A COMPARISON OF DSS/ES TEACHING STRATEGIES: CONCEPTUAL VS. INTERACTIVE APPROACHES

Madjid Tavana
Cyrus Mohebbi

La Salle University

Madjid Tavana is an Assistant Professor of Management Information Systems and Director of the Center for Technology and Management at La Salle University in Philadelphia. His research and consulting interests are in systems analysis and design, expert systems, decision support systems, and strategic information systems.

Cyrus Mohebbi is an Assistant Professor of Marketing at La Salle University. His research interests are in marketing research and statistical information systems.

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Decision support systems (DSS) were first articulated in the early 1970s by Michael S. Scott Morton under the term "Management Decision Systems" [15]. Today, DSS is defined as a set of computer-based tools used interactively by a manager, in connection with his or her problem-solving and decision-making duties [3, 11]. DSS is a new wave in management information systems, and many of the leading corporations have introduced DSS as one of their most important support systems for decision making. Most of the interviews for jobs, along with the increasing number of offerings in the business schools, bear witness to this fact [1, 4, 8, 10].

Expert systems (ES) are intelligent computer programs that use knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution [6]. Because of increasing pressure from the industry to train managers who could make better and faster decisions, Data Processing Management Association (DPMA) has adopted decision support and expert systems (CIS/86-11) in their model curriculum for undergraduate computer information systems education [5].

Purpose and Hypotheses

Due to the increasing demand for a new generation of graduates with the necessary knowledge and skills in DSS/ES, more and more colleges and universities are offering courses in decision support and expert systems at the undergraduate and graduate levels. The changing character of DSS/ES along with the rapid technological changes has made the task of teaching DSS/ES rather difficult. For this reason, a study was conducted to evaluate two different teaching strategies: 1) the conceptual approach and 2) the interactive approach.

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During the first phase of the project, a short questionnaire was sent to 50 randomly selected management information systems departments (AACSB accredited schools) offering an undergraduate course in DSS/ES. The purpose of this questionnaire was to identify different teaching methodologies used to teach such courses. A total of 34 questionnaires was returned. The analysis shows that 25 schools use the traditional/conceptual approach, which consists of standing lectures, very little or no hands-on problem solving, and a course project in some cases. On the other hand, 9 schools use the hands-on/interactive approach, which relies heavily on the hands-on aspects of DSS/ES. In the interactive approach, classes are mostly held in a computer lab. In addition, students are normally required to work on a course project.

A recent survey of 113 schoools by McLeod [13] shows that faculty teaching the CIS courses often stress the need for experiential activity. This activity is especially important when students have a modest appreciation for difficulties of management decision making and the role that DSS and ES plays. Study of the literature suggests that the CIS curriculum should promote hands-on skills for computers and carefully integrate this curriculum with the computer facility resources [1, 2, 4, 7, 8, 9, 10, 12, 14, 16, 17, 18]. The DPMA model curriculum for CIS/86-11 provides educators with a course description, course objectives, and course contents [5]. Among the course objectives, are to familiarize students with the theoretical and practical aspects of DSS/ES. But the main question remains: Which is more effective, the conceptual or the interactive approach?

The main purpose of this study is to measure the effectiveness of each teaching methodology. Hence, the following hypotheses were developed and tested:

Hypothesis-1:
There is no difference in class participation between the two groups.

Hypothesis-2:
There is no difference in hands-on knowledge between the two groups.

Hypothesis-3:
There is no difference in theoretical knowledge between the two groups.

Hypothesis-4:
There is no difference in the course project between the two groups.

Hypothesis-5:
There is no difference in the final grade of the two approaches.

Research Sample

The research sample of this study consists of 78 DSS/ES students, with a mean age of 21.1 years. Two classes taught by the same instructor were used for this study. The interactive approach was applied to the first class of 41 students. The second class was taught with the conceptual approach and consists of 37 students. The course is offered in the senior year, and all students have taken at least two computer courses (Introduction to Management Information Systems and one programming language) prior to their enrollment in DDS/ES. *Decision Support and Expert Systems* by Leigh and Doherty is the text used in both classes, along with the Execucom's Interactive Financial Planning System (IFPS) and VP-Expert, two commonly used packages for DSS and ES.

Measures

The final grade (FG) in both classes was dependent upon class participation, hands-on exam, conceptual exam, and a course project.

Class Participation (CP):
Class Participation comprises 20% of the final grade and it is simply the number of times each student attends classes throughout the semester.

Hands-on Exam (HE):
Hands-on exam using computers contributes to 30% of the final grade. The exam consists of two DSS and one ES problem to be solved using a computer in three hours.

Conceptual Exam (CE):
This exam contributes to 30% of the final grade and consists of 50 multiple choice and 50 true/false questions to be answered in two hours.

Course Project (CJ):
Course project contributes to 20% of the final grade, and all students were given the same project in expert systems to work on.

Results and Analysis

Figures I and II show a summary of the grades associated with the conceptual and interactive approaches:

FIGURE I
Grade Summary for the Conceptual Approach (n=37)

VAR	MEAN	STD DEV	MIN	MAX	SE	SUM	VARIANCE	C.V.
CP	14.11	4.25	4.00	20.00	0.70	522.00	18.10	30.16
HE	19.49	6.69	5.00	30.00	1.10	721.00	44.76	34.33
CE	22.81	4.94	11.00	30.00	0.81	844.00	24.44	21.67
CJ	15.00	4.40	3.0	19.00	0.72	555.00	19.33	29.31
FG	72.41	13.79	32.00	94.00	2.27	2679.00	190.25	19.05

FIGURE II
Grade Summary for the Interactive Approach (n=41) I

VAR	MEAN	STD DEV	MIN	MAX	SE	SUM	VARIANCE	C.V.
CP	16.93	2.81	8.00	20.00	0.44	694.00	7.87	16.57
HE	25.15	5.26	10.00	30.00	0.82	1031.00	27.63	20.90
CE	23.07	6.20	4.00	30.00	0.97	946.00	38.42	26.86
CJ	17.37	2.67	11.00	20.00	0.42	712.00	7.14	15.38
FG	80.54	13.33	48.00	98.00	2.08	3302.00	177.81	16.55

One-way multivariate analysis of variance MANOVA was used to analyze the data. We assume X_{ij} ($i=1,2,\ldots n_j, j=1, 2$) are independent four-dimensional vector observations sampled from two multivariate normal populations with mean vectors μ_j, $j=1,2$ and common variance-covariance. We are interested in the hypothesis

$$Ho: \mu_1=\mu_2$$

that the population mean vectors are identical (i.e., there is no difference between the two teaching approaches) vs. the alternative hypothesis

$$Ha: \mu_1\neq\mu_2$$

of different means.

The sample means for dimensions of two types of teaching had these values:

Approach	CP	HE	CE	CJ
Traditional	14.11	19.49	22.81	15.00
Interactive	16.93	25.15	23.07	17.37

The matrix of sums of squares and products among different dimensions along with the error matrix is given in Figures III and IV:

FIGURE III
Sums of Squares Matrix

DF=1	CP	HE	CE	CJ
CP	154.52	310.28	14.38	129.70
HE	310.28	623.02	28.88	260.43
CE	14.38	28.88	1.34	12.07
CJ	129.70	260.43	12.07	108.86

FIGURE IV
Sums of Squares Matrix

DF=76	CP	HE	CE	CJ
CP	966.35	588.49	509.98	430.10
HE	588.49	2716.37	1007.97	148.81
CE	509.98	1007.97	2416.46	410.90
CJ	430.10	148.81	410.90	981.51

Four test statistics (Wilks' lambda, Pillai's Trace, Hotelling-Lawley Trace, and Roy's maximum root), all functions of the eigenvalues of $E^{-1}H$ (or $(E+H)^{-1}H$), are reported with F approximations (Figure Va–e).

FIGURE Va
MANOVA Test Criteria for the Hypothesis of No Overall Group Effect

H	=	Type III SS&CP Matrix for: Group		
E	=	Error SS&CP Matrix		
P	=	Rank of (H+E)	=	4
Q	=	Hypothesis DF	=	1
NE	=	DF of E	=	76
S	=	MIN(P, Q)	=	1
M	=	.5(ABS(P–Q)–1)	=	1.0
N	=	.5(NE–P)	=	36.0

FIGURE Vb
Wilks' Criterion L = DET(E)/DET(H+E) = 0.71

Exact F = (1–L)/L*(NE+Q–P))/P with P and NE+Q–P DF

F(4,73) = 7.45 PROB > F = 0.0001

FIGURE Vc
Pillai's Trace

V = TR(H*INV(H+E)) = 0.29

F approximation = (2N+S)/(2M+S+1) * V/(S–V)
with S(2M+S+1) and S(2N+S) DF I

F(4,73) = 7.45 PROB > F = 0.0001

FIGURE Vd
Hotelling-Lawley Trace

TR(E**–1*H) = 0.41

F approximation = (2S*N–S+2)*TR(E**–1*H)
(S*S*(2M+S+1))
with S(2M+S+1) and 2S*N–S+2 DF I

F(4,73) = 7.45 PROB > F = 0.0001

FIGURE Ve
Roy's Maximum Root Criterion

Roy's Maximum Root Criterion = 0.41

First Canonical Variable Yields an F Upper Bound

F(4,73) = 7.45 PROB > F = 0.0001

All four tests are rejecting the null hypothesis of equal means. Now the question of which dimension or dimensions have contributed to this rejection should be addressed. After constructing simultaneous confidence intervals for all four dimensions, it can be concluded that except CE, the other three dimensions are highly significant in favor of the interactive approach. In the case of CE, the sample mean of interactive approach is greater than the traditional approach, but we cannot conclude that these two approaches are statistically significant on that dimension.

Conclusion

One of the main objectives in the DPMA Model Curriculum for CIS/86-11 is to utilize commercial spreadsheets and database integrated packages to develop "what if" simulation models to support the decision-making process. In addition, there is an increasing demand for graudates to have hands-on experience with both DSS and ES. With the increasing number of microcomputers on campuses, it is relatively easier to accomplish these goals.

This study suggests that the interactive approach is more effective than the conceptual approach used in teaching decision support and expert systems. It was also shown that whether students participate in a conceptual or interactive educational environment, it does not affect their theoretical/conceptual expertise, but it does effect class participation and their hands-on expertise.

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