Research Report 1: The Sustainability of the Advanced Technological Education Program (page 8 revised July, 2011)

Findings from the Targeted Research Grant: Assessing the Impact and Sustainability of the Advanced Technological Education Program (NSF Grant Number 0832874).

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The research findings are presented in two reports. Report 1 is a description of the study methodology and sustainability findings while the impact findings are presented in Report 2.

Acknowledgements

I. Introduction and Purpose

The purpose of this research is to assess the sustainability (persistence or continuation) and impact (effect or influence) of Advanced Technological Education (ATE) grants. The general findings will be presented in two reports. Report 1 is a description of the research process and the sustainability findings. Report II will present general findings about the impact of ATE grants. These reports are intended to fulfill NSF reporting requirements. Specific research findings will be submitted to professional research journals. One article has already been submitted and is in the process of being revised following reviewer comments (Welch & Barlau, 2010).

The purpose of Report 1 is to answer the question, "What is the level of sustainability of programs and activities implemented by institutions that received NSF/ATE grants?"

The ATE program, funded by the National Science Foundation (NSF), is designed to improve the education of technicians in high-technology fields such as bio-, advanced manufacturing-, and aerospace technologies. The program makes grants to projects and centers, usually at the community college level, to achieve this goal. It began in 1994 and more than 1,000 awards have been made including several for research and evaluation studies. An ATE research award provided the funding the study reported here.

The first task was to develop procedures to assess the *continuation* or *persistence* of an ATE grant. There are two ways to view this. One approach is to think in terms of the sustainability of the total project or center. The grant might evolve into a permanent unit able to obtain its own funding, as is the case with some research and resource centers. Perhaps other sources of funding are found to continue the full scope of work intact. However, a second approach is to examine the persistence of the various elements of the original grant. Some things persist but others will not.

It is the second approach that is followed in this report. Instead of examining a project or center as a whole, a grant was viewed in terms of several elements or dimensions. A previous study showed that funding levels drop after NSF funding ends so it seems unreasonable to expect all project activities will or should continue (Welch & Gullickson, The Sustainability of Advanced Technological Education Supported Efforts: An Evaluation, 2006).

Sustainability of the elements of a grant can be revealed in different ways. One way is for the activity to become <u>institutionalized</u>. For example, a new curriculum is developed and it becomes part of the school's regular program of study, or perhaps a new faculty position is created during the life of the grant and the position becomes permanent.

Another type of evidence of sustainability is the continued <u>presence</u> of the products created during the life of a grant. Laboratory equipment, educational materials (modules, books, computer programs), trained students who join the workforce or lasting changes in pedagogy are examples of this kind of sustainability.

A third type is the <u>prolongation</u> of things done during a grant. Examples include the collaborations among faculty members or between a community college and a four-year college or local industries. Another is the continuation of a faculty collegial network that was established as part of the grant.

A fourth type might be <u>new</u> products and activities that are created after the original work ends. Because of the experiences gained during a grant, a college obtains funds from an industrial partner to develop a new welding program to help them manufacture railcars or a new taconite plant needs trained workers to mine, and process iron ore.

These examples are not meant to be exhaustive but, rather, to describe an elements-based approach to sustainability. In this study, evidence was sought to identify the things (accomplishments, activities, changes, products, etc.) that were judged to be sustained after the grant was implemented.

II. Methodology

The accepted procedures for developing an instrument to measure sustainability were followed during the implementation of this research (Borg & Gall, 1983). These steps are listed below along with a description of what was done to implement each step.

<u>A. Identify the thing that is to be measured</u>.

The object of this research is the sustainability of the work carried out by ATE grantees. As mentioned above, the interest was to identify those elements or dimensions that grant leaders believe were continued.

<u>B. Define the elements of the object sometimes called the domain of content.</u>

Several authors have written about the elements or dimensions of a grant where change could occur. These elements were summarized and considered by an advisory committee. A working outline of potential dimensions of sustainability was developed. A sketch of the outline is shown below.

1) Faculty
2) Students
3) Business and industry representatives
4) Materials
5) Colleges, particularly community colleges
6) Administration
7) ATE PIs and staff
8) National Science Foundation
9) American Association of Community Colleges or other professional organizations
10) Communities/regions
11) Secondary schools

In order to gather examples of how these elements might be affected by the work of a grant, ATE team leaders were asked to respond to the following question on the 2008 ATE survey administered by Western Michigan University.

> Imagine your institution in the future, perhaps three years after the ATE grant has ended. (Institution is defined broadly to include students, faculty, materials, community stakeholders, etc.) What things started during the grant will be or are still in place? Please describe your ideas in a paragraph or two.

A content analysis of their responses plus interviews with people familiar with the ATE program resulted in the following revised content domain elements. This outline serves as a checklist of where one might look to find evidence of sustainability.

1) Programs
    a) Content: courses, curriculum, degrees, certificates, instructional activities
    b) Delivery mechanisms: workshops, classes, on-line, modules, internships, web sites

2) Collaborations: business/industry, schools, 4-year colleges, two-year colleges

3) Educational Materials: texts, electronic materials

4) Faculty: networks, professional development, self-esteem, permanent position

5) Facilities: laboratories, equipment

6) Students: recruitment, alumni, outreach, interns, well prepared, workforce candidates

7) Institution: administration, reputation, organizational change, other institutions, new degrees

8) Revenue:
    a) Sources of revenue: new grants, sale of materials, contract for services
    b) Form not-for-profit organization
    c) Request additional NSF funding

As statements were developed and selected, they were mapped against the domain to ensure that all elements were represented.

C. Develop measures of the elements of the content domain.

The interactive process of defining a potential domain and then revising it according the statements made by those working on ATE projects yielded 65 statements about sustainability. They were scattered across the domain but time constraints required that about half of those be selected for the final instrument. The goal was for respondents to complete the survey in 20-25 minutes.

After reviewing the statements again, 35 of them were selected for a preliminary version of the survey. The selection criteria included clarity of the statements, match to the domain elements, and non-duplication. These statements were reviewed by three experts in questionnaire construction and three active ATE PIs for relevance, understandability, and as effective indicators of sustainability. This step reduced the number of items to 28 items.

Each item was printed as a quoted statement with a request to respond by indicating the degree of agreement of disagreement using a Likert-type response format. Here is an example.

"Changes made in our technological education program will continue after our ATE grant has ended." Please indicate the extent to which you Disagree or Agree with the statement using the following response scale.

DD   Strongly Disagree
D   Disagree
U   Uncertain
A   Agree
AA   Strongly Agree
NA   Not Applicable

This approach to survey development was named Peer-Generated Likert Scaling. It is based on the belief that asking subjects to respond to statements made by their peers will result in less yea-saying response bias than having them respond to items presented by professional researchers.

D. Review and pilot test the surveys.

The next step was to pilot test the items. This was carried out by three ATE principal investigators who were very familiar with the ATE program and who had been implementing grants for many years. They rated the items on validity and usability from their perspective as users. Each of these steps required many iterations and discussions as decisions were made on which statements to include. This process eventually reduced the number of sustainability items for the survey to 23. There were about three items for each of the eight elements of the content domain.

These items were combined with 29 items that had developed for the impact survey and printed in a single 4-page booklet. Different colors were used to distinguish one section from the other.

The first page of the final version of the survey, along with five items from Section I, Impact, and five items from Section II, Sustainability, is attached as Appendix A.

E. Select an appropriate research population.

The research population consisted of all active ATE grantees that began prior to Jan 1, 2009 and grantees that had expired between Jan. 1, 2007 and Dec. 31, 2009. The potential pool of subjects was 185 active projects/centers and 193 expired projects/centers.

These grants were a sub-population of all ATE grants made through October 2009. The total population of grants at that time was about 900. Earlier grants were not included because of perceived difficulties in being able to contact PIs from grants that had expired prior to 2007. For various reasons, 23 active projects were excluded leaving a pool of 162 respondents. Planning grants, research and evaluation awards and support for special projects were excluded.

A large number of expired grants (n=82) was excluded as well. The most common reason was that a site that once had an expired grant currently has an active grant. It seemed an unnecessary response burden to send a PI two surveys.

Planning grants, research and evaluation projects, support for conferences and special projects (Welch & Barlau, 2010) were also excluded. This left a potential expired population of 111. The total for both the active and expired groups was 273.

As the returned surveys were being checked for accuracy, another 12 sites were discovered that at one time had an expired grant and now had an active grant. These sites were excluded as well because of burdening PIs with two surveys. The final population was 261 grantees.

The complete list of reasons for excluding a grant is available at wwelch@umn.edu. The report is entitled, "Selection of Sites for the ATE Impact and Sustainment Research Study (April 2010)."

F. Distribute the survey to the research subjects and conduct follow-up activities to obtain a reasonable response rate.

This process was carried out at the University of Colorado. An initial mailing of the survey, a cover letter, and a return-addressed, stamped envelope, and a $5 gratuity was sent out in early January, 2010. Two weeks later, a reminder letter was sent to those who had not replied and two weeks after that an email was sent to all nonresponders. Finally, on March 9, a complete packet, minus the $5, was sent to all non-respondents.

The cover letter included a statement that all findings will be reported as group results and no individual responses will be identifiable. It also offered to send a copy of the research findings to those who might be interested. Nine active and 10 expired grantees indicated they would like to receive a copy. At the end of the data collection process, letters were sent to each respondent thanking them for returning the survey.

Respondents were also told that all findings will be reported only as group results and no individual responses will be identifiable

Ultimately, 216 completed surveys were received for a response rate of 82.7%. This exceeds the average response rate for similar surveys reported in the literature. For example, (Baruch, 1999) found an average response rate of 56%, and (Welch & Barlau, 2010), found an average of 59% in their review of the literature. The response rate for the active grants was 83.8% and 81.2% for the expired group.

G. Process and check the data for accuracy.

The responses were double entered to help reduce coding errors. Initial data entry was done at the University of Colorado. Then the surveys were mailed to the author and the responses were re-entered in Excel spreadsheets. The two sets of data entries were examined for agreement. There were 95 inconsistencies out of approximately 22,500 data entries, a percentage of 0.4%. When the data entries of the two coders differed, the original surveys were examined to determine the correct response and the appropriate corrections were made. Each coder had approximately the same number of incorrect entries.

The data examination process also revealed a few other mistakes. For example, several responders circled two answers on the Likert scale and five surveys were found that had

the wrong identification number. These errors were corrected and the appropriate data entered into the final spreadsheet.

H. Analyze the Data

Each survey was given a unique identifier number that showed whether it was from an active or expired grant. The survey responses were entered on a spreadsheet by the I.D. number and several background variables were added to the database. The data were transferred to an SPSS Data Set and the data analyses were done using SPSS.

   1) Nonresponse bias analysis

Although survey response rate was good, 83%, a nonresponse study was conducted to determine if there might be differences between those that returned the survey and those that did not. This analysis is straightforward if *a priori* data are available for the two groups. Some information on the awardees is found in NSF's FastLane summary of awards. The response group (n=212) was compared to the nonresponse group (n=49) on the following background characteristics

       Grant Status: Active or Expired
       Program Track: Project or Center
       Grantee Institution: Two-year college, Four-year college, Other
       Size of Grant: Amount awarded in dollars
       Age of Grant: Number of months between initial award and survey date

A Chi-square test was used to determine if there were differences in response rates for Grant Status, Program Track, and Grantee Institution. T-tests were used to test the significance of differences for Size and Age of grant. The results are shown in Table 1.

Table 1

Variable	Categories	%Responders (n =212)	%Nonresponders (n =49)	Test and Value	p-value
Grant Status	Active	81.9	18.1	X^2 = 0.114	.735
	Expired	80.2	19.8		
Program Track	Projects	79.1	20.9	X^2 = 3.719	.054
	Centers	91.3	8.7		
Grantee Institution	2-Yr Colleges	80.8	19.2	X^2 = 0.116	.944
	4-Yr Colleges	83.0	17.0		
	Other	81.0	19.0		
Size of Grant	Average Award	$826,699	$648,090	t-test = 1.155	.259
Age of Grant	Average Age	46 months	50 months	t-test = 1.131	.121

None of the comparisons reached the .05 level of significance although the project/center comparison is close. The response rate for centers was higher than the response rates for projects, 91.3% and 79.1% respectively. This finding plus the fact that centers receive higher levels of funding on average, $1,832,725 versus $570,751 suggests that some of the analyses should be done separately for projects and centers.

However, of major concern is the potential nonresponse bias in the replies to the survey items. Because the replies of the nonrespondents are unknown, a proxy must be used to estimate their responses.

One approach recommended in the literature (Miller & Smith, 1983), (Lindner, Murphy, & Briers, 2001) is to use late responders as a "rough" estimator of nonrespondents' replies. One keeps track of the return dates of the surveys and then compares early responses with late responses to see if there are differences.

It is not immediately clear how to define a late responder. One recommendation was found in Lindner, et.al, (2001). They argue that late respondents should be those who respond to the last of several waves of contacts. If the last stimulus does not generate 30 or more responses then use the last two stimuli as the definition of late responders. If this does not yield 30 responses, they suggest using the later 50% of responders as the late responder group

There were only 32 responders in the last group so the other recommendations were considered. Comparisons were made of the actual characteristics of the nonresponder group with the values for three late responders groups: those that responded to the last contact (Wave 4), those that responded to the last two reminders (Waves 3 and 4), and the last 50% of responders. These results are shown in Table 2.

Table 2: Comparison of Three Late Responder Definitions with Actual Nonresponders on Selected Background Variables

Variable	Late Responders 4th Wave (n=32)	Late Responders 3rd and 4th wave (n=63)	Late Responders Last 50% (n=106)	Actual Nonresponders (n=49)
Percent Active Grants	43.8	54.2	60.4	59.2
Percent Projects	81.3	82.5	81.1	91.8
Percent 2-Year Colleges	78.1	77.8	74.5	73.5
Average Age (months)	50.5	49.7	44.8	50.1
Average Size	$754,204	$814,307	$849.952	$648,091

All three groups appear to be appropriate proxies for the nonresponders. While the fourth wave group is a closer match for size of grant, it is the poorest surrogate for the percent of active grants. If one ranks each variable on a scale of one to three in terms of being closest to the actual figure for nonrespondents, the best ranking goes to the group consisting of the third and fourth waves.

Based in part on the above, the responders to the third and fourth waves were selected as the proxy for the nonresponders. The larger group also was preferred because of anticipated missing values.
Four items were chosen and random from the 23 on the survey and the responses to these items were compared for early and late responders. The early responders are

those that replied to the first mailing before first follow-up reminder. There are 101 surveys in that group. Their responses were compared with those in waves three and four. The sample size to each item varied somewhat because of the number marked not applicable (NA). For example, if an item asked about laboratory equipment and the grant did not do that activity, then the responder would mark Not Applicable (NA). These replies are treated as missing values. The percentages reported in the table are those marking either AA or A for those that actually replied to the item. These numbers are shown in the parentheses.

The comparison between early and late responders agreeing or strongly agreeing to the four items is shown in Table 3. A cross-tabulation of the differences and the resulting chi-square statistic is shown in the last column.

Table 3: Comparison of Early and Late Responders on Four Survey Statements

Statement (Item) About Sustainability	Percent Strongly Agree or Agree		
	Early Responders	Late Responders	Chi-square Test
Statement Number 6 (n = 150)	90.2	91.4	p = .687
Statement Number 14 (n = 97)	15.5	8.3	P = .673
Statement Number 22 (n = 157)	89.6	86.9	p = .762
Statement Number 5 (n = 163)	5.0	4.8	p = .336

The differences between the early and late responders on these four items are not statistically significant at the p = .05 level. By inference, one can also say that the item responses between responders and nonresponders are roughly similar. A full discussion of the nonresponse analysis is available in (Welch & Barlau, 2010).

III. Findings

A. Summary of Survey Responses

The purpose of the research was to determine which elements of a grant were continued by an ATE grantee site. Current PIs and others familiar with the program described in a series of statements some of the things they did that were continued. The statements were quoted and put on a survey for other ATE PIs to judge the degree to which the statements described their situation. This kind of survey was named a Peer-Generated Likert Scale because respondents are asked to rate their answers on a five-point Likert scale that ranged from "strongly agree" to "strongly disagree". There was also an option to circle "not applicable" if the activity in question was not part of their grant work. Some grants did not address all of the elements of the defined domain of content. For example, some projects developed educational materials while others did not.

The responses of 216 returned surveys were used in this analysis. This is four more than were used in the above analysis because there were four projects where two people answered. Thus, the sample size for *sites* is 212 (used in the preceding analysis) and 216 *people* (used in the following analysis.)

The percent of respondents that either agreed or strongly agreed with statements that reflected positively on the work was calculated, for example, "Our grant was successful." If the statement reflected negatively on the work, "Our grant was a failure", the percentage that disagreed or strongly disagreed with the statement was reported. The sample size varied among the items because some people marked "not applicable" for their situation. The net item sample size is shown in the parentheses following the statement itself. There were a few missing values that also lowered the net sample size, but this occurred only 13 times.

The findings of this analysis are presented in Table 4. The statements are organized by the eight elements of the original domain, Programs, Collaborations, Faculty, etc. It is a rough classification system but such a structure may help to interpret the results.

Table 4: Percent of Respondents Expressing Agreement or Disagreement with Peer Statements about Sustainability

Statements About Sustainability	Percent Agree or Strongly Agree	Percent Disagree or Strongly Disagree
Programs		
6. *"Changes made in our technological education program will keep going after our current grant ends." (n = 199)*	90.9	
11. *"Most of the programs and activities started during our ATE grant will come to an end when our NSF funding stops." (n=215)*		78.2
13. *"The new curriculum was created through the regular institutional approval process so all the new classes are in the regular college catalogue and are part of approved college degrees." (n=173)*	90.8	
Collaborations		
1. *"We have at least one industry partner who is committed to support some of our work after NSF funding has ended." (n=194)*	66.5	
5. *"It is doubtful that the relationships we have established with our various partners will continue after our ATE grant has ended." (n=215)*		87.4

Statement		
9. *"Through this grant we have created liaisons with our industry partners and academia that will end when our grant does." (n=211)*		82.5
Educational Materials		
7. *"The materials we have developed are seldom used by other colleges for technician preparation programs." (n=185)*		64.8
20. *"Revenue earned from the sale of educational materials is used to provide scholarships for students." (n=72)*	11.1	
Faculty		
10. *"Our faculty has become a part of a collegial network that will continue to share program information, workforce trends, and cutting-edge instructional technologies." (n=202)*	82.5	
12. *"The professional development program(s) we developed is/are used at other sites." (n=177)*	63.3	
21. *"The teaching methods adapted by faculty as part of our ATE project will continue to be used after the grant ends." (n=201)*	92.0	
Facilities		
3. *"The instrumentation and equipment we secured as part of our ATE grant will have little use by the college after the grant ends." (n=159)*		93.7

Statement		
Students		
8. *"Alumni of our project are ambassadors to the larger technical community and tell potential students about the value of technology education." (n=179)*	80.5	
15. *"Very few of the graduates prepared under our grant are employed as technicians." (n=171)*		76.0
19. *"The recruitment efforts developed through the grant will be incorporated into the college's general recruitment activities." (n=177)*	71.2	
23. *"Internships, supported by industry, will continue as a way to provide our students with exposure to the real world." (n=161)*	82.0	

Institution		
2. *"Our use of a national review committee has helped make our advisory committees more effective." (n=130)*	63.6	
4. *"Our ATE grant experience has caused our administration to encourage other faculty to seek external funding to address workforce needs.(n=203)*	77.3	
17. *"It is unrealistic to expect that ATE grants will have a long term impact on community colleges." (n=211)*		91.5
22. *"The grant has enhanced our reputation as a regional leader in advanced technology education." (n=209)*	88.5	
Revenue		
14. *"Our Center/Project has formed a not-for-profit corporation to help us continue our work beyond NSF funding." (n=121)*	12.4	
18. *"We will be able to keep our project/center going by obtaining revenue income for specific education services." (n=172)*	35.5	
24. *"We would not be able to continue our project/center without continued funding from NSF." (n=209)*		37.3

B. Discussion of Findings

Overall, the findings suggest many of the elements implemented by ATE grantees have been sustained. Program changes have been institutionalized and the collaborations the institutions have formed with industry partners have persisted. New professional development programs are in place and faculty have improved their teaching methods and formed new collegial relationships.

About two-thirds of the respondents believe the materials they produced have been used by other colleges; however, few have obtained revenue by selling these materials. This finding is consistent with their responses to other statements about revenue.

There were four items obtaining revenue to continue project activities. None of them had desired response rates above 38%. They were not confident about their ability to secure funding to continue the total scope of work. Few have formed not-for-profit corporations and only a third believes they will be able to continue their work by obtaining income for services provided. About two-thirds think the only way they can carry on their work is through continued funding from NSF.

The grantees report that students are being employed as technicians and serving as ambassadors for technology education. Prepared students are an outcome of the grants that continues to manifest itself…at least while the students are employed as technicians. In addition, improved student recruitment methods are in place and student internships will be continued.

Certain elements of the institutions have made changes that respondents think will continue. They report a three-fourths majority of administrators are encouraging other faculty to seek grants. Reputations have been enhanced, review committees have been improved, and the colleges expect that their ATE experiences will have a long-term impact on community colleges.

Only one statement was about equipment, however, nearly 94% of those who thought the statement was applicable to them, disagreed that the equipment would have little use after the grant ended.

The difficulty in obtaining revenue supports the belief that it is unreasonable to expect the grantees would be able to secure enough revenue to continue the total scope of their work. However, there is evidence that parts of the grants were sustained through such mechanisms as institutionalization, prolongation, on-going presence, and new efforts.

IV. Concluding Remarks

Several things have been learned from the implementation and findings of this research that may be useful for the National Science Foundation, its grantees, and prospective ATE researchers. These are listed below.

1. The study has identified several elements of a grant that have been sustained. The positive findings could be used to provide accountability evidence for the ATE program in particular and NSF in general. The results may also be helpful when the Foundation prepares future budget requests.

2. The review of the literature and information obtained from those involved in ATE projects and centers led to a new conceptualization of sustainability. Sustaining a total project or center is difficult and the view taken in this report is that it would be better to identify certain elements of the body of work that should or could be sustained. This turned out to be the case and is consistent with the new view of sustainability first presented in the 2010 ATE Program Solicitation. They wrote:

 "A center or project is expected to communicate a realistic vision for sustainability and a plan to achieve it. Being sustainable means that a project or center has developed a product or service that the host institution, its partners, and its target audiences want continued. To be sustainable is to ensure a center's or project's products and services have a life beyond ATE funding. For example:

- The institution commits to maintaining some of the positions for faculty hired by the project.
- Partners pledge to supply external resources to fund parts of the project after the NSF award ends.

- The institution commits to continuing to use, improve, and disseminate curricula and instructional materials developed in the project." (National Science Foundation, 2010)"

While this view of sustainability seems reasonable, it does present challenges to proposal writers and grantees. How can this approach be implemented in practice? Specifically, how can a college commit to funding a faculty position or partners pledge post-grant funding before the grant even starts?

During a review of this report, it was pointed out that one way colleges do this is to request a half-time faculty position the first year and then plan to pick up more of it as the grant continues. This seems reasonable and represents a commitment to sustainability. However, if the college experiences budget cuts or if the plan does not work out, alternative plans need to be implemented. It may be better to withhold a set amount of sustainability funds and as the project unfolds, decide where these dollars could best be spent to ensure sustainability.

Another reviewer mentioned that institutions receive substantial indirect costs and some of those funds could be used for new faculty positions. Budget and grant offices might object to this, but perhaps it would be possible for some of this money be added to the "sustainability pool" mentioned above to support activities that are deemed worthy of continuation as the project is implemented.

These and other similar questions will be considered as the research moves forward. What kind of process would work best in determining which, if any, of the elements of a grant should be continued? What information can be provided to help PIs develop a reasonable sustainability plan?

3. Large-scale research studies such as this one are feasible for individual researchers. The Evaluation Center at Western Michigan University (WMU) has conducted surveys of active projects for several years and has achieved high response rates. However, they were an ongoing center funded by NSF and were well known by the grantees. In addition, their data gathering was aided by requests from NSF program leaders to complete the survey. The current research was carried out by individual researchers largely unknown to grantees and ATE leaders had little incentive to respond. However, more that 82% of them did provide the information requested. Response rates that high should be an encouraging fact for future research efforts.

4. The impact and sustainability findings augment the information obtained by Western Michigan University and may have implications for their annual surveys. Their population of 203 sites includes all active grants in 2010. The current study has a population of 216 grantees and includes both expired sites and grants active in 2009. However, some of the population characteristics are remarkably similar. For example, 73.6% of this study's respondents were from 2-year colleges while 71% of the WMU study was for 2-year colleges.

The percent of projects in the two populations was surprisingly similar as well; 80.7% compared to 81.0%. The consistency of these findings lends validity support to both surveys.

5. The survey items could be reformatted into a checklist for grantees to use when considering how to improve sustainability. It may also serve as a reminder to proposal writers and PIs as to possible elements for targeting their sustainability efforts. (It should be noted that the impact data has not yet been analyzed. It seems likely that additional elements of sustainability will be found among these responses.)

6. The targeted research efforts have provided opportunities to conduct basic research studies that will increase understanding of how to improve research efforts and ATE program implementation. For example, one byproduct of the study was a research article on addressing nonresponse issues in large-scale data gathering. The article has been reviewed by a professional journal and is currently being revised. There are several other secondary analyses of the data that should be carried out and submitted for publication in journals or on ATE web sites such as DECA at the University of Colorado or the Evaluation Resource Center at Western Michigan University.

7. Studies such as this one require considerable time and effort. The time required for all of the tasks that were carried out during this research was greatly underestimated. Defining the concept of sustainability and its domain of elements, developing measures of these elements, selecting the sample, gathering the data, processing it to make sure it was accurate and data analysis each took more time that was budgeted. Also adding to the amount of time was writing reports describing the steps followed during each task.

 A record was kept of the number of person-hours devoted to the research. It may be possible to examine this record and calculate a rough estimate of the work required for each task. Perhaps this would be useful to NSF and for other researchers considering submitting an ATE research proposal.

8. The ATE program appears to have been quite successful in its goal of sustaining certain elements of the grants. However, it is important to remember that the findings reported here are the summaries of the opinions of ATE recipients. Despite the fact that they were told that only group results will be reported and no individual responses will be identifiable, they may think it is in their best interest to reply in a favorable manner. This possible yea-saying response bias was addressed by using quotes from fellow grantees instead of from outside "experts". In addition, a few items had low response rates. This fact suggests that responders were considering their replies and were not hesitant to disagree with some favorable statements. Still, caution must be exercised in extrapolating the results to other ATE projects and centers.

 A second report of this research study will address statements about impact, that is, the affect or influence a grant had on people and their institution. It is expected this analysis will provide some additional information about sustainability because if an impact persists, it might be an example of desired sustainability.

(iii) Bibliography

Baruch, Y. (1999). Response Rates in Academic Studies-A Comparative Analysis. *Human Relations*, 451-468.

Borg, W. R., & Gall, M. D. (1983). *Educational Research: An Introduction.* New York and London: Longman.

Lindner, J. R., Murphy, T. H., & Briers, G. E. (2001). Handling Nonresponse in Social Science Research. *Journal of Agricultural Education*, 43-53.

Miller, K. L., & Smith, L. E. (1983). Handling Nonresponse Issues. *Journal of Extension*, 45-50.

National Science Foundation. (2010). *Advanced Technological Education (ATE).* Program Solicitation 10-539: http://www.nsf.gov/pubs/2010/nsf10539/nsf10539.htm

National Science Foundation. (2007). *Advanced Technological Education.* Retrieved from Program Solicitation: http://www.nsf.gov/pubs/2007/nsf07530/nsf07530.htm

Welch, W. W., & Barlau, A. N. (2010). *Addressing Survey Nonresponse Issues in Evaluating National Science.* Available from author at wwelch@umn.edu.

Welch, W. W., & Barlau, A. (2010). *Selection of Sites for the ATE Impact and Sustainment Research Study.* wwelch@umn.edu.

Welch, W. W., & Gullickson, A. (2006). *The Sustainability of Advanced Technological Education Supported Efforts: An Evaluation.* Retrieved from Evaluation Resource Center for Advanced Technology Education: http://evaluation.wmich.edu/evalctr/ate/ATESustainabilityReport.pdf

ATE Impact and Sustainability Inventory
Developed by Wayne W. Welch © 2009
ATE/DUE Grant #0832874 to the University of Colorado

Members of the leadership teams of ATE projects and centers were asked to write about the impact and sustainability of their grant(s). I asked what impact the grant had on them, their institutions, and those involved in their programs. I also asked about programs and activities that will be or have continued (sustained) after their grant ends. I have selected about a third of their statements, mostly direct quotations, and are interested in whether you agree or disagree with their statements.

Please read each statement and then indicate the extent to which you Disagree or Agree with using the following response scale. (Circle the response option at the right of the page that best represents your opinion.)

*AA**   Strongly Agree with the statement*
*A**   Agree with the statement*
*U**   Uncertain on whether I agree or disagree*
*D**   Disagree with the statement*
*DD**   Strongly Disagree with the statement*
*NA**   Not applicable*

Part I of the survey is about Impact and Part II is about Sustainability. Please answer all questions and return your survey in the enclosed, stamped return-addressed envelope.

Thank you for your help.

Part I: Impact	Circle the option that best represents your opinion.
1. "Our administration has supported our ATE efforts."	AA A U D DD NA
2. "Persistence of students recruited through our project is lower than the college's average persistence."	AA A U D DD NA
3. "Our NSF grant has given us the confidence to seek and obtain funding from other sources."	AA A U D DD NA
4. "Faculty members who have no colleagues in their specialty on our campus really appreciate the community they have created through this project."	AA A U D DD NA
5. "Our NSF/ATE grant has had little long-term impact on our college."	AA A U D DD NA

6. – 30.

Part II: Sustainability	Continue to circle the option that represents your opinion.

1 "I have at least one industry partner who is committed to support some of our work after NSF funding has ended." AA   A   U   D   DD   NA

2. "Our use of a national review committee has helped make our advisory committees more effective." AA   A   U   D   DD   NA

3. "The instrumentation and equipment I secured as part of our ATE grant will have little use by the college after the grant ends." AA   A   U   D   DD   NA

4. "Our ATE grant experience has caused our administration to encourage other faculty to seek external funding to address workforce needs." AA   A   U   D   DD   NA

5. "It is doubtful that the relationships I have established with our various partners will continue after our ATE grant has ended." AA   A   U   D   DD   NA

6. – 24.

Thank you for your help. Please return in the stamped, addressed envelope.