student responses to the question 2 illustrated the challenges faced by curriculum writers and instructors. Responses covered the spectrum from make it longer and harder to do not change it to make it shorter and easier. There is no one right or best way to develop curriculum or deliver instruction. Within any class there are students with diverse learning styles, levels of skill, interests, and prior knowledge. It is challenging to capture and engage every student's attention.

Student responses to all three questions regarding the decision-making unit were positive but question three was unique in that it asked students specifically how they would use the information from the decision-making unit. Fifty-three responses were reviewed and then grouped into three categories (Table 4):

1. Explanations of how the unit had impacted their decision-making approach
2. Examples of decisions where they would apply the unit
3. Other -- statements did not fit into the first two categories

Eighty three percent of students' responses fell in to the first two categories which included how and where students would apply the information they had gained from the unit.

In the past, decision-making assessments have been based primarily on self-report items. The researchers used an objective measuring tool along with self-report items. Although the objective measurements of integrated decision-making did not provide evidence of a significant gain, students said they were giving more thought to their decisions. Students' positive responses provided evidence that if the instrument used had been based on self-report items only, the results would have indicated a significant change in integrated decision-making ability. The results also provide evidence that the instrument may have been too easy or was not effective at detecting changes in students' approach to decision-making.

Student responses explained how their thought processes had changed after completing the decision-making unit. Responders said they would think more before making a hasty choice and consider the

Table 2 Student Responses Indicating What They Liked About the Decision-making Unit

Number of responses (% of those responding)	Category & Description
26 (43%)	Learning: I learned, challenging, made me think, helped me, gave me knowledge
19 (31%)	Format/approach: liked computerized examples, liked the situations, liked the questions, simple, straightforward, provided way to consider options
13 (21%)	Applicability: applicable to me, useful, multi-disciplinary, agriculture & non-agriculture, helpful in future
3 (5%)	Other

Table 3 Student Responses Indicating What They Would Change About the Decision-making Unit

Number of responses (% of those responding)	Category & Description
15 (28%)	No change
13 (24%)	Make unit tougher and/or longer
13 (24%)	Other, “have it once a week,” “apply it more to agriculture,” “incorporate more non-agriculture situations”
7 (13%)	More activities or interaction
6 (11%)	Make unit shorter and/or easier

Table 4 Student Responses Indicating How They Will Use the Decision-making Unit

Number of responses (% of those responding)	Category & Description
25 (47%)	Explained how the unit had impacted their decision-making approach. Included phrases “I will think more,” “look at the big picture”, “consider all the factors/consequences”
19 (36%)	Provided examples of decisions where they would apply the unit such as college, investments, enterprise selection, etc.
9 (17%)	Other, did not fall into the first two categories. Examples include, “as much as possible,” “the same way I did here,” and “I will use the decision-making circle.”

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potential outcomes of the options being considered. Other students described where they would apply the concepts they had learned in the decision-making unit. Students mentioned many types of decisions they were or would be facing where their newly learned decision-making process could be applied ranging from enterprise selection to investments, jobs, and colleges. Direct student feedback illustrated that the unit was applicable to students and that they were going to or are using what they learned.

Feedback on the decision-making unit provided by both students and instructors was clearly positive indicating that they thought the CD-based curriculum was useable, applicable, and challenging.

Instructor Influence

Clearly, the instructors' attitude and enthusiasm in delivery of the decision-making unit were reflected in their students' responses to the open-ended questions. Instructors that provided positive and upbeat comments on the decision-making unit had students that enjoyed the unit and provided similar comments. The opposite was also true for instructors that were critical of the decision-making unit. However, these instructors were a very small percentage of the sample. The students of the instructors who had negative comments regarding the unit, made almost identical statements in their evaluation. This feedback illustrates the high degree of influence instructors have on the interest level and acceptance of curriculum by their students.

Most instructors do not follow lesson plans, even their own, verbatim. If the instructor is passionate about a topic they will spend more time, be more interested, be more knowledgeable, and convey that enthusiasm in the classroom.

Summary

The purpose of this study was to examine the impact a decision-making unit had on the decision-making approach of high school students. Student approach to decision-making was measured as the variance related to the level of importance students placed on items related to four domain areas (animal science, environment, financial, and human). While significant interactions between pre and post test administrations were not detected, self report by students indicated their approach to decision-making had changed as a result of completing the decision-making unit.

Recommendations

While this research tested a new instrument designed to objectively measure decision-making approach, that pursuit led to additional questions regarding the future of agricultural education and assessment of approaches to problem solving. Will/how/can agricultural education continue when virtually all students participating in agricultural

education are from rural areas? How can the objective portion of the instrument be improved or changed to provide an accurate assessment of student approach to decision-making? It is recommended that further research explore the recruitment of non-agriculture students to agriculture education programs and that further research be conducted to pursue the development of an effective objective decision-making assessment.

Improve Objective Assessment Instrument

The purpose of the objective portion of the instrument was to have students complete exercises that would demonstrate their approach to problem solving. Other instruments designed to assess thought process and decision-making rely on self-report measures where students indicate their perceived skill level by responding to statements such as, "I consider all options before making a choice," or "I think about the results of the choices I make before rushing into decisions." Statements on self-report instruments may prompt respondents to provide a certain answer. For example, if a student was responding to the statement, "I consider all options before making a choice," the student may think it sounds good to say they definitely do, whether they actually think that way or not.

While conceptually it makes sense to assess the level of importance students place on various domain areas when facing a decision, there may be better approaches to assess student approach to problem solving. Further research exploring objective approaches to assess thought processes including decision-making is needed as well as the ability to quantify the quality of decisions.

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