



ATE Assessment Practices: Reconceptualizing the Role of Participants in Professional Development Evaluation: Supplemental File

Information in this file is intended to support A.R. Gullickson, R. Datta, A.M Gullickson, M. Chen, “ATE Assessment Practices: Reconceptualizing the Role of Participants in Professional Development Evaluation” and includes the following:

1. A brief description of the project work of the authors.
2. A description of key characteristics of the ATE program and supporting tabular data for those who are not familiar with ATE or its PD practices.
3. Fourteen tables that more fully describe and support the findings presented in the paper.
4. Supporting discussion information regarding:
 - a. The ATE program’s evaluation expectations.
 - b. Caveats on the use of participant teachers as collaborators in assessment.

Background

The described differences between formative and summative assessments served as grounding for the ATE project, Formative Assessment for ATE (FAS4ATE) initiated in 2013 and continued with a second project FAS4ATE2. This work has focused on ATE Professional Development (PD) in education. The work of the two projects has centered on understanding project evaluation practices, especially the ways in which formative assessment practices are employed and might be better used to serve the needs of ATE projects and the ATE program as a whole. The survey effort described here is part of the overall work of the two FAS4ATE projects.

In this paper we explain the joint roles of formative and summative assessment by providing a theory of change for professional development, including ATE’s expectations for PD evaluations. A technique called backward design was integral to our study efforts. The theory and backward design constructs together provide a basis for analyzing and interpreting data gathered from a survey of ATE principal investigators about their PD assessment practices. Our intention is to provide a better understanding of what is being done, and what needs to be done, to improve both outcomes and evaluation in PD.

The ATE Program

The ATE program is unique in NSF. Unlike NSF programs generally, that are created and “governed” by NSF, ATE was federally mandated by Congress in 1992 (PL 102-476). ATE’s funding is determined on an annual basis by Congress and the ATE Program Lead reports annually to Congress. Projects have been funded through this program since 1994. In 1994 the program funded 40 projects for a total of \$25 million (Status Report I, May 2000); by 2021, the program’s annual budget had grown threefold to \$75 million dollars with 344 funded projects. Currently, in Track 2 of the ATE program where most projects receive funding, individual projects can expect to receive a maximum budget of \$650,000 over three years (NSF 21-598). A small number of special projects and centers receive more funding over a longer period (e.g., 4 to 5 years).

Despite its unique origins and governance, the ATE projects and their PD efforts are like many other federally funded education programs. ATE works primarily with community colleges, focuses on STEM education, and intentionally builds partnerships in technician education with business and industry and secondary schools. EvaluATE, one of the ATE grantees, annually surveys all ATE projects to describe project efforts and achievements.



To provide context of the ATE program and the population for our study, we addressed five characteristics of currently funded projects obtained from the 2022 EvaluATE survey of projects, census and a sixth characteristic from the 2021 survey.

1. Project Types: Which types of projects received funding?
2. Disciplines: What disciplines did the funded projects engage in?
3. Institution Types: What types of education institutions were funded?
4. PD length: What lengths of PD were conducted?
5. PD Curricula: What topics and disciplines were addressed by PD providers?
6. Participant characteristics: What is the education level of participants?

Project Types:

ATE funds several types of projects (Table S1). Although ATE labels all awards as projects, it divides most of its funding into smaller and larger categories, respectively termed projects, and centers. Together the two categories constitute 70 percent of currently ATE funded entities and 76 percent of those conducting professional development. The project category contains the greatest number of funded awards, comprising more than 60 percent of all grant awards, including those conducting PD. The center category, as three subcategories, comprise seven percent of awards. However, due to their larger funding allocations, centers are proportionally much more likely to engage in PD and to reach a larger audience.

Table S1. Numbers of the types of projects funded in 2021 by the ATE program showing: (a) all reporting projects (N=367), and (b) those that reported having conducted Training or Professional Development for educators (N=145).

Type of Award (Q1.1)		All responding projects (N)	Conducted Training or PD (N)
	1 Project	231	88
	2 Small grant	75	24
	3 Center: National	11	8
	4 Center: Regional	8	8
	5 Center: Support/resource	7	6
	6 Targeted Research	18	5
	7 Conference or meeting	4	0
	8 Other	8	2
	9 Coordination network	5	4
Total		367	145



Disciplines:

Table S2 shows that in 2021 the ATE program included funded grants in 33 discipline categories (e.g., engineering, biotechnology, and agriculture). Seventy-four projects indicated their STEM discipline was related to manufacturing technologies, making it the largest discipline group. Other categories such as agriculture, environmental, biotechnology, and cross cutting technologies also included large numbers of 20 or more projects.

Of the approximately 40 percent of projects indicating that they conducted PD for educators; their discipline category numbers tended to be consistent with the discipline representations generally. In sum, those providing PD for educators represent the wide array of the technology disciplines funded by the ATE program.

Table S2. The discipline areas of all currently funded ATE projects (N=367), and the subset of those who conducted professional development in 2021 (N=145).

Technology Discipline	All Reporting Projects N	Conducted Training or PD N
Manufacturing technologies	74	37
Agriculture and aquaculture	9	0
Energy technologies	11	4
Environmental technologies	5	0
Natural resources	2	0
Other Agricultural and Environmental Technologies (please specify)	5	2
Biotechnology and Chemical technologies	37	12
Optics	4	2
Electronics and controls	7	3
Marine technologies	3	1
Space technologies	1	1
Materials technologies	1	
Engineering	25	6
Information and communications technologies	21	9
Geospatial technologies	9	4
Security information assurance, and forensics technologies	41	16
Micro and nanotechnologies	10	7
Evaluation	1	0
Learning research	7	4
Teacher preparation	5	3
Other general or interdisciplinary/cross-cutting	57	23
Recruitment and/or retention	8	1
Mechatronics	16	8
Welding	8	3
Total	367	145



Institution Types:

The program's proposal guidelines stipulate, "The ATE program focuses on IHEs [Institutions of Higher Education] that award two-year degrees in advanced technology fields and expects these IHEs and their faculty to have significant leadership roles on all projects. It is recommended that two-year IHEs serve as the fiscal lead on proposals with four-year IHEs being sub-awardees. When a four-year IHE submits as the fiscal lead, then two-year IHE faculty must be PI or Co-PIs." Table S3 shows that projects in two-year colleges are the primary providers of PD (72%). Four-year colleges and universities, the second largest group represented 16% of PD providers.

Table S3. Education Level of Institutions that received ATE grant funding (N=367) crossed with those who conducted training/PD (N=145).

Institution Type	All Reporting Projects (N)	Those who conducted training/PD. (N)
4-year College/University (1)	58	23
2-year College or 2-year College system (2)	272	105
K-12 School or School system (3)	0	0
Nonprofit Organization (4)	24	14
Other (describe) (5) [Small Business; Private University that offers associate's, bachelor's, and master's degrees; Technical college]	12	3
Total	366	145

PD Length:

As Table S4 shows, 145 projects conducted 220 PD programs of varied length. Notably the most often offered workshop was of short duration, less than a day. This table also shows that as the length of the workshop increased, fewer conducted that type of PD.

Table S4. Numbers of projects conducting Training/PD by Length of PD.

PD length	Number conducting PD (N=145)
Workshops of 1 day or less	91
Workshops greater than 1 day and less than a week	66
Workshops greater than 1 week in length	42
Long term PD (e.g., internship)	21
Total	220



PD Curricula:

Table S5 describes the nature of topics covered in the 2021 PD activities. Most PD focused on one or more of three topics, discipline- or industry-specific knowledge or skills, training on specific equipment, or pedagogy. Of the three, discipline- or industry-specific knowledge or skills was the only topic selected by a majority of respondents. This indicates a strong STEM technology emphasis in PD activities.

Table S5. Topics addressed in projects' professional development efforts. (N=145)

	Topic	N %
1.	Pedagogy	57 39%
2.	Discipline- or industry-specific knowledge or skills	117 80%
3.	Recruitment or retention of students (3)	32 22%
4.	Training on specific equipment (4)	71 49%
5.	Addressing issues of equity, diversity, or inclusion (5)	25 17%
6.	Other professional skills (e.g., leadership, communication) (describe) (6)	35 24%

Participant Characteristics:

Information about the nature of PD participants was not available for 2022 but is available in the 2021 annual survey report (Marshall et. al, 2021). In 2021 116 projects reported conducting PD. The report states: "Sixty-two percent of educators served by professional development activities were two-year college faculty, followed by four-year college faculty (18%) and high school teachers (12%). Pre-service teachers made up less than 1% of professional development participants, and other types of educators made up 8%."

Survey Findings:

The study's findings, presented in the main paper, are supported by the tabular information below. Each item's findings are presented in its own table, seven tables in all (Tables S6-S12). Each table shows two perspectives regarding those who conducted assessments. The first data column presents findings in terms of the 70 projects who reported using assessments. The second data column presents findings in terms of all 145 PD providers. This second column provides a basis for contrasting current findings with those of previous surveys.

To organize findings and highlight the most salient findings, in tables S6-S12, cells and rows are highlighted when the "checked" response was 50 percent or greater in the group that conducted assessments. That 50 percent criterion was met for seven responses. Those highlighted findings were used as major descriptors for each of the PD components addressed in the survey. Lesser findings (i.e., where less than a majority responded to an option) accompany the major findings to describe more fully each of the four categories. Finally, Table S13 provides highlighted findings across the four PD components to summarize information regarding participants' achievements, valuations, intentions, and contextual factors.



Findings Tables:

Table S6. Why did your project conduct assessment in your professional development activities in 2021? Select all that apply. Number and percent of projects that chose each option. (N=70)

	Reason for Using Assessment in the PD effort	Among Assessment Providers N (%)	Percent of all PD Providers (N=145) %
1	To select and evaluate prospective participants to tailor instruction	14 (20%)	10
2	To assess participant learning needs to tailor instruction	32 (46%)	22
3	To confirm alignment of participant learning needs with planned activities	39 (56%)	27
4	To assess participant willingness to implement professional development learning in their home classroom setting	30 (43%)	21
5	To guide participant learning during the professional development activities	20 (29%)	14
6	To improve teaching and learning in real time	26 (37%)	18
7	To assess outcomes and impact of professional development activities	59 (84%)	41
8	To understand how participants incorporated and implemented what they learned in their home classrooms	33 (47%)	23
9	Other (describe)	2 (3%)	1

Table S7. For professional development (PD) work your project completed in 2021, which of the following types of information did you collect prior to the PD activity? Select all that apply. Number and percent of projects that chose each option. (N=70)

	Item Response Options	Among Assessment Providers N (%)	Percent of all PD Providers (N=145) %
1	Information about participants' knowledge or skills in the area of your professional development focus	46 (66%)	32
2	Information about participants' valuation of new ideas, materials, or techniques for use in their home institutions	19 (27%)	13
3	Information about participants' intent to implement new ideas, materials, or techniques in their home classrooms	26 (37%)	18
4	Information about any contextual factors that could influence participants' use of professional development	14 (20%)	10

Table S8. At the time participants were recruited did they agree to provide follow-up feedback on the impact of the professional development on any of the following topics? Select all that apply. Number and percent of projects that chose each option. (N=70)

	Item Response Options	Among Assessment Providers N (%)	Percent of all PD Providers (N=145) %
1	Their own learning	38 (54%)	26
2	Their incorporation and implementation of what they learned (i.e., their own instruction)	42 (60%)	29
3	Their students' learning	19 (27%)	13

Table S9. For professional development (PD) work your project completed in 2021, which of the following types of information did you collect during the PD activity? Select all that apply. Number and percent of projects that chose each option. (n=70)



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	Item Response Options	Among Assessment Providers (N=70) N (%)	Percent of all PD Providers (N=145) %
1	Information about participants' valuation of new ideas, materials, or techniques for use in their home institutions	30 (43%)	21
2	Participants' opinions about the PD	35 (50%)	24
3	Information about participants' learning/achievement related to the PD	25 (36%)	17
4	Information about participants' intent to implement new ideas, materials, or techniques in their home classrooms	30 (43%)	21
5	Information about any contextual factors that could influence participants' use of what they learned in the PD	21 (30%)	14
6	Information about whether participants correctly implemented the ideas, materials, or techniques from the PD	8 (11%)	6

**S10.
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Participant-based actions were part of your project's professional development activities. Number and percent of projects that chose each option. (N=70)

	Option Statement	Among Assessment Providers (N=70) N (%)	Percent of all PD Providers (N=145) %
1	Participants demonstrated what they learned (not including self-reports).	38 54%	26
2	Participants received instruction on student assessment.	21 30%	14
3	Participants were provided tools, protocols, etc. for gathering information on their impacts on students.	18 26%	12
4	Participants were taught how to use the tools, protocols, etc. for gathering information on student impacts.	22 31%	15
5	Participants had time to try out the tools and protocols for gathering information on student impacts.	16 23%	11
6	Participants were provided tools, protocols, etc. for reporting information on student impacts.	12 17%	8
7	Participants were taught how to use the tools, protocols, etc. for reporting information on student impacts.	11 16%	8
8	Participants had time to try out the tools and protocols for reporting information on student impacts.	11 16%	8



Table S11. For professional development (PD) work your project completed in 2021, which of the following types of information did you collect at the conclusion of the PD activity? Select all that apply. Number and percent of projects that chose each option. (N=70)

	Item Response Options	Among Assessment Providers (N=70) N (%)	Percent of all PD Providers (N=145) %
1	Information about participants' valuation of new ideas, materials, or techniques for use in their home institutions	45 (64%)	31
2	Participants' opinions about the PD	61 (87%)	42
3	Information about participants' learning/achievement related to the PD	48 (69%)	33
4	Information about participants' intent to implement new ideas, materials, or techniques from the PD in their home classrooms	49 (70%)	34
5	Information about any contextual factors that could influence participants' use of PD information	19 (27%)	13

Table S12. For professional development (PD) work your project completed in 2021, which of the following types of information did you collect after the PD activity and after participants applied the workshop materials in their home classrooms? Select all that apply. Number and percent of projects that chose each option. N=70

	Item Response Options	Among Assessment Providers (N=70) N (%)	Percent of all PD Providers (N=145) %
1	Information about participants' valuation of new ideas, materials, or techniques from the PD for use in their home institutions	20 (29%)	14
2	Participants' opinions about the PD	21 (30%)	14
3	Information about participants' learning/achievement related to the PD	16 (23%)	11
4	Information about participants' intent to implement new ideas, materials, or techniques from the PD in their home classrooms	24 (34%)	17
5	Information about any contextual factors that could influence participants' use of PD information	8 (11%)	6
6	Information about participants' intent to implement	24 (34%)	17
7	Information about whether participants correctly implemented the ideas, materials, or techniques from the PD	12 (17%)	8
8	Information about the impact of the training on students' interest in STEM	14 (20%)	10
9	Information about changes in achievement/learning among students related to the PD	13 (19%)	9



Table S13. PI responses to what data were collected regarding achievement, valuation, implementation, and contextual factors in four specified assessment situations. Number and percent of projects that chose each option. N=70

Assessment Situation	What data were collected?			
	Information about participants' learning/achievement related to the PD. N (%)	Information about participants' valuation of new ideas, materials, or techniques for use in their home institutions. N (%)	Information about participants' intent to implement new ideas, materials, or techniques in their home classrooms. N (%)	Information about any contextual factors that could influence participants' use of professional development. N (%)
Prior to the PD activity	46 (66%)	19 (27%)	26 (37%)	14 (20%)
During the PD activity	25 (36%)	30 (43%)	30 (43%)	21 (30%)
At the conclusion of the PD activity	48 (69%)	46 (64%)	49 (70%)	19 (27%)
After the PD activity and after participants applied the workshop materials in their home classrooms	16 (23%)	20 (29%)	24 (34%)	8 (11%)



Table S14. ATE budget and number of projects dedicated to professional development by year.

From 2008 through 2015 data were gathered in the annual EvaluATE survey of principal investigators to assess the percentage of project level funds devoted to professional development. Across this span of time the overall percentage of annual grant budgets devoted to professional development was quite stable ranging from 18 percent to 22 percent. In six of the eight years, the percentage was 20 percent or larger. Our estimate of 20 percent for 2021 is an extrapolation of those findings but seems reasonable given the stability of the noted findings and the fact that the percent engaged in professional development is consistent with the percent conducting professional development during the 8 years for which data are available. Supporting data and discussion for the ATE PI survey years referenced here can be found at EvaluATE's online repository (<https://atesurvey.evalu-ate.org/survey-resources/>).

Year	% of Budget	% Engaged in PD	Source
2008	19	41	A. R. Gullickson and L. A. Wingate, " Advance Technological Education Program 2008 Survey Fact Sheet ," (2008).
2009	21	44	L. Wingate and A. R. Gullickson, " Advanced Technological Education Survey 2009 Fact Sheet ," (2009).
2010	18	37	L. Wingate, C. Westine, and A. Gullickson, " Advanced Technological Education Survey 2010 Fact Sheet ," (2010).
2011	22	41	L. Wingate, C. Westine, and A. Gullickson, " Advanced Technological Education Survey 2011 Fact Sheet ," (2011).
2012	22	46	L. Wingate, C. Smith, C. Westine, and A. Gullickson, " Advanced Technological Education Survey 2012 Fact Sheet ," (2012).
2013	20	49	C. Smith, L. Wingate, and A. Gullickson, " Advanced Technological Education Survey 2013 Fact Sheet ," (2013).
2014	21	49	C. Smith, L. Wingate, and A. Gullickson, " Advanced Technological Education Survey 2014 Fact Sheet ," (2014).
2015	22	39	Smith, Corey D, Wingate, Lori A, Perk, Emma, Wilson, Lyssa N, and Gullickson, Arlen, " ATE Annual Survey 2015 Report ," (2015).
2016		41	Wilson, Lyssa N, Wingate, Lori A, Lee, Miranda, and Gullickson, Arlen, " ATE Annual Survey 2016 Report ," (2016).
2017		37	Wilson Becho, Lyssa, Gullickson, Arlen, Leebug, Emma, and Wingate, Lori, " ATE Annual Survey 2017 Report ," (2017).
2018		34	Wilson Becho, Lyssa and Wingate, Lori A, " ATE Annual Survey 2018 Report ," (2018).
2019		48	Wilson Becho, Lyssa, Wingate, Lori A, Gullickson, Arlen, and Marshall, Valerie A, " ATE Survey 2019 ," (2019).
2020		53	Marshall, Valerie A, Wilson Becho, Lyssa, Wingate, Lori A, and Gullickson, Arlen, " ATE Survey 2020 ," (2020).
2021		38	Marshall, Valerie A, Sturgis, Erika, Wingate, Lori A, and Gullickson, Arlen, " ATE Survey 2021 ," (2021).
2022		39	Datta, Robin P, Gullickson, Arlen, Gullickson, Amy, and Neider, Xyanthe, " Formative Assessment: Diversity, Equity, and Inclusion in ATE Professional Development ," presented at HI-TEC 2022 Conference, Salt Lake City (July 25, 2022).
AVERAGE	20.6	42.4	



Five Evaluation Expectation per the ATE Proposal Guidelines:

1. Demonstrate use in the classrooms: In sum the findings indicate that slightly more than a third (35%) gather at least information about the number of students served. That is the same percent that stated they gathered information regarding participants' intentions to implement what they learned in the PD. Those findings suggest that approximately a third of the projects met this expectation.
2. Demonstrate sustainable changes in practice of participating faculty and teachers: Sustainable change carries with it two expectations. First a change must occur. Second, the change must persist over time. Our findings indicate that about a third measure changes in participant learning/achievement during PD instruction or at the conclusion of the instruction program. While that does not demonstrate that a change in practice has occurred, it does suggest that such assessments provide a necessary condition to assert a change has or can occur. Additionally, just six percent reported gathering data regarding whether participants correctly implemented the ideas, materials, or techniques from the PD. Inattention to accuracy in implementation makes it impossible to confirm changes in participants' practice or further to assess whether such changes were sustained.
3. Measure changes in students' perceptions of technical careers: Ten percent gathered information regarding students' interest in STEM. Technical careers are STEM based and represent a subset of all STEM. The question regarding STEM rather than technical careers weakens our position. Yet, it seems probable that if interest in STEM was not pursued, neither was perception of technical careers.
4. Measure changes in student learning outcomes: Information about student learning can encompass a wide array of factors, including the increase or decrease in numbers of students, dropout rate in courses, gains or losses in achievement and interest, and even the mundane question of how much of the PD content was provided to the students. While we did not ask for specifics, 9 percent reported they sought information about student learning. That suggests few projects gathered these types of information.
5. Demonstrate an increase in qualified technicians for the industry: This expectation appears to be met by none of the projects. As noted above few projects state that they gather information about what is taught to students or what is learned. It is a considerable further task to first confirm changes in students, then follow up to determine whether the student take positions in industry, and finally whether those in industry view the incoming employees as more qualified than previously employed technicians. Follow up in industry is really outside the scope of nearly all PD projects; it requires longitudinal study and funding.



Caveats on the use of participant teachers as collaborators in assessment:

The choice to use participant teachers as full partners in the assessment and evaluation processes does incur challenges. One obvious concern is ensuring objectivity, elimination or reduction of bias effects that can result from teachers whose work and achievements are being evaluated. The challenges also include an array of practical matters including: i) teacher participants' agreement that they will do this assessment work and that work is clearly described, ii) the participants have or will attain the requisite skills for gathering and reporting information, iii) systems that enable reporting are in place and functional, and iv) participants know how to access and interact with the project's evaluator to support them. These challenges require attention and attendant actions in every phase of the PD, before the PD activity, during the PD activity, at the close of the PD activity, and after participants return to their own classrooms to teach what was learned.

While there are challenges to changing teachers' role to be more active in assessment matters, the fruits of such involvement are large. As students in the PD process, participant teachers have a strong interest in increasing their knowledge and developing the intended skills. We noted in the introduction that research shows substantial benefits for engaging sound assessment practices throughout the learning situation. For those concerned about the burden that the added focus on preparing and including participant teachers in assessment practices, the dividends seem well worth it. Additionally, while there is a learning curve, examples in practice suggest that the workload need not be greater—just distributed differently. It turns out that sharing the assessment load with students, participant teachers or others, pays dividends for both the instructor and the students. The challenge before us is about how to transition to effectively sharing the assessment load.

Those who conduct research on assessment practices acknowledge the importance of preparing/teaching teachers how to conduct useful assessments. In PD situations this includes four sets of people, the PI, the PD instructor, the participant teachers, and the external evaluator. Because of the constraints of our survey, we focused on participant teachers, but we know that identified assessment issues must also include attention and learning on the part of the other stakeholders.

The organization of the survey questions enabled us to look at preparatory practices for post-PD assessments at multiple points, before PD activities, during and at the close. Our choice to solicit information just from PD providers who applied assessments yields information from projects that already act to gather data. This choice gives insights to what types of data collection activities and information tend to be prioritized among this group.

Before the PD activity, projects prioritized (a) learning about participants knowledge and skills to focus instruction and (b) gaining agreement from participants regarding their incorporation and implementation of what they learned (i.e., their own instruction). Far fewer of these projects sought agreements to gain participants' involvement regarding their students' learning. Similarly, fewer sought information on matters such as participants' intention for use of the PD learnings and material, or the context in which the participants would apply what was learned in the PD. Those findings strongly suggest that PD providers are not looking downstream toward use of participant teachers in substantial ways for gathering student impact and outcomes information in their own classrooms.

These same types of emphases emerge when the PD activity occurs. A majority do seek to ensure that their participants demonstrate learning, but few go further to check whether participants correctly implemented the ideas, materials, or techniques from the PD. The slightly larger numbers who assess matters of participants' valuation of the PD, as well as their intention to use what was learned, and the context in which materials will be used, suggest that during the PD activity there is a greater interest/focus on application of PD learning than was apparent before the PD activity. Despite somewhat more attention regarding the use by participants back in their classrooms, the large majority, at least 7 of every 10 PD providers, did not prepare their participants to actively gather data in their own classrooms. Such preparation seems essential if teachers are to be successful in producing multiplier effects for PD outcomes.

Note on the length of PD on assessment practices:

At the suggestion of former ATE co-lead, Dr. Elizabeth Teles, we investigated the effects that the length of PD workshop had on assessment practices. No substantial effects were found; findings among projects that provided PD experiences longer than a day did not apply assessment practices more extensively than did others. Tables showing those findings are provided at: <https://edmonds.edu/go/FAS4ATE2>.