Applying Project Management Skills to NSF ATE Funded Grants: A Roadmap to Success for First-time Grantees

Ms. Elaine L. Craft, Florence-Darlington Technical College

Elaine L. Craft (Florence-Darlington Technical College, Florence, SC-retired) holds a baccalaureate degree in chemical engineering from the University of Mississippi and a MBA from the University of South Carolina with additional graduate studies in mathematics. Following work in industry and administrative and teaching positions within a two-year college system, she continues leading educational improvement initiatives and serving as Principal Investigator of NSF-funded projects.

Pamela J Silvers, Mentor-Connect/Florence Darlington

Pamela Silvers is Professor Emeritus - have taught in the Computer Technologies Department at Asheville-Buncombe Technical Community College. Currently she is co-Principal Investigator (co-PI) for the Mentor-Connect Forward Grant. She previously served at PI for three NSF ATE Grant entitled Skilled Workers Get Jobs which focused on recruiting and retaining more women into technology programs.

Buffy Quinn, University of Southern Mississippi

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Abstract

The National Science Foundation (NSF) Advanced Technological Education (ATE) program is specifically designed to support workforce development that primarily takes place in technician education programs offered at two-year colleges across the nation. Even so, NSF grant funding is infrequently or never pursued by most two-year colleges even though there is a need for funding to support high-cost, high-impact STEM programs. Since two-year colleges are focused on teaching vs. research, securing grants is seldom, if ever, required or recognized as important as part of employee performance review, tenure, and promotion processes at these institutions. As a result, technical/STEM faculty members typically do not have prior grant experience, nor do they have experience in managing a grant-funded project using industry-standard techniques. Guiding new grantees in applying Project Management skills as they implement NSF ATE-funded grants for the first time holds promise for improving project outcomes, reducing the frustration of a steep learning curve for new PIs, and encouraging follow-on grant proposals to the ATE Program.

The first two principles of project management, (1) set clear objectives from the start and (2) create a project plan, are required to receive a first grant from NSF. When a grant award is received, two-year college faculty are invariably faced with working grant-funded activities into their already heavily-scheduled work weeks. Knowing about and employing project management skills can make a positive difference in the experience one has as a PI responsible for grant implementation and outcomes. These skills can help prevent chaos as workloads and competing demands for their time increase.

To help new PIs learn and use project management skills within the context of NSF expectations so that they may maximize project outcomes and position themselves for subsequent NSF funding. A new professional development opportunity, PI 101, is providing instruction, mentoring, and technical assistance during the first year of project implementation. Based on PI 101 pilot year experiences and research, this support is being strengthened to specifically include the other three principles of project management: (1) organize and manage resources, (2) assess risks and changes throughout the project, and (3) monitor progress and performance on a regular basis.

Mentor-Connect Forward, funded by the NSF ATE Program, added a newly developed component that addresses the critical need for first-time grantees to have instruction and support during their first year of project implementation. This professional development opportunity, called PI 101, is being offered to first-time, two-year college PIs to develop skills and help them build confidence by learning to apply proven strategies that can improve project outcomes so that their initial NSF ATE-funded work will build a worthy foundation for future grant awards and associated program improvements and innovation in technician education. PI 101 provides a collegial cohort environment for new PIs as they address issues such as grants management, budgets, and reporting expectations. New PIs can also get answers and receive direction on communication, building internal and external relationships, and developing industry

partnerships. An important component of PI 101 is the introduction of the principles of project management as they apply to grant management. The pilot cohort of PI 101 participants received NSF ATE awards in 2023. The impact on the people involved, project progress, and outcomes are being monitored to inform improvements to PI 101 and future research questions. This paper explores the challenges and lessons learned in assisting a cohort of 15 two-year colleges so that they may effectively incorporate principles of project management and other grantsmanship strategies as they implement their first NSF ATE projects.

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Historically, two-year colleges have not created a culture of grant writing within their institutions; however, as these institutions face budget shortfalls due to decreased enrollment, lower state funding, and a loss of tuition dollars they must explore options to continue offering high-quality, cutting-edge programs. Faculty members can contribute to this effort by securing external grant funding and successfully completing the project to benefit themselves, their institutions, and their students. Unfortunately for faculty members, a culture of grants to support faculty who engage in grant-funded endeavors has never been cultivated at most two-year colleges, and many faculty members may not have the skills to turn a funded proposal into a project with measurable outcomes and relevant deliverables. The National Science Foundation (NSF) Advanced Technological Education (ATE) Program has funded a series of projects, most recently Mentor-Connect: Leadership Development and Outreach for ATE Forward (DUE #2227301) to address this challenge. PI 101 is a new program of instruction, technical assistance, and mentoring that has been created by Mentor-Connect to assist new PIs and their teams acquire grant management skills that includes applying the principles of project management as they implement their funded project.

National Science Foundation's Advanced Technological Education Program

The NSF initiated the ATE program in 1992 to help strengthen science, technology, engineering, and math (STEM) technician education programs across the country (Craft, et al., 2017). What is unique about this ATE program is that, instead of being focused on scientific research projects typically housed at four-year, graduate-degree granting institutions, ATE is designed to help two-year technical and community colleges (hereafter referred to as two-year colleges) build STEM offerings associated with technician education. The ATE Program emphasizes preparing students to go directly into the workforce while also providing opportunities for future academic and career advancement. Technology programs such as nano fabrication, automotive technology, biotechnology, computer technologies, advanced manufacturing, or robotics are necessary for preparing the next generation workforce. However, these programs can be expensive to develop and maintain and rely on up-to-date faculty expertise and specialized equipment that may be out of financial reach for two-year colleges already dealing with budget shortfalls.

The ATE program provides funding that helps address these challenges to benefit institutions, students, and their communities; however, many two-year colleges do not seek NSF ATE grant funding that could be transformational on their campuses. Applying for a federal grant such as

those offered by the NSF is time consuming and complicated. Two-year college faculty often have heavy teaching loads (e.g., five or more classes per semester), and are typically not expected to publish research. These faculty often have no experience in applying for external funding because securing grants is not an expectation, and no incentives or rewards are offered by the college for faculty to secure and implement grant-funded projects. Another limiting factor is that many two-year colleges do not have a grants office or a grant-development professional on staff with the expertise and experience to provide support.

Mentor-Connect: Leadership Development and Outreach Initiative

The Mentor-Connect: Leadership Development and Outreach initiative (NSF DUE #1204463, #1501183, #1840856, #2227301) provides no-cost mentoring to two-year college faculty and administrators who are interested in applying for NSF-ATE funding. The Mentor-Connect program is funded by the NSF ATE Program and is administered through Florence-Darlington Technical College in South Carolina. The Mentor-Connect program is an adaptation of the IBM mentoring model that promotes retention and professional development at IBM. The model has been modified to work in an academic setting and for a specialized purpose (Craft, et al., 2014).

Since 2012, a cohort of potential ATE grant applicants has been selected each year by Mentor-Connect project leaders. Teams applying for the program typically consist of two faculty members, a grants professional/grant writer, and an administrator from each two-year college; however, larger teams are also welcome if the college financially supports travel expenses for additional team members. Teams are selected based on a short biography for each faculty team member and a one-page description of the team's proposal idea. If selected to participate, team members are assigned a mentor to work one-on-one with them throughout the proposal development process. Participant teams attend two, in-person workshops that provide grant writing instruction and face-to-face work time with their mentor (which was adapted to a virtual workshop during the pandemic quarantine). Workshops are augmented by a series of technical assistance webinars provided over a nine-month time frame leading up to the October NSF-ATE proposal submission deadline. Colleges that are accepted into the program receive mentoring and travel cost reimbursement for a four-person team to travel to the workshops (mentor-connect.org. n.d.). Mentor-Connect also provides a help desk to answer questions and provide other types of just-in-time assistance as well as a searchable resource repository specific to NSF-ATE grant funding and project implementation can be accessed via the project website (Mentor-Connect.org).

The Importance of Project Management for New Grantees

Mentor-Connect is based on principles developed in industry (Craft, et al., 2014), and the project has been successful in preparing teams for their NSF-ATE proposal submissions. According to the most recent funding report available from the National Science Foundation, just 26% of proposals submitted to the agency are funded (Jeffers, 2023). For teams that complete the Mentor-Connect program, the funding rate skyrockets to 71% (National Science Foundation, 2023). These data illustrate that the Mentor-Connect program provides effective mentoring for *preparing* and *submitting* a competitive NSF ATE grant proposal.

After a team submits a highly competitive proposal that results in an ATE grant award to the college, faculty PIs and Co-PIs sometimes wonder, "What happens now?" Mentor-Connect answers this question for new PIs with a year-long program of support entitled PI 101.

Mentor-Connect project leaders have observed that once a team receives an award, first-time grantees often find it difficult to complete their funded projects on time and within the budget originally developed as part of the proposal. Lack of faculty grant experience, NSF expertise within the college, and grant support structures, creates a steep learning curve for all involved, impedes progress, and too often results in what Mentor-Connect leaders refer to as "one-and-done," meaning that a college receives a first NSF-ATE grant award but then does not seek additional ATE grants due to faculty burnout.

Invariably, faculty are faced with working grant-funded activities into already heavily scheduled work weeks. The hypothesis underlying the new PI 101 intervention is that increasing faculty knowledge about and assisting them with applying project management skills can make a positive difference in the experience as they assume the responsibility for grant implementation. Even though faculty release time or overload pay can be included in a grant, there are no more hours in a week to get the work done. Project management skills can help prevent chaos as workloads and competing demands on a faculty member's time increase and the new PI gains an understanding of NSF expectations.

Transitioning from the proposal stage to project implementation can be made easier by applying project management principles. In developing the proposal, PIs developed and articulated clear project objectives and created a project plan. These elements are essential for a successful NSF-ATE grant award because they demonstrate a thoughtful approach to solving a problem. Therefore, these new PIs begin with a framework in place for a successful project; however, turning that framework into project implementation in a way that meets deadlines and achieves objectives can be daunting for busy faculty members with no prior project management (PM) experience. The NSF 15-page project description constraint limits the details that can be included in the proposal. Work plans and activities need to be outlined in greater detail to provide sufficient guidance for project implementation.

Why is project management so important? Without attention to project management, many projects—whether in higher education or in industry—are likely to fail. Although prevalent in industry, project management is not often implemented in higher education despite its importance. "An organization's ability to accomplish its mission is often contingent upon its collective capacity to execute projects and/or initiatives in a timely and organized manner. Project management has a critical role in the delivery of projects within designated timelines, budgets, and defined quality" (Johnson, et al., p. 102).

Project Management for Small Projects

Applying project management techniques, even with small projects, can help a PI achieve the goals described in their NSF-ATE proposal. By employing project management methodologies, such as defining scope, setting realistic timelines, and monitoring progress, PIs overseeing small projects can maintain better control over the entire process. This oversight ensures that tasks are

completed in a timely manner, potential risks are identified and mitigated early on, and the overall project goals are achieved with greater success.

A crucial first step for new PIs is to transform the proposal into an actionable work plan. A well-constructed work plan serves as a cornerstone in the project management process, irrespective of the project's size. It plays a crucial role in guiding the project team, providing a roadmap for task execution, and facilitating effective communication. The importance of a work plan lies in its ability to outline project objectives, deliverables, timelines, and dependencies, offering a comprehensive view of the project's trajectory. Typically, a work plan includes key components such as a project schedule, resource allocation, milestones, and a risk management strategy. A detailed work plan not only aids in organizing and sequencing tasks but also allows for better tracking and adjustment as needed, fostering a proactive and adaptable approach throughout the project's lifecycle. A detailed work plan also promotes clear communications within an implementation team.

PIs have a starting point for developing a project work plan that was articulated in their project proposals. After reviewing their proposal, a PI can identify all the deliverables described in their initial plan. These deliverables are such things as reports, presentations, curriculum modules, or new courses. PIs should then break down the deliverables into smaller discrete tasks that are required to achieve each one. For example, building a curriculum module might require research into what other ATE projects or centers have available for adoption or adaptation and getting on their college curriculum committee’s agenda for curriculum modification approvals.

After identifying these tasks, PIs need to identify who will be responsible for each task and set realistic timelines for accomplishing the task. One strategy is to work backward from the project end date. A key project management task is then to determine dependencies. Dependencies refer to the relationships between tasks or activities that affect the timing or sequencing of those tasks. That is, some tasks cannot begin until others are complete.

To complete each task in the allotted time, the PI must allocate resources, whether that be people, equipment, or funds to each task. From there, the PI creates a schedule starting with the one presented in the NSF-ATE proposal with the task details built in. From there, managing the project consists of monitoring progress, adjusting tasks and timelines as circumstances warrant and/or in response to evaluation feedback, and communicating with stakeholders, including the project’s external evaluator, with updates about progress.

Managing a project depends on keeping a master schedule with associated tasks; however, scheduling tools such as Gantt charts can be intimidating to a new PI. Developing and maintaining a schedule for small projects can be streamlined using widely available spreadsheets, like Microsoft Excel or Google Sheets, that can provide a simple yet effective solution. In a spreadsheet, the PI can create a straightforward cascading schedule as a list of tasks, then allocate time estimates for each, and arrange them in chronological order to form a basic timeline. This straightforward approach allows for easy adjustments and updates as the project progresses. Free online project management platforms such as Trello or ClickUp offer user-friendly interfaces with drag-and-drop functionalities, making it convenient to create task lists, set due dates, and visualize project timelines in a collaborative environment. These tools

provide a balance between simplicity and functionality, enabling even those with limited project management experience to develop and maintain schedules effectively for small projects.

Even the most carefully constructed and detailed work plan can be impacted by forces beyond the control of the PI. Project managers refer to these forces as risk. Without project management principles in place, a delayed shipment of equipment or a series of campus closings due to weather could derail a project and lead to PI frustration. With a work plan in place with a detailed schedule of tasks and deliverables, it is easier to identify where shifts can occur that will keep the project moving without jeopardizing the entire effort. Helping new PIs learn how to apply these kinds of project management principles may help them feel confident in their abilities to lead an NSF-ATE project to a successful outcome to benefit students, their institution, and the NSF community at large.

PI 101: The Roadmap to Success

A half-day Getting Started workshop for new grantees is held annually at a mandatory ATE Program PI conference held in late October; however, many ATE projects have start dates the preceding June or July before the annual conference. This lag time between an award start date and the conference means that new PIs may not have all the information necessary to implement their projects at a time when they may need the most support—in the first weeks and months after receiving an award. Also, due to time constraints, not all information that a new PI needs to know or things they need to do can be covered in a single, half-day workshop.

To respond to a recognized need for support for new ATE PIs, the Mentor-Connect project began providing the new PI 101 service in 2023. PI 101 consists of just-in-time media support, one-on-one help, one-to-many Zoom sessions, an in-person meeting at the ATE PI conference, and accompanying resources developed by experienced PIs, new grantees, mentors, and advisors. This new service builds on and adds to existing Mentor-Connect resources and services to guide new PIs from the time an award is received through the first year of grant-funded project management. PI 101 is designed to build PI confidence, support strong project outcomes, and stimulate interest in submitting subsequent grant proposals, with an overall goal of improving the first-year grant implementation experience for new PIs. PI 101 also helps prepare new PIs by introducing principles of project management that will help them complete their projects on time and within budget. Specific principles include organizing and managing resources, assessing risk and changes throughout the project, and monitoring progress.

PI 101: The First Cohort

The first PI 101 cohort is participating as a pilot program to study the impact of, and to identify ways to improve, this intervention. The first cohort was recruited from those colleges who were Mentor-Connect participants the previous year as they developed and submitted NSF ATE grant proposals and received 2023 grant awards (See Table #1). Special requests from collaborating projects resulted in two additional colleges being included in the inaugural cohort.

As colleges were notified of their NSF award, an invitation letter was sent to each team. The invitation included an offer from Pamela Silvers, lead investigator for the PI 101 project, to

schedule an individual Zoom meeting to answer any initial questions the PIs might have. Due to the four-month time spread associated with 2023 funding award notifications, it was critical to provide just-in-time support to participating teams as awards were received.

Grant Number	Start Date	College Name
2247777	10/1/2023	Dakota College at Bottineau
2300378*	7/1/2023	El Paso County Community College District
2247525	7/1/2023	Fullerton College
2247861	8/1/2023	Harper College (William Rainey)
2300420	8/1/2023	Illinois Community College
2301204	10/1/2023	Independence Community College
2301165	10/1/2023	Lake Area Technical College
2300497	7/1/2023	Linn-Benton Community College
2301294	10/1/2023	Merritt College - Peralta Community College
2300902	10/1/2023	Mount Wachusett Community College
2300641	10/1/2023	National Park College
2301183	7/1/2023	Santa Fe Community College
2300914*	8/1/2023	Southeastern Community College
2300513	10/1/2023	University of Arkansas Community College at Batesvllle
2300335	7/1/2023	West Kentucky Technical College
*Participant from a collaborating project and not in the 2022 Mentor-Connect Cohort		

Table 1: Cohort 1 participating colleges

At an initial face-to-face meeting in July 2023 at the NSF-ATE PI conference, PI Group Leader Pamela Silvers and Project Management professional Buffy Quinn discussed this new initiative and the importance of implementing proper project management skills to aid project success. To gauge the PIs' understanding of project management and the role it could take in helping ensure project success, Silvers sent a short questionnaire to the cohort members in November of 2023, immediately following the ATE PI Conference where PI 101 participants met in person as an "affinity group." In response to the question "Did you know anything about project management (PM) before attending the affinity group meeting on October 25?" seven of nine respondents indicated they did know something about project management through their work in industry, administrative roles they held on their campuses, from the military, and/or other grant-funded

projects. When asked about how PI 101 could help support new PIs with a short project management handbook, respondents (even those with PM experience) answered that the resource should include information related to budget management, scheduling, templates for schedule management, leadership, deliverables tracking, and getting started.

Subsequent activities followed the schedule shown in Table 2: Schedule and description of activities for PI 101 Cohort 1.

Date	Modality	Comments
August	Online Zoom	Topics included tracking activities, what is a program officer (how to communicate with, how to make requests, or how get help or advise when problems arise); budget management, drawing down funds; working with your evaluator; advisory committees and initial overview of the PI conference (signing up for and the importance of the pre-conference Getting Started workshop)
October	In person	In-person meeting during affinity portion of PI conference to answer questions, provide feedback from the Getting Started webinar, discuss project management
December	Online Zoom	Topics included preparing for annual reports, working with your evaluator and your evaluation; first year activities, communication (internal and external); common reasons for falling behind schedule and how to avoid them; handling change.
February	Online Zoom	Follow up with questions and topics; types of conferences that are organized each year, some by NSF centers, that provide opportunities for learning, networking and disseminating.
May	Online Zoom	Review of annual reports, dissemination, going forward; best practices for dissemination. Incorporating an effective communication process; managing and monitoring your team members
Summer 2024	Online Zoom	Dissemination - representatives from JATE and ATE Central invited to discuss dissemination and archiving of materials

Table 2: Schedule and description of activities for PI 101 Cohort 1

Copies of the materials presented on the Zoom calls were shared with the Mentor-Connect leadership team. Meetings were recorded with access to the recording intentionally limited to mentored team members. PI 101 cohort participants were invited to attend two webinars: one that addressed NSF-ATE annual reporting (hosted by Mentor-Connect) and another which guides prospective grantees in seeking additional ATE grant funding following their first NSF ATE award (hosted by the American Association of Community Colleges).

Challenges and Lessons Learned

Challenges: The initial plan for PI 101 assumed that all colleges would receive notification of their grant award and have start dates in summer 2023 (June, July, or August); however, 2023 was an anomaly as some colleges did not receive award notifications until September with project start dates set for October 1. NSF-issued changes in project start dates led to a modification of original PI 101 plans. For example, Zoom meetings were not going to be recorded to allow more open conversation. Since teams needed information at different times, however, it became critical that the recordings be available to provide the knowledge when needed for those with late funding notifications and amended start dates.

Another unanticipated challenge resulted from changes in personnel at the participating colleges. From the time ATE proposals were submitted (October 2022) until funding, two designated PIs left their colleges for other employment. There were also numerous changes in other personnel including Co-PIs and other project staff at several participating colleges. As a result, one of the first questions for which participating teams sought answers was how these changes should be handled.

Lessons learned: There is a greater-than-anticipated absence of fundamental knowledge about how NSF-ATE grants work, PI responsibilities, and NSF expectations among new PIs at two-year colleges. Since the PI 101 program is managed by experienced PIs, and only highly experienced and successful ATE PIs serve as mentors, those working with new-to-ATE PIs must be sensitive to what it was like when they received their first award. No level of knowledge or understanding about project or program logistics should be assumed. For example, a question asked by many teams was when they could expect the check from NSF. They did not know that there is no grant award check coming from NSF. Awarded grant funds are accessed through a system of electronic funds-transfer via a draw-down process. Others wanted to know what should be included in their letter to NSF accepting the award. With NSF, no letter is required because when submitting a grant proposal, an institution commits to accept the funds and implement the project should an award be made.

The schedule of topics introduced will also be adjusted to better benefit the new PIs. When the teams received the invitation to join the PI 101 cohort, an implementation checklist and sample press release were included in the email. Project management was not discussed with the new PIs until the first face-to-face meeting held in October. The PI 101 leadership team recognizes that waiting until October to discuss project management meant that many colleges started out less organized than would be optimal, so PM will be introduced much earlier with future cohorts.

Based on initial feedback received from this cohort of PIs in the short questionnaire and in discussions regarding the importance of using project management tools and techniques to manage their grants, future cohorts will receive a checklist for creating a work plan from their project proposals included in either the initial email or when the invitation is accepted. For future cohorts, an introductory project management guidebook or other resource will also be made available to PI 101 teams earlier in their grant-funded project cycle.

Future Research

Interviews will be scheduled with the current PI 101 teams in spring and summer 2024 to get feedback on their experience. The interviews will be facilitated by the Mentor-Connect project manager and documented by the Mentor-Connect external evaluator. This feedback will be used to make program improvements to PI 101.

Future PI 101 research will be focused on taking the program to scale. PI 101 Cohort 1 enrolled 15 teams although the original proposal plan was for 12 teams. Cohort size was increased to accommodate a higher level of interest in participation than anticipated. Mentor-Connect is committed to providing support for any ATE-funded two-year college without veteran PIs and Co-PIs. Developing strategies to effectively provide this support to a larger number of new PIs will contribute to achievement of Mentor-Connect goals. NSF program officers and other ATE-funded projects and Centers are supporting this initiative by helping to ensure targeted colleges with first-time PIs receive an invitation to participate in future PI 101 cohorts.

As the number of teams continues to grow it will be critical to have online resources available. A key new resource will be a project management handbook designed for new PIs that includes frequently-asked questions. PI 101 resources will be included in the searchable, online Mentor-Connect Resource Library (https://library.mentor-connect.org).

Support for teams not enrolled in a Mentor-Connect PI 101 cohort is also needed. To begin addressing this need, a half-day workshop will be offered in July 2024 at the High Impact Technology Exchange (HI-TEC) Conference to be held in Kansas City, MO.

Further questions to be explored include how to connect with new grantees at the opportune time for them to benefit. While new PIs for projects funded in the Small Projects for Institutions New to ATE track are the primary target for PI 101, there are other types of ATE Project funding awards made where the PI and Co-PI(s) have no NSF or NSF-ATE experience and can benefit from PI 101. Strategies for scaling up the intervention to address the needs of any first-time PI will be explored.

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