

LEVERAGING TECHNOLOGY TO IMPROVE LEARNING OUTCOMES WITH AN INTERACTIVE FEDERAL BUDGET EXERCISE

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Abstract

Through a U.S. Department of Education grant, The University of Akron developed electronic delivery methods for an interactive federal budget exercise previously administered only face to face. Research on university and high school populations demonstrates that:

- Participation significantly increases knowledge of and interest in the federal budgeting process.
- Participation through an electronic delivery method results in significantly greater engagement with the content itself.

This paper describes the research process and outcomes and notes how project results align with the call for challenge-based methods in student learning.

Background

The University of Akron (UA) received several grants from the U.S. Department of Education to develop electronic delivery methods for a federal budget exercise that had been administered for over 20 years with moderator and participants in the same location. *An Exercise in Hard ChoicesSM*, an interactive budget exercise written by the Committee for a Responsible Federal Budget (CRFB), challenges participants to role-play members of Congress as they debate options and achieve consensus. Their decisions are recorded on a scorecard, which reveals if they have achieved a balanced budget, a surplus, or a deficit, and also represents the budget's impact on future years. The *Exercise* requires participants to address the same hard choices faced by the President and Congress while demonstrating the need to achieve a group consensus.

Although it had long been conceived as a useful tool to educate students about the complex budgeting process, in practice it was administered more to adults who were able to spend half a day debating policy face to face with others. These traditional three-hour sessions brought together large groups of people (hundreds at a time) in one location. The groups were broken into smaller "budget committees" of six to eight people, with each group arriving at a final budget under the direction of trained moderators. Therefore,

there was a need to develop delivery methods that would facilitate distance moderation and interaction.

In 2002–2003, through a U.S. Department of Education (DOE) grant, three electronic versions were created and piloted with groups of convenience, mostly students at UA. Feedback from those trials guided the revision of the *Exercise* to make it more accessible to a younger audience, standardize procedures for administration, and enhance the design of the electronic formats and an Electronic Scorecard that would facilitate complex calculations. In 2003–2004, through a second U.S. DOE grant, the newly revised *Exercise* was administered to UA students. A pre-test was administered to a sample of 50 college students (the control group) and a post-test with the same questions to *Exercise* participants in each of four delivery methods. Results demonstrated that all groups that participated in the *Exercise* demonstrated significantly more knowledge about, and increased interest in, the federal budget and the budgeting process.

During the third and final grant period, an updated version of the *Exercise* was administered to students in four states through four delivery methods: traditional and three electronic methods, whenever possible over Internet2. All groups had the benefit of an electronic scorecard that allowed small groups to easily observe the short-term and long-term effects of different spending and revenue decisions.

The Delivery Methods and Electronic Scorecard

The University of Akron is one of more than 200 member universities that make up Internet2 (<http://www.internet2.org>), a not-for-profit advanced networking consortium that has proven to be the perfect partner to the electronic delivery methods of *An Exercise in Hard Choices*SM. In the current grant cycle, UA partnered with high schools in four states (Ohio, Michigan, Pennsylvania, and Maryland) that had access to Internet2. We also delivered the *Exercise* to one high school that did not have Internet2 capability, which provided the opportunity to study the effect of Internet2 vs. non-Internet2 delivery.

Two synchronous and one asynchronous electronic delivery methods were developed and tested with the *Exercise*. The synchronous Videoconferencing method was delivered over Polycom; the synchronous Webconferencing method was delivered using a specially designed Flash Communications Server interface; and the asynchronous learning management system method was delivered using WebCT. The features of each delivery method are summarized in Table 1.

Table 1: The delivery methods of *An Exercise in Hard Choices*SM

Version	Individuals deliberate as part of a group	Individuals participate in real time	Individuals participate Face-to-face	Moderator in the same location
Traditional	Yes	Yes	Yes	Yes
Videoconferencing	Yes	Yes	Yes	No
Webconferencing	Yes	Yes	No	No
Asynchronous	Yes	No	No	No

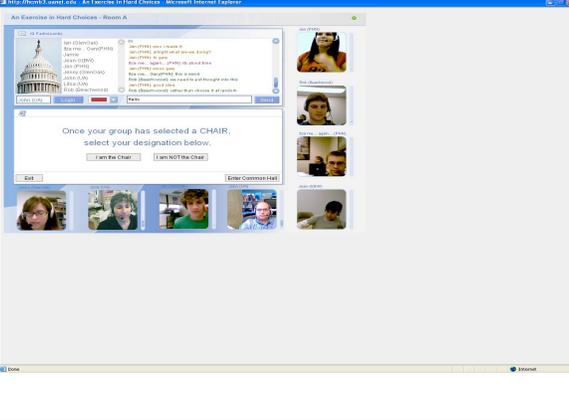
In the **traditional** version, participants deliberate in face-to-face small groups with an onsite moderator (Figure 1). This treatment is ideal when participants are able to gather in a common location at a common time for half a day or so.

Figure 1. Traditional Delivery	Figure 2. Videoconferencing Delivery
	
<p>Students in the traditional delivery method consult a hard copy of the <i>Exercise</i>, negotiate budget options, and input their decisions into the electronic scorecard on their laptop.</p>	<p>Students in Ohio (top left) and Michigan (top right) interact with a UA moderator (bottom) through a videoconferencing site-to-site connection.</p>

In the **videoconferencing** version, participants deliberate in face-to-face small groups with a moderator in a different location (Figures 2–4). The treatment is ideal for participants that can meet at a common place and time but do not have the availability of an onsite moderator, or for participants at different locations that wish to interact with each other during orientation and wrap-up sessions.

Figure 3. Opening Session	Figure 4. Closing Session
	
<p>Sen. Carl Levin (top right) of Michigan pre-recorded comments for the opening session.</p>	<p>Students comment during the closing session while they view group choices for a budget option.</p>

In the **webconferencing** version, students participate from different locations in “cyber” small groups. This treatment is ideal for people who can meet at a common time but not at a common location. Each participant has a laptop with a webcam and headphone with a microphone. The moderator is also in a separate location. The moderator can address the students in a Common Room during the orientation, and then students move to separate rooms where they will deliberate in small groups (Figures 5 and 6).

Figure 5. Common Room	Figure 6. Virtual Room
	
<p>A webconferencing participant in the virtual Common Room reviews <i>Exercise</i> charts during the orientation.</p>	<p>Participants in Group A deliberate in a virtual room while two support team members look on. Participants see, hear, and can text to each other.</p>

In the **asynchronous** method, participants access content through a learning management system and use threaded discussion to negotiate to consensus. As this method was not part of the field study, it will not be further discussed here.

All delivery methods made use of an electronic scorecard, a web-based, interactive application that facilitated calculating short- and long-term impact of individual decisions. The scorecard allowed participants to easily engage in “what if?” speculation by examining the effect of a decision on the budget and debt in the present and projected into the future as far as the year 2040. The scorecard was built by John Kelley of UA’s Design and Development Services with ColdFusion and HTML, with SQL Server serving as the database to store all data.

Research Design

In the third cycle of the project, the rewritten *Exercise* was delivered more widely over Internet2 in order to further assess the effectiveness of the *Exercise* with various delivery methods and to determine if the positive results of the previous studies would generalize to a field study of high school students.

To measure the **knowledge** component, 21 test items reflected specific information embedded in the *Exercise* regarding the Federal Budget process. Some of these questions covered general information (e.g., why will the social security system run large deficits in the future?). Others were more specific (e.g., what is the size of the U.S. government as compared to other developed countries?). The *Exercise* was also intended to increase participants’ interest in the budget process and motivate them to continue exploring how our government works. As a result, 25 additional items on the survey captured attitudes and interest as well as future voting intentions by measuring to what degree students agreed with each statement. A final set of questions addressed student reaction to the *Exercise* itself.

Implementaton of *An Exercise in Hard Choices*

In the opening session, students were placed into small groups, each with a unique Group ID, each including students of different backgrounds to increase the likelihood of different opinions. They were asked to imagine that they were going to attend the movies Friday night with a group and that they would need to buy a ticket, a drink, and popcorn to share, but their funds were limited. They offered typical suggestions for controlling their spending; with the altered scenario that the Friday evening was two weeks away, students could be prompted to suggest that they could increase funds available by working for it themselves. The movie scenario was then related to the work of Congress in creating an annual budget, including reducing spending, sharing costs, borrowing funds, and raising income. Next, the moderator reviewed key concepts included in the “Introduction” and “Budget Basics” sections of the *Exercise*, including pie charts on U.S. revenue and income as well as graphs and tables indicating historical and comparative trends. Finally, the moderator introduced the decisions and a timeline for *Exercise* completion. The *Exercise* included three types of decisions: Goal (in terms of reducing

debt); Outlays (seven individual spending decisions); and Revenues (a la carte income options, with multiple selections possible). Participants then broke into small groups.

Groups were instructed to choose a chair, to ensure decisions were proceeding in a timely manner, and a recorder, to input each chosen option into the electronic scorecard. If they had time, students were encouraged to compare their final budget numbers with their original goal to see if they aligned. After small group deliberations were completed, participants gathered to view the distribution of options selected by all groups on PowerPoint slides prepared by members of the *UA Exercise* team. Participants were given the opportunity to discuss their choices, and finally a field test survey was administered.

Effect of Delivery Method on Content Knowledge

Data was collected on students who participated in the field study (Table 2).

Table 2: Demographics of study participants

Condition	Sample Size	Gender		Ethnic Group		Political Affiliation		
		Male	Female	Caucasian	Minority	Dem	Rep	Indep
College Baseline	50	26%	74%	78%	22%	42%	20%	38%
Field High School Sample								
Traditional	138	40%	60%	76%	24%	43%	39%	18%
Videoconf. Internet2 (I2)	224	47%	53%	72%	28%	45%	25%	30%
Videoconf.No n-I2	53	41%	59%	49%	51%	33%	22%	45%
Webconf.	19	58%	42%	89%	11%	47%	32%	21%

The baseline group consisted of university students who took the pre-test during the previous grant cycle.

Traditional Face-to-Face Method

The *Exercise* was delivered in a face-to-face format to 138 participants from two high schools in Ohio and one in Maryland. As in the previous study, individuals who participated in the *Exercise in Hard Choices*SM via the traditional method exhibited significantly more content knowledge than the baseline group (Table 3).

Table 3: Baseline vs. traditional group on content knowledge

	Sample Size	Mean (Std. Dev.) Test Score (0-21 possible)	Min. Test Score	Max. Test Score	Test of Mean Differences From Baseline Sample
Baseline	50	7.3 (1.96)	4	12	
Traditional	138	9.9 (2.37)	4	15	$t = -6.96, df = 186, p < .001$

Videoconferencing Site-to-Site Method

The *Exercise* was delivered via a Polycom videoconferencing system over Internet2 to 224 participants from 8 high schools. On several occasions, high schools in different locations completed the *Exercise* simultaneously in a multiple-site connection. All sessions involved a moderator and multiple small groups of students completing the *Exercise* with the same protocol developed for traditional delivery. The *Exercise* was also delivered in two videoconferencing sessions to 53 students at an Ohio high school that did not have Internet2 access, and the connection was “dropped” several times. As a result of this disruption, the non-Internet2 data was analyzed both with and apart from the other videoconferencing schools.

Survey responses were received from 208 of the 224 Internet2 participants and all 53 non-Internet2 participants. Responses to the knowledge questions on the survey demonstrate that both sets of videoconferencing participants evidence a highly significant gain in knowledge as a result of the *Exercise* experience as compared with the baseline college sample (Table 4). The difference is more pronounced for the Internet2 participants, who scored significantly higher on the knowledge questions than the non-Internet2 group ($t = 2.34, df = 312, p = .02$).

Table 4: Baseline vs. videoconferencing groups on content knowledge

	Sample Size	Mean (Std. Dev.) Test Score (0-21 possible)	Min. Test Score	Max. Test Score	Test of Mean Differences from Baseline Sample
Baseline	50	7.3 (1.96)	4	12	
Internet2 Videoconferencing	208	9.3 (2.66)	0	17	$t = -5.93, df = 309, p < .001$
Non-Internet2 Videoconferencing	53	8.4 (2.54)	1	14	$t = 2.42, df = 101, p = .016$

Webconferencing Computer-to-Computer Method

Participants for the Webconferencing delivery method included 37 students from three high schools in two different states. Each small group included students from each high school to ensure that the technology was being used to its best advantage. We received completed surveys from 19 of the participants. The Webconferencing group demonstrates a significantly higher knowledge of the federal budgeting process when compared to the Baseline group (see Table 5).

Table 5: Baseline vs. webconferencing groups on content knowledge

	Sample Size	Mean (Std. Dev.) Test Score (0-21 possible)	Min. Test Score	Max. Test Score	Test of Mean Differences from Baseline Sample
Baseline	50	7.3 (1.96)	4	12	
Webconferencing	19	9.5 (2.29)	5	14	t=-3.93, df=67, p<.001

The Effect of Synchronous Online Delivery vs. Traditional Delivery on Content Knowledge

Data from the two synchronous online formats, Videoconferencing (both Internet2 and non-Internet2) and Webconferencing, were combined and compared to the traditional delivery method. While participants in each online delivery method scored significantly higher on knowledge questions than did the Baseline group (Tables 4 and 5), individuals who completed the traditional method of the *Exercise* did significantly better ($p < .05$) than those using the online *Exercise* (Table 6). However, the traditional participants outscored the synchronous online participants by less than 1 point (9.9 vs. 9.3).

Table 6: Traditional vs. synchronous online groups on content knowledge

	Sample Size	Mean (Std. Dev.) Test Score (0-19 possible)	Minimum Test Score	Maximum Test Score	Test of Mean Differences
Traditional	138	9.9 (2.37)	4	15	t = 2.08, df = 385, p = .039
Synch. Online	280	9.3 (2.63)	5	14	
Mean of traditional significantly higher than online synchronous					

Effect of Delivery Method on Attitudes and Interest

Survey results for all synchronous online delivery methods (Internet2 Videoconferencing, non-Internet2 Videoconferencing, and Webconferencing) were compared to those of the Baseline group for Attitude and Interest questions. These measured both self-reported interest in the federal budgeting process as well as intentions connected with future behavior in such areas as continued reading, discussion, and voting. Results are summarized in Table 7.

There were significant difference between the baseline group and the combined synchronous groups on five of 25 questions that related to interest, attitudes, and intentions. In each case, the synchronous online group was more sensitive to budgeting issues than the baseline group. Participants were more likely to understand or value, in general:

- diversity and concessions in negotiations; and
- the need for politicians to modify their promises or opinions.

In addition, they valued politicians' concern about the deficit in particular.

Table 7: Significant differences between baseline and synchronous online methods in interest and intentions

Percentage who Agreed/Strongly Agreed to Item	Baseline	Synchronous Online
When negotiating with others to reach a final decision, I think it is necessary to make some concessions to people with different opinions.	50%	65%
I will encourage my friends not to vote for politicians who are unconcerned with the budget deficit.	24%	43%
I will not vote for a politician who promises more than she/he can deliver.	60%	50%
An effective Congressman never changes his or her position on issues.	36%	22%
In order to make effective policies, I believe it is important to avoid having diverse opinions represented in the negotiations.	49%	20%

Note: These differences were identified with a test of mean differences for independent samples; the difference was significant at the $p < .05$ level.

The only significant difference in attitudes and interest between the Internet2 and non-Internet2 Videoconferencing groups was the item about avoiding diverse opinions with the non-Internet2 group believing it was more important to do so.

The unstable connection that characterized the non-Internet2 delivery may have been enough of a distraction to cause more of those participants to eschew a diversity of opinions that might have also delayed the decision-making process.

There were also significant differences in attitudes and interest between those individuals who participated in a traditional *Exercise* and those who participated in synchronous delivery method (Table 8).

Table 8: Significant differences between traditional delivery and synchronous online methods in interest and intentions

Percentage who Agreed/Strongly Agreed to Item	Traditional	Synchronous Online
I am interested in economic issues.	35%	49%
I am interested in how the federal budgeting process works.	25%	43%
I would like to learn more about the federal budget.	28%	45%
I plan to read up on the federal budget process.	18%	35%
I would like to find out more about how our government makes spending decisions.	30%	46%
I like to discuss political issues with friends.	39%	46%

Note: These differences were identified with a test of mean differences for independent samples; the difference was significant at the $p < .05$ level.

In each case, groups that completed the *Exercise* through synchronous online delivery indicated more interest or greater intent to continue with self-education about the federal budgeting process.

A final set of 20 survey questions addressed participant reaction to the *Exercise*. There were significant differences between the traditional and synchronous online groups in only three, as summarized in Table 9.

Table 9: Significant differences between traditional delivery and synchronous online delivery in reactions to the *Exercise*

Percentage who Agreed/Strongly Agreed to Item	Trad.	Online
This exercise has motivated me to find out more about the federal budget process.	26%	39%
It was NOT worthwhile for me to do this exercise.	19%	17%
This exercise tried to cover too many details in the time we had.	43%	31%

Note: These differences were identified with a test of mean differences for independent samples; the difference was significant at the $p < .05$ level.

In each case, the online group responses were in the direction of greater engagement and satisfaction. These results corroborate those related to interest and intentions: participants who experienced an online delivery of the *Exercise* had an experience that surpassed that of traditional participants. This may be the single greatest finding of our field study research — that completing the *Exercise* with the added benefit of technology seems to pique participant interest in the content area itself.

Conclusion

The *Exercise in Hard Choices* has had a positive impact on thousands of students and their teachers and administrators. That it could be successful with different groups has long been recognized. In 1987 it was administered to graduate and undergraduate classes to create “a true taste of the budget environment within which Congress and the President must operate” (Higgins, 1988, p. 105). In 1999, Vice Chair of the Federal Reserve Board Alice M. Rivlin related administering the *Exercise* to Congressmen and Senators who “learned how hard it was” and concluded the experience “brought home to me, not only the learning value of role playing, but the importance of getting students involved in actually making economic choices and not just hearing people talk about them” (Rivlin, 1999).

Our research indicates that participants’ increased engagement with the economy and the budget-making process will motivate them to continue their reading and discussions of these topics in the future. Furthermore, our research suggests that use of technology with the *Exercise* heightens its impact, which may have even more far-reaching effects in terms of overall student satisfaction and retention.

There are additional benefits of enabling delivery of such an exercise through technology. Participants included students in Appalachian Ohio, a rural area where students do not typically go on for higher education. The students were connected to a site in Michigan for videoconferencing delivery (Figures 2 and 3). Their teacher, Cindy Hykes, commented “my students were able to communicate directly with an instructor at the University of Akron to analyze and compare results with students in Michigan. . . It opened my eyes to the real possibility of distance learning. To me this project fulfilled the promise of the democratizing nature of technology” (Newhall, 2005, p. 20). Those students were exposed to the culture, values, and priorities of other participants, and able to share their own.

Finally, activities like the *Exercise* create an opportunity for student-centered, challenge-based, learning. A 2009 report warns that public school education in the U.S. must change to reverse declining trends in graduation rates and science and math studies. The solution offered is challenge-based learning, which “leverages technology tools to put the daily experiences of students in the service of their education. It focuses learning on real-world issues, gives students a chance to work on important problems, gets their voices heard, and empowers them. . .” (Johnson, Smith, Smythe, & Varon, p. 9). This exercise is a perfect example.

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