A VIDEO ON DEMAND PROJECT EVALUATION: IMPLICATIONS FOR DEVELOPING AN ENTREPRENEURIAL MODEL FOR ECONOMIC INSTRUCTION

Fred Carr, The University of Akron
Isadore Newman, The University of Akron

ABSTRACT

Video on demand (VOD) is a technological method that has great growth potential in assisting teachers in instructing students. Public Television WNEO/WEAO, 45/49 in Northeast Ohio developed video clips in Math and Science and matched these video clips with the state of Ohio student proficiency objectives for grades 4-9. The project demonstrated that significant concept attainment was possible through the use of VOD. The 45/49 project found that there were various start up difficulties. These difficulties related to teacher and school system inexperience in computer online setups. There were also difficulties related to the initial matching of video clips to subject objectives and the overall length and quality of the clips used. None of these difficulties however prevented the use of VOD as an effective teaching method.

Economic educators, entrepreneurs and the television media have the opportunity to develop innovative materials, which can duplicate the success of this study. Using the experiences of the 45/49 VOD model, various creative and effective VOD programs could be implemented. Economic educators could form beneficial partnerships with entrepreneurs and media organizations to provide cutting edge computerized instructions to meets increasing demands related to student proficiency examinations, many of which contain economic and entrepreneurial concepts.

INTRODUCTION

Video on demand is a growing segment of teacher assistant technological advances. These advances are well documented as reported by Wyman (1997) and Van Dusen (1995), Cawkell (1997) and Hargadon (1995). Teachers with varying technological capabilities are being brought into the world of computer assisted

learning. Economic educators, entrepreneurs, and the public and private television sectors have tremendous potential for using vast video files to enhance this process. Northeastern Ohio Public Television station channel 45/49 has recognized this potential and has started an innovative project to develop a partnership with schools to assist teachers, within it's viewing area, to furthering student concept attainment in science and math through the 45/49 web site. The initial success of this educational effort holds potential applications for the field of economics and economic education. The Video On Demand Project (VOD) also provides a projection of future partnerships, which can be developed between schools, television studios, and those organizations or individuals with and entrepreneurial proclivity towards innovation in instructional methodology.

The future potential for VOD types of project is discussed by Vedro (1995) and Galbreath (1996), who both illustrate the infancy of these types of projects and the great potential teacher assistance partnerships hold for both education and public television. Channel 45/49 is developing a good model from which field of economics and economic education could develop, refine, and enhance instruction for students K-16 in furthering economic concept attainment.

OVERVIEW

Public Television Station WNEO/WEAO, Channels 45/49 in Northeast Ohio has developed an ongoing project, which entails classroom teacher use of, selected video clips in mathematics and science. The project director was Mr. Steve Mitchell, Director of Educational Services for Channels 45/49. Teachers volunteered, from selected schools, for the project. The volunteer participants were asked to view and select from videotapes taken from Channel 45/49 video files concerning topics in mathematics and science. The teachers were then asked to formulate math and science instructional objectives, which would match the content of the videotapes with the State of Ohio Proficiency Competencies for their grade level. The development of the instructional objectives necessitated repeated reviews of the videotapes. Channel 45/49 reduced the selected videotapes to no more than three-minute computerized video clips. After the teachers interpreted the instructional objective(s) within the clips, they composed six questions, which related to the same instructional objective(s). The questions were randomly selected to make up a three-question pretest and a three-question posttest. The overall goal was to create computerized video clips that the teachers could show in their classrooms via the internet, provided by the 45/49 studio web site, that reflected the math and science subject area and grade level at which the teachers realistically instruct.

The Video on Demand (VOD) Project involved twelve teachers from seven school locations located within the Channel 45/49 viewing area in Northeast Ohio.

The schools were selected to represent urban, rural, and suburban neighborhoods. The school levels were two high schools, one middle school, and four elementary schools. The small scale of the 45/49 project was necessary due to the expense and lack of operational maintenance for a beginning project. The research done by Tristram (1995) also found that small video systems are currently the most successful. The teacher participants began evaluation formulation and familiarization processes in February 1997 and concluded with the data collection through December 1997. Participants were to provide qualitative and quantitative data. Teacher participants were asked to provide qualitative data through analyzing project activities at participant determined appropriate occurrence intervals beginning with the formative evaluation process. In addition, teacher participants were given data pre/post test data sheets to provide evaluators with quantitative data. Qualitative and quantitative data was collected from six of the seven schools: one high school, one middle school and four elementary schools. Ten of the thirteen teacher participants provided pre-test/post-test data on 518 students and post-post-test data on 306 students from six teachers. Probable reasons for the differences in total posttest scores recorded and post-posttest scores recorded are discussed in the study limitations section.

EVALUATION PLAN

The evaluation plan was to derive qualitative and quantitative data from all project teacher participants. The effectiveness of the video clips was analyzed from test and a teacher participant journal perspective. Elementary and middle school student knowledge growth was assessed using a pretest-posttest control group design (Cambell & Stanley 1966). The research design was analyzed using the analysis of covariance, co-varying teacher differences (McNeil, Newman & Kelly 1996) (Newman & Benz 1995). High school and middle school students were given a pretest and posttest of their knowledge of the video clip math and science content. Within group and across group evaluations were analyzed using bi-directional tests of significance at alpha level .05. To access each segment, students were required to answer questions about the concept included in the video. After the video segment was viewed, the student was required to answer questions to test whether the concept had been learned. Outside math and science consultants were given questionnaires and asked for qualitative judgments as to the objective matching, effectiveness and quality, of the developed video clips.

Participant teachers were asked to keep a log of what worked and what did not, including statements about their success in using the video clips, computers, and the Internet. A qualitative analysis was then done on the activity logs.

STUDY LIMITATIONS

While the overall results of the study were encouraging, project analysis was hampered by several factors. Schools and teacher participants could not be randomly selected which is not uncommon in educational research data with a start up project that must develop its content. Schools are reluctant to enter a blind pool and therefore administrative support must be solicited for participation resulting in the selection of a limited number of schools. Attempts to gather data from schools with rural, urban and suburban locations was made but the pooled data did not account for an effect breakout by location for this study.

Differences in teacher affect were analyzed in the pre/post text data. However a number of teachers, 3 out of 12 on the pre/post test data and 6 out of 12 on the post/post-test data, did not turn in results. No reasons for teacher incomplete records were gathered. However, from the qualitative activity logs, it can reasonably be assumed that several factors caused this phenomenon:

- Trouble with computer services
- Inexperience with computer applications
- Teacher load and conflicting schedules

It is highly probable that the VOD project will overcome these limitations as the video clips become more refined, teacher participants become more familiar with PC operations and the Internet and the overall project design develops into a more formal and deliverable teaching tool. The data did show, even with these complications, significant results when data results were compared across all test results.

A final limitation was the lack of data collected on student perceptions about the clips and the learning process. The second phase of the VOD project will collect student input on concept attainment using the Internet. The limitations of this study, however, should not detract from the overall completion of the VOD project and the positive learning experiences attained by all the participants.

VIDEO CLIP OBJECTIVES

Two outside experts in science and five outside experts in math were asked to rate the video clips and the instructional objectives. The objectives were rated as to how well they related to the selected video clips in their subject areas. The objective clip question form is presented in Exhibit 1.

Exhibit 1

FM01 Objective
125.0 Clip number

How good a match is this clip to the objective?

5	*4*	*3*	*2*	*1*
Very good	*Good*	*Fair*	*Poor*	*Very Poor*

How effective do you think this clip is in teaching the objective?

5	*4*	*3*	*2*	*1*
Very good	*Good*	*Fair*	*Poor*	*Very Poor*

In general, the quality of this clip is:

5	*4*	*3*	*2*	*1*
Very good	*Good*	*Fair*	*Poor*	*Very Poor*

Comments on this clip.

The form allowed the experts to judge the objectives in three ways. The criteria asked was:

- Did the objective match the clip?
- Was the clip effective in teaching the objective
- The overall quality of the clip in teaching the objective

A Likert style scale of 1 to 5 representing very poor to very good was used to quantify the results. For individual ranking of each math video clip objective, see Appendix A. For individual ranking of each science video clip objective, see Appendix B. Summative data in Exhibit 2 and Exhibit 3 show the mean and standard deviation for the math and science objectives respectively.

The math evaluation results showed that out of 29 clips, approximately 50 percent were rated above average in matching, effectiveness, and overall quality and 50 percent were rated below average. The science evaluation results showed that out of 26 clips, approximately 50 percent were rated above average in matching, effectiveness, and overall quality and 50 percent were rated below average. The math and science evaluations showed the objective/clip match to be in the mid-range (fair, 3.08 for math and fair, 3.06 for science). Similar results were found for effectiveness (3.09 for math and 3.06 for science) and quality (3.1 for math and 3.3 for science). Teachers found it difficult in making the objectives fit the clips. Comments such as "It was very difficult to pin objectives on some of the clips" were

expressed throughout the educators' logs in variety of similar expressions. The clips, however, were shown to be effective in producing significant student gains supported by the pre/post test results, which follow. It could reasonably be expected that clips could be made, with future revisions, to rate in the upper ranges in future VOD phases.

Exhibit 2
Simple Statistics

Variable	Mean	Std. Dev.	Sum	Minimum	Maximum
MATH	1.0000	0	145.0	1.0000	1.0000
MATCH	3.0896	1.1136	414.0	1.0000	5.0000
EFFECTIVE	3.0896	1.1136	414.0	1.0000	5.0000
QUALITY	3.1194	1.1375	418.0	1.0000	5.0000

Exhibit 3
Simple Statistics

Variable	Mean	Std. Dev.	Sum	Minimum	Maximum
SCIENCE	1.0000	0	52.0	1.0000	1.0000
MATCH	3.0652	1.3233	141.0	1.0000	5.0000
EFFECTIVE	3.0652	1.3233	141.0	1.0000	5.0000
QUALITY	3.2826	1.2049	151.0	1.0000	5.0000

QUALITATIVE RESULTS

Project participants entered the project with expressed eagerness and relatively high expectations. There was evidence that the teachers had a wide range of computer experience, which was expressed from very little to widely experienced. Anxiety over being able to accomplish the project requirements was also evident. Participants expressed appreciation for 45/49 support through assignment of staff personnel to the individual schools.

As the project progressed, the teacher participants' expectation levels of what the video clips could accomplish lessened. The clips were seen as being too short, not good enough in content or overall having little effect. Some comments made were of the nature of "clips were too short, not enough (objective) explanation." and "some videos were good, some were cut off too much". Some teacher disillusionment with the project continued but results were confounded by outside variables. Teachers with little computer experience and very little support from their schools experienced a higher frustration level than teachers with greater computer experience and/or support from a colleague with a higher level of computer experience. Disillusionment was also impacted by high teacher expectations that their schools would be on-line with a high level of computer service and functioning in correlation with their video clip instruction. Comments were made throughout the teacher activity logs that were typically reflected by this teachers comment "September - PC's not delivered and Internet not running." When school networks did not come on line in time or failed to perform as anticipated, teacher project participants experienced frustration, which was transferred to difficulties with the project. Comments such as "…(we) have met approximately six times after school to access the clips and to decide which ones we would like to use in our classrooms first. Each time we have done so there has been a problem. It is getting very frustrating. The computers crash, the server is down, or we just cannot simply get to the clips." There were also insightful observations about the group and project reflected by this statement, "I felt very proud today. I think people, in general, have a negative tendency which frustrates me. This project is workable. We are the frontiers for VOD." Overall, concerns were gradually lessened as computer systems came on line and the teachers worked with the materials.

Participants experienced misconceptions, which became evident as the project progressed. The project was thought to have required much more work than was originally anticipated. In addition, participants expressed concern over how much time the project consumed. Comments were made such as "The other frustration I have is that I do not have enough time. It has been a challenge to incorporate the clips into my teaching". Participants were not prepared for, or generally misperceived, the amount of time and work involved.

Other participant misconceptions also occurred in project student outcomes. Initially, the teacher participants had very high student outcome expectations in which a "home run" for subject level improvement was the anticipated norm. The project design did not allow for the immediate "home run" effect. Initial use any material has inherent difficulty of use and combined with beginning use of PC's and the Internet through first year school system set-ups, teachers did not receive immediate positive feedback in many cases. There were, however, many "little hits" which the following quantitative data will support which were not perceived by the

teachers. Had the teachers been aware of the "little hits" during the course of the project, the evaluation of the teachers' subjective perceptions could be expected to be higher than reported. This emphasizes the advantage of doing both qualitative and quantitative data, in that, the quantitative analysis was capable of detecting this "small hit" difference while the quantitative analysis was not.

PROJECT QUANTITATIVE OUTCOME

Subject area pretest/posttest was collected. Pre/post test comparisons were made on subject areas using project developed clips and subject areas not using project-developed clips. Teachers randomly selected certain subject objectives that would be taught by video clips and subject objectives that would be taught without using video clips. The quantitative data was run through two measures of analysis. A Pearson Correlation Coefficient analysis and an Analysis of Variance controlling for teacher difference were run. In the Pearson Correlation (Point-Biserial Correlation), there was a significant difference between the "clip" and "no clip" usage such that the students using project developed clips gained significantly more in concept attainment than when students did not use the project developed clips. Probability was found to be at the 0.0001 level with an n=518 (see Exhibit 4). The results of this project support the study of Branch and Durran (1996) which found VOD system to be a benefit to students, which use it.

Exhibit 4
Pearson Correlation Coefficients / Prob > IRI under H_0 : Rho = 0
(Point-Biserial Correlation which is a t-test)

	CLIP	NOCLIP	M	F	PRE
GAIN	0.26418	-0.26418	-0.04440	0.04440	-0.63190
	0.0001	0.0001	0.3132	0.3132	0.0001
	518	518	518	518	518

Post-posttest data run on 306 student subjects showed no significant gain between the posttest and the post-posttest scores. The data demonstrated that the knowledge obtained between the pretest and the posttest period, that gain was not significantly changed ("maintained") since there were found no significant difference between the posttest and the post-posttest scores (p=.49). (See Exhibit 5).

Exhibit 5

Model: MODEL2
Dependent Variable: GAIN2

Analysis of Variance

Source	DF	SS	Mean square	F Value	Prob>F
Model	3	0.24080	0.08027	0.807	0.4907
Error	303	30.13403	0.09945		
C Total	306	30.37483			
Root MSE		0.31536	R-square		0.0079
Dep Mean		-0.00449	Adj R-sq		-0.0019
C.V.		-7030.91344			

There was a concern that the significant difference produced by the Pearson Correlation analysis may in part, have been due to a difference within the participating teacher group. An Analysis of Covariance was run which held any differences related to the instructing teachers constant. Again, the probability value was significant at the 0.0001 level (see Exhibit 6).

Exhibit 6

Model: MODEL1
Dependent Variable: GAIN

Analysis of Variance

Source	DF	SS	Mean square	F Value	Prob>F
Model	6	10.88648	1.81441	21.667	.0001
Error	511	42.79089	0.08374		
C Total	517	53.67737			
Root MSE		0.28938	R-square		0.2028
Dep Mean		0.11834	Adj R-sq		0.1935
C.V.		244.53133			

Exhibit 6 Continued
Parameter Estimates

Variable	DF	Parameter Estimate	Std. Error	T for HO Paramater=0	Prob > ITI
INTERCEPT	1	-0.118119	0.03553292	-3.324	0.0010
CLIP	1	0.175159	0.02552354	6.863	0.0001
TEACH1	1	0.145043	0.05212360	2.783	0.0056
TEACH2	1	0.350123	0.06729452	5.203	0.0001
TEACH3	1	0.024151	0.04968067	0.486	0.6271
TEACH4	1	0.422931	0.05347739	7.909	0.0001
TEACH5	1	0.153231	0.03691427	4.151	0.0001

As shown in the quantitative analytical charts above and as noted earlier, the quantitative data did not support the participant teacher subjective data, which expressed concern over subject clip usage effectiveness. The clips were shown effective in student subject concept attainment.

IMPLICATIONS FOR ECONOMICS AND ECONOMIC EDUCATION

The promise of this creative educational effort should not go unnoticed by private sector entrepreneurs, economists and/or economic educators who believe that innovative technological instructional methods hold forth the potential for effective content and concept attainment by students. Developed video clips, proven to be effective, could be expected to be in high demand in the classrooms of the future.

Educators and creative entrepreneurs in the field of student instruction, who follow the study format, can expect to encounter many of the same difficulties that were encountered by the 45/49 initial project. There will be differences in teachers' technological skill levels. Video's appropriate to the field of economics will have to be located and analyzed, however, any television station with news that pertains to the economy could be a potential computerized instructional video clip.

One major advantage to this type of project is the capability to use local economic events, which have been, recorded by local news shows and public television programs. These local economic news events could be used for realistic

applications of economic concepts with which area students readily identify. An example may be the bankruptcy or successful growth of a local business, with which the local students are familiar, to illustrate the concepts of supply and demand through a computerized video clip. Such clips could also be updated and kept current to make instruction more meaningful and relevant.

One of the most important aspects of this type of effort is that the video clips can be used to develop a partnership between business, education (K-16), and the media. The idea of a profitable entrepreneurial educational VOD development holds promise, especially if the results of the 45/49 VOD project prove to be effective with further refinement and testing. Certainly, economic education would benefit from VOD development if the right financial, media and educational partnerships can be established

SUMMARY

The Video on Demand project showed that video clips produced significant quantitative gains in subjects who were exposed to them. This project also demonstrates the value of taking a qualitative and a quantitative analytical approach simultaneously. Our example clearly demonstrates a meaningful amount of information would have been lost in taking either methodology alone.

Several outside variables which impacted negatively on teacher project perceptions could be expected to disappear in future project efforts as school systems become effective in providing consistent computer network services and teacher computer usage comfort levels increase. In addition, teacher misconceptions about project time consumption and work involved can be expected to decrease greatly as subject clips are refined and support activities are further developed.

The 45/49 VOD project has demonstrated success in its initial development and promises an even greater effective teaching potential with future product refinement. Due to the results of this study, it would be reasonable to expect that an expanded effort of this nature can positively work on a nationwide scope.

REFERENCES

Branch, P. & J, Durran, (1996). PC based video on demand trials. "Learning technologies: prospects and pathways," *Selected papers from EdTech '96 Biennial Conference of the Australian Society for Educational Technology. (Melbourne, Australia, July 7-10, 1996).*

Cambell, D. & J. Stanley. (1966). *Experimental and Quasi-Experimental Designs for Research.* Chicago: Rand McNally & Co.

Cawkell, T. (1997). The information superhighway: A review of some determining factors. *Journal of Information Science*, *23*(3), 187-208.

Galbreath, J. (1996). Interactive television: The state of the industry. *Educational Technology*, *36*(2), 24-35.

Hargadon, T. (1995). The state of the info highway. *Newmedia, 5*(10). 44-49, 52-53.

McNeil, K., I. Newman & F. Kelly. (1996). *Testing Research Hypotheses with the General Linear Model.* Carbondale, Illinois: Southern Illinois University Press.

Newman, I. & C. Benz. (1995). Qualitative/quantitative research methodology. *Exploring the interactive continuum.* Carbondale, Illinois: Southern Illinois University Press.

Tristram, C. (1995). Stream on: Video servers in the real world. *Newmedia, 5*(4), 46-51.

Van Dusen, G. C. (1995). The virtual campus: Technology and reform in higher education. *ASHE-ERIC Higher Education Report*, *25*(5).

Vedro, S. (1995). What is interactive television anyway? And how do we prepare for it? *Part one: Datacasting makes a comeback.* Washington, D.C.: Corporation for Public Broadcasting.

Wyman, B. (1997). Networked multimedia: Are we there yet? *Iall Journal*, *29*(2), 65-74.

Appendix 1

Obj	Clip	Match	Effective	Quality
FM01	84	4,4,2,1,1	3,4,2,1,1	3,2,3,1,1
FM01	125	3,3,3,2	3,3,3,2	3,3,3,2
FM02	129	3,1,4,1,1	3,1,3,1,1	3,1,4,1,1
FM03	106	1,3,4,4,2	1,3,4,4,3	3,4,4,3,1
FM04	132	1,4,4,1	1,4,4,1	1,4,3,1
FM08	55	3,2,4,4,3	3,2,4,4,3	2,5,4,3,3
FM10	118	4,3,4,3,1	1,4,3,4,3	4,4,4,3,1
FM10	119	5,4,4,3,1	5,4,4,3,1	5,5,5,3,1
FM18	401B	3,2,3,3,2	2,3,2,3,3	3,2,2,3,2
FM20	30	4,4,4,4,3	4,4,4,4,3	4,4,4,3,4
FM20	193	3,4,4,5,4	3,4,4,5,4	3,4,5,5,4
FM21	133	3,2,4,4,2	3,2,3,4,2	2,4,4,2,3
FM22	56	2,1,2	2,1,2	2,1,4
FM23	58	4,1,1	4,1,1	4,1,1
FM24	113	2,3	2,3	2,3
FM24	115	3,5,3,2	3,4,3,2	3,3,3,2
FM25	402B	2,1,4,4,2	2,1,4,4,2	1,4,4,2,2
NM01	152	3,4,4,4,1	4,3,3,1,2	4,3,4,1,2
NM01	154	1,4,4,5,2	2,4,4,5,2	2,4,4,4,2
NM05	199	4,3,4,3,4	3,3,3,3,4	3,3,3,3,4
NM05	200	4,4,5,4	4,4,4,4	4,5,5,4
NM09	166	3,3,4,4,3	3,3,4,4,3	3,4,4,3,3
NM09	167	3,3,3,3,2	3,3,3,3,2	3,4,3,2,3
NM11	196	4,3,4,5,4	4,3,5,5,4	3,5,5,4,4
NM12	205.1	4,4,4,2	4,4,4,2	4,4,4,2
NM13	403B	3,4,4,4,4	3,4,4,4,4	3,4,4,4,4
NM15	189	4,4,3,3,4	4,4,4,4,3	4,4,4,3,4
NM16	185	2,4,4,3,3	2,4,3,4,3	4,4,4,3,2
NM16	186	2,4,4,4,3	2,4,4,4,3	4,4,4,3,2

Note: For match, effective and quality categories, the number under each category represents each judge's ratings of the clips

Appendix 2

Obj	Clip	Match	Effective	Quality
FS01	343			
FS02	209	2,2	2,2	3,2
FS03	369	3,1	3,1	2,1
FS05	210B	5,3	5,3	5,3
FS05	210	5,2	5,2	5,2
FS06	289	3,4	3,4	3,4,4
FS07	202.2	4,1	4,1	4,3
FS08	322	2,3	2,3	2,3
FS11	371	4,2	4,1	4,2
FS12	353	5,4	5,4	5,4
FS12	354	5,1	5,1	5,1
FS13	334	4,2	4,2	4,2
FS14	214	5,4	5,4	5,4
FS15	314	5,3	5,3	5,3
FS16	344	4,1	4,1	4,1
FS17	234	4,4	4,4	4,4
NS05	310	4,1	4,1	4,1
NS07	237	3,1	3,1	3,3
NS08	225B	5,3	5,3	5,3
NS10	223	4,2	4,2	4,4
NS11	217	2	1	2
NS12	400B	4,2	4,1	4,2
NS15	387	4,2	4,1	4,2
NS16	388			
NS18	213	4,3	4,2	4,4

Note: For match, effective and quality categories, the number under each category represents each judge's ratings of the clips