

Interactive television
is put to the test to
evaluate its impact
on student grades.

In-Class Versus Interactive Television Instruction

A Study to Determine Comparability

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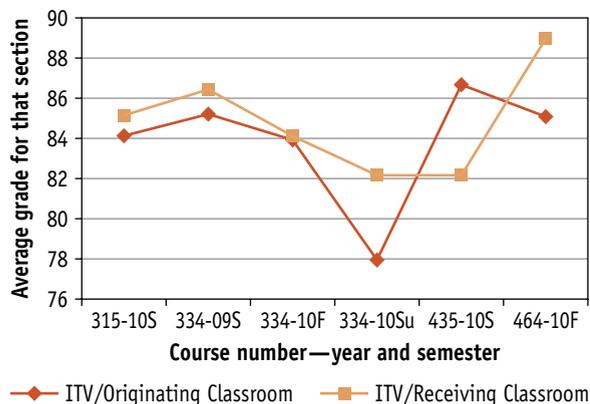
Abstract

The economic factors and convenience advantages of interactive television (ITV) classes are well known. The question remains, however, as to the effectiveness of ITV instruction versus traditional in-class, face-to-face instruction. This study provides a statistical comparison of the relative effectiveness of three approaches: traditional face-to-face instruction, face-to-face instruction combined with originating an ITV class, and remote ITV-recipient classes. Final grade performance was analyzed using several different models and tests, with care taken to screen out controllable variables to the extent possible. Results failed to detect a significant positive or negative impact on grades due to ITV instruction.

Purpose of the Study

After five semesters of teaching both traditional and interactive television (ITV) classes for a Minnesota university, the principal author of this article wondered whether the three different teaching modes—traditional face-to-face instruction (traditional class), face-to-face instruction combined with originating an ITV class (ITV-originator class), and remote classes receiving the ITV transmissions (ITV-recipient class)—resulted in different overall student grades. Statistical results for the final grades of 23 different sections of six upper-class business courses were compiled and reviewed (see Figure 1). This initial analysis showed that for five of six paired ITV classrooms, the ITV-recipient class earned higher grades than the ITV-originator class. Students t-tested on the

Figure 1: Paired ITV Class Grades



paired results showed two courses were significantly different at the 95% level of confidence (see Table 1, Analysis 3). This was encouraging enough to bring in a statistician to look at the results in more detail.

Three questions were posed of the available data:

- *Analysis one:* Is there a difference in final grades between the traditional classes held at the main campus and its satellite? This was done first since a systematic difference here would need to be removed from the data prior to looking at the ITV effect.
- *Analysis two:* Is there a difference in final grades between traditional classes and ITV-originator classes? In other words, if the instructor is the same, does the use of extra technology in the classroom have an impact on grades?
- *Analysis three:* Is there a difference in final grades between ITV-originator and ITV-recipient classes?

Anecdotal feedback from both instructors and students imply a preference for in-class, face-to-face instruction. Sedlac suggests that both television and computer network models serve students well in a flexible environment at the University of Wisconsin-Stout.¹

The perception exists that interactive ITV instruction has an impersonal flavor which is a barrier to the student-instructor relationship and thus affects the learning outcome. An additional negative of ITV classes may be the occasional television technical problems, the inability to conduct proctored exams, and the difficulty of in-class assignments at the remote location. Sharp and Cox note that from time to time there are technological problems, but these problems are

not major for most students. Off-campus students take the course by television, and noted “They received the same instruction as campus students for a lower cost (as compared to main campus tuition), and at a convenient location.”²

Angiello contrasts the pedagogical argument, “The more traditional are convinced that face-to-face instruction is not only superior to online instruction but the only acceptable way to teach and learn. They view online classes as no better than the old-fashioned correspondence courses, despite the inclusion of web-based resources and media technology. They think the upsurge in degrees from online institutions tarnishes the credibility of all of education. Others think that the virtual classroom should supplement and possibly replace face-to-face education. Among them are certainly some seduced by technology without regard to its effectiveness.”³

Additionally, Bellotti encourages the use of television as a pedagogical tool, stating “TV may play a significant role in the current life-long learning challenges, provided that meaningful applications are implemented.”⁴

Regardless of the perception, the question remains as to the degree of effectiveness of the contrasting instructional approaches. Reisslein notes that the overall student satisfaction index was approximately the same with either form of distance education video delivery.⁵

Study Protocol

The sites of the study are the main campus of Winona State University in southeastern MN and its associated sister school in Rochester, MN, which is 40 miles from the main campus. The study population is confined to upper-class students in the college of business. The university has approximately 9,000 students, with 1,300 college of business students split between the two campuses.

Throughout the study, the ITV-originator class instruction was simultaneously transmitted to the paired ITV-recipient class. In addition, there was simultaneous dual computer-screen viewing and document viewing for students in the two locations. Built-in controls for the study for each course included the same instructor, text, exams, and real-time instruction.

The data on student performance is summarized as their final cumulative grades for the semester, which includes four to five exams,

Table 1: Summary of Class Results and Analysis Comparisons

Course	Semester	Number of Students	Location	Minimum Final Grade	Average Final Grade	Maximum Final Grade	Standard Deviation	Instruction Type	Student's t	Critical value for 2-tailed test $\alpha = 0.05$ (unadjusted)
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Analysis 1

315	2009 F	30	Winona	75.6	84.10	94.8	4.31	Traditional		
315	2009 F	22	Rochester	64.9	84.19	94.0	8.28	Traditional		
325	2009 F	32	Winona	87.1	91.04	96.7	2.08	Traditional		
325	2009 F	33	Rochester	77.6	90.19	95.3	3.39	Traditional		
495	2010 S	33	Winona	83.1	89.74	96.0	2.77	Traditional		
495	2010 S	21	Rochester	80.9	89.61	95.1	3.54	Traditional		

Analysis 2

334	2009 S	31	Winona	71.0	84.08	95.5	6.02	Traditional		
334	2009 S	19	Winona	69.5	82.66	95.0	7.22	Traditional		
334	2009 S	36	Winona	62.0	84.39	94.0	7.24	Traditional		
334	2009 S	42	Winona	72.0	85.21	97.0	5.95	IIV-Originator		
334	2010 F	31	Winona	71.1	83.92	93.9	5.78	IIV-Originator	Not used for Analysis 2b	
334	2010 Su	17	Winona	71.4	77.94	89.7	4.89	IIV-Originator	Not used for Analysis 2b	
334	2009 S	14	Rochester	76.0	86.43	96.5	6.72	IIV-Recipient	Used for Analysis 2b only	

Analysis 3

315	2010 S	21	Winona	74.1	84.13	93.0	5.65	IIV-Originator	0.63	2.040
315	2010 S	12	Rochester	72.2	85.15	93.9	5.51	IIV-Recipient		
334	2009 S	42	Winona	72.0	85.21	97.0	5.95	IIV-Originator	0.74	2.005
334	2009 S	14	Rochester	76.0	86.43	96.5	6.72	IIV-Recipient		
334	2010 F	31	Winona	71.1	83.92	93.9	5.78	IIV-Originator	0.16	2.006
334	2010 F	24	Rochester	74.9	84.12	95.6	6.00	IIV-Recipient		
334	2010 Su	17	Winona	71.4	77.94	89.7	4.89	IIV-Originator	3.21**	2.042
334	2010 Su	15	Rochester	70.3	82.16	90.1	5.12	IIV-Recipient		
435	2010 S	12	Rochester	72.2	86.66	95.6	6.93	IIV-Originator	2.15*	2.042
435	2010 S	20	Winona	67.2	82.16	93.8	7.39	IIV-Recipient		
464	2010 F	31	Winona	61.8	85.09	96.2	8.06	IIV-Originator	1.99	2.017
464	2010 F	14	Rochester	81.4	88.95	97.8	4.79	IIV-Recipient		

* Significant at the 95% level of confidence only

** Significant at the 95% and 99% levels of confidence

in-class participation, and comparable homework. All exams were taken electronically using the testing system of Desire to Learn (D2L), a provider of enterprise e-learning solutions. This organization develops online learning management systems used at more than 450 institutions around the world. Computers were utilized for exams and have the ability to provide a "lock-down browser"

allowing only the exams in progress to be active, thus avoiding any ability to look up answers in the computer's database or Internet. Even with this safeguard, however, there is a potential for cheating, since there is no proctor in the remote location in spite of remote television overview.

Although not initially planned for quantification in this study, there is thought to be a tendency for

Rochester students to be of a more nontraditional profile. No special enrollment considerations were made to allow for the comparison of student/location influences that could affect the outcome, e.g., extra-curricular activity, SAT rankings, campus activities, employment experience, or living conditions (dorm, home, off-campus, etc.). A general location-to-location comparison (Analysis 1) was incorporated into the study when the courses available for analysis showed that such a comparison could logically be performed.

Supplemental Protocol

A single instructor taught three courses at both Winona and Rochester, using only the traditional instructional approach. Paired sections of general management (MGMT 315), organizational dynamics (MGMT 325), and strategic planning (MGMT 495) served as a way of comparing the student populations at the two campuses (Table 1, Analysis 1).

Courses in operations management (MGMT 334) were taught at Winona in both the traditional and ITV-originator instructional modes. Two groups of three sections each were compared to see if adding the technology to the classroom made a difference in grades (Table 1, Analysis 2).

Paired sections in general management (MGMT 315), operations management (MGMT 334), managing for quality (MGMT 435), and project management (MGMT 464) were used to contrast the ITV-recipient versus the ITV-originator classes (Table 1, Analysis 3).

The traditional courses used to compare the two campuses are non-conducive for ITV due to the concentration required for in-class presentations and writing requirements. MGMT 495 and MGMT 325 are comparable to laboratory courses, which present a new set of statistical hurdles. However, Boone discusses how to overcome the potential ITV problems in the sciences, especially laboratory activity, "...a two-way audio and two-way visual signal was broadcast between a studio and three urban elementary schools. This allowed teachers enrolled in the class at any of the three remote sites to see and hear class instructors. Furthermore, participants at each school site could fully communicate with the instructors and teachers at other school sites. The success of the class suggests that distance education can be an effective mechanism for providing educational opportunities

to individuals in major urban areas. The class also demonstrates that laboratory-based courses can indeed be delivered via distance education technology."⁶

Discussion

With current economic pressures on educational funding and the justifiable desire for continuous improvement in the quality of education, it is necessary to utilize optimum combinations of teaching techniques, supporting the popularity of the ITV approach for remote location students. When asked about testing, students accepted whatever method was given them, whether it was a paper test or a computer test.² Sharp and Cox provide an insight into the students' acceptance of televised off-campus learning.² One feature appreciated by students in computer exams (D2L) at Winona State University was the immediate feedback of their score and how specific questions were graded.

Another reason for ITV popularity is the benefits enjoyed by students—lower travel cost, lower tuition, and time savings—all due to the college's dual use of faculty and minimized facilities to service the remote locations.

Regardless of this study's results, questions remain with three areas in need of improvement for the quality of ITV instruction versus face-to-face classroom experience. Williams discussed key communication principles critical to effective communications, such as listening skills and body language, as well as verbal feedback—all difficult to fulfill in distance television.⁷ These three factors are, unfortunately, diminished in ITV instructions. To circumvent some of the negatives, Lin and Crewsell have proposed the use of interspersed questions and eye contact to enhance the ITV learning experience. Results yielded four conclusions:

- Presenter eye contact and questions are perceived as useful teaming aids in televised lecture presentations.
- Student satisfaction with and interest in televised courses is relatively low.
- Positive perception of eye contact and inserted questions correlate with higher levels of student interest.
- Neither eye contact nor inserted questions directly impact short-term learning.⁸

Table 2: ANOVA Results

Analysis 1						
Source	Degrees of Freedom	Sums of Squares	Mean Square	F	F _(critical, α=0.05)	Significant?
Blocks: Classes	2	1350.9192				
Treatments: Location	1	0.4557	0.4557	0.03	3.91	Not Significant
Error	168	2987.7005	17.7839			
Total	171	4339.0754				

Analysis 2a						
Source	Degrees of Freedom	Sums of Squares	Mean Square	F	F _(critical, α=0.05)	Significant?
Treatments: Classes	5	702.785	140.557	3.57	2.27	Significant
Error	170	6696.487	39.3911			
Total	175	7399.275				

Analysis 2b						
Source	Degrees of Freedom	Sums of Squares	Mean Square	F	F _(critical, α=0.05)	Significant?
Treatments: Classes	4	143.3822	35.8455	1.06	2.44	Not Significant
Error	137	4611.7008	33.6621			
Total	141					

Analysis 3						
Source	Degrees of Freedom	Sums of Squares	Mean Square	F	F _(critical, α=0.05)	Significant?
Blocks: Classes	4	865.6863				
Treatments: Location	1	65.4560	65.4560	1.74	3.89	Not Significant
Error	215	8097.8017	37.6642			
Total	220					

Wallin critiques distance education further, saying, “The most frequently cited criticism of distance learning is its passivity and the lack of opportunity for student-teacher interaction.” Wallin also noted that a point-to-point microwave system which allows two-way audio and video interactivity in the Eastern Iowa’s Community College district has developed a model which involves the students actively in the learning process.⁹

Although not a direct comparison of ITV versus face-to-face education, a 2010 study released by the U.S. Department of Education noted,

“Students who took all or part of their classes online performed better than those taking the same course through traditional face-to-face instruction.”⁸

Statistical Methodology and Results

The initial statistical analysis was performed as a series of t-tests comparing the final grades for six pairs of classes. Of these six comparisons, two were statistically significant (using a two-tailed test with an α of 0.05; see Table 1, Analysis 3). When alpha is adjusted to account for the fact that six comparisons were made, however, this

dropped down to one statistically significant comparison. This led to the question of whether performing an analysis of variance (ANOVA) on the data would yield different and more obvious conclusions.

Since the original set of comparisons confounded the impact of location with the impact of using ITV, the first challenge was to determine whether location did, indeed, have an effect that had to be factored into the analysis. Three courses had been taught using traditional methods at each of the two locations. By using the courses as blocks, the location-to-location impact on grades could be assessed for traditional classes (see Tables 1 and 2, Analysis 1). Results failed to show a significant difference, allowing us to treat classes from the two campuses as if they were pulling students from the same population.

The second analysis looked at the two different modes of face-to-face instruction—traditional and ITV-originating classes—to see whether the act of originating an ITV class impacted grades (see Tables 1 and 2, Analysis 2a). Six sections of operations management taught by the same instructor at Winona were available for analysis. A one-way ANOVA looking at the final grades in these sections revealed a statistically significant difference (alpha of 0.05). The results from the most recent semester (summer of 2010) were significantly lower than the other sections. This could have been due to a slight change in content, classroom focus, or student attention during the summer—all factors which could not be controlled over time. A secondary analysis (see Tables 1 and 2, Analysis 2b) was performed looking at only results from the five sections of this course taught during the spring semester of 2009. This secondary analysis failed to find a difference that could be attributed to the different modes of instruction, reinforcing the conclusion that sections of the same course taught by the same instructor during the same semester generate similar grades, no matter where they are located or what their form of instruction.

Finally, five pairs of ITV classes were analyzed (see Tables 1 and 2, Analysis 3), blocked by course pair to determine whether there was a significant difference between Winona ITV-originating sections and Rochester ITV-recipient sections. This analysis failed to detect a statistically significant effect. The single pair of ITV

classes with Rochester as an originating location was not used for this analysis.

Summary

There is no evidence to support a conclusion that ITV instruction for upper-class business students has any impact on grades. Conclusions from this study are limited by a variety of factors that limit extension of the results to other situations:

- Students were not randomly assigned to campus, courses, and sections. This limits the ability to generalize results to other courses at other schools.
- The population from which students were drawn was limited. Only a relatively small number of high-level courses were included in the study. Only two campuses were involved in the study.
- Only one instructor was involved in the study. There is no way of knowing whether results from classes taught by other instructors would be similar.

These limitations point the way to future study approaches.

Recommendations and Future Studies

Although there is an indication that equality exists between traditional, ITV-originating, and ITV-recipient class results, there still is a perception of inequality among many involved in the discussion, who advocate for ITV classes to move closer to the Socratic method of personal involvement. Another future study that addressed the questions below might clarify the differences in these approaches and lead to a greater consensus:

- Are results from this study generalizable to other schools, instructors, and courses of study?
- Why do students and instructors prefer the face-to-face interactions as noted from anecdotal discussions?
- Is there an inherent value, other than comprehension and learning, in the face-to-face relationship?
- Does the academic and social profile of the in-class and the ITV student body require an analysis to confirm the authenticity of the data? Thus, do issues such as age, SAT scores, GPA, employment and experience, and living conditions matter?
- Are certain courses inappropriate for ITV instruction? Laboratory courses and courses requiring oral presentations are of particular concern.

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