Original Research Article

Developing, Implementing and Evaluating Training for Online Graduate Teaching Assistants Based on ADDIE Model

Abstract

Graduate teaching assistants (GTAs) play an important instructional role in teaching undergrad- and graduate-level courses, yet they receive very little training. The most common form of teaching professional development to GTAs is a pre-semester workshop held at the course, department, or college level. In this study, we describe the development, implementation, and evaluation of GTA training programs using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). We used observation and interviews for data collection. ADDIE is generally used in instructional design. The results show the value of utilizing ADDIE in developing and evaluating a training program. It is intended to analyze the multi-dimensional connection of designing a training program: meeting expectations of trainees seeking to acquire skills sets as well as understanding the nuances and navigating the complex system that is needed to be successful on the job.

Keywords: Graduate teaching assistant, ADDIE model, training, training evaluation

1. Introduction

Graduate teaching assistants (GTAs) are graduate students who teach undergraduate and graduate courses in exchange for stipends and/or tuition. This is

financially beneficial to both students and universities [1]. Acknowledging that TAs report feeling that they receive insufficient supervision, guidance, and feedback in their workloads [2], the departments are devising training programs focused on departmental needs of the GTAs. The training greatly improves GTAs' confidence, self-efficacy, and pedagogical content knowledge [3, 4, 5, 6], and emphasizes the importance of providing GTAs with adequate preparation to support their roles. Still, how to best support GTAs remains uncertain [7]. They differ in content, duration, and timing of training administration. Some programs only last one weekend; others run concurrently with GTAs' first full semester of teaching. Most take place during their first summer on campus, sometimes a full year before they begin teaching [8].

The lack of a system for GTA training programs can impact organizational effectiveness and individual performance. Specific impact includes such things as a slow learning curve, higher incidence of error (assignment grading, information shared with various stakeholders), inconsistencies of workflow between various concurrently running courses, and incomplete and ineffective training. All of these impacts the morale of GTAs and overall functioning of the organization. The effectiveness of PD for GTAs therefore has far-reaching implications for student learning. Fortunately, the importance of PD programs for GTAs is increasingly being recognized by universities [5].

The existing literature on the design of GTA PD includes reports on program content, structure, and activities. With respect to PD content, PD programs have covered topics such as assessment, pedagogical methods, policies and procedures, and multicultural issues [9, 10]. With respect to PD structure, GTA PD programs have often taken the form of a onetime workshop [11, 12]. Other designs or design elements, such as GTA mentoring or receipt of teaching

feedback, are much less common [13, 14]. Also, with respect to PD activities, prior research has examined the effectiveness of activities such as microteaching [15] and teaching using skits [16]. The literature suggests that some PD design variables (e.g., training length) positively enhance changes in GTA cognition [10, 17]. Very little information, however, has surfaced in higher education that describes specific systematic processes that higher education administrators can use to evaluate the impact and effectiveness of their support of GTA training [18,19,20].

To address this gap, in this paper, we aim to describe the development, implementation, and evaluation of GTA training that fully integrates principles of human resource development, instructional design, and professional development strategies [19, 20]. We also include the evaluation of the training program after the trainees had opportunities to apply what they learned from the training. We hope that in offering details of the history, development, and content of this training program, we can aid other institutions in the planning of their own GTA preparation programs.

2. Literature Review

The ADDIE model provides high-level guidance for the development and revision of training programs of all sorts [20]. The phases of the ADDIE model are analyze, design, develop, implement, and evaluate. These phases are sequential; each depends upon the successful completion of the preceding phase. We decided to use the ADDIE model because GTAs' actual implementation of training content is not always straightforward [5]. ADDIE provides the conceptual phases of systematic training [21]. It has a proven record of determining if expertise is required for an organization to achieve important performance goals [22]. The ADDIE model also ensures the systemic connection to the organization. The unique concern of performance in the field is complemented and informed by the application of the ADDIE model [23]. Of

particular interest is the fact that both training specialists and I/O psychologists find the ADDIE framework for systematic analysis and intervention to improve human performance in organizations [24].

The *analysis phase* of the ADDIE model identifies performance gaps that can be addressed by training programs (i.e., a set of training and assessment materials, a qualified trainer, and a training audience). A performance gap is a discrepancy between a standard stipulated and employee performance [25, 26]. The analysis process helps eliminate the instruction that is unrelated to the job. Job analysis uses data from many sources, including mission statements found in regulations or locally developed statements. Instruction may also be developed as a "preventive" measure - that is, to prevent problems and to meet the informational and educational needs of personnel. The analysis of job requirements is done through occupational, job, and task analyses that result in statements of behavior, conditions, and standards for task performances. Defining training requirements includes a need analysis to determine if training is needed, assessment of a trainer's characteristics, and selection of tasks for instruction through consideration of such factors as criticality, learning difficulty, and frequency of task performance [21].

This is followed by the *design phase*, where a carefully planned approach, documented in a training outline, is prepared to address the performance gap. Also, behavioral objectives are specified in the design phase, where the training program—the training materials and the assessment materials—is developed to address the performance gap. There are four components of the development phase: identifying the objectives of the training module based on the relevant operational SOP and the training outline; preparing the training materials with special attention

to structure on-the-job training materials and e-learning materials; preparing the assessment materials; and assembling these materials into the training program [27].

In the *development phase*, the training materials are developed. As a final step in this phase, the implementation plan is revised. During this phase, instructional developers also validate each unit and/or module of instruction and its associated instructional materials as they are developed. They correct any deficiencies that may be identified and rectified. The revisions of units and/or modules occur as they are validated based on feedback from formative and summative evaluation activities [21].

During the *implementation phase*, the training materials and assessment materials are rolled out. In this phase, the instructional system is fielded under operational conditions. The activities of operational evaluation provide feedback from the field on the participant's performance [21].

The *evaluation phase* follows implementation. Evaluation is a continuous process that begins during the analysis phase and continues through the life cycle of the instructional system. Evaluation consists of the following:

- Formative evaluation, consisting of process and product evaluations conducted during the analysis and design phases, and validation that are conducted during the development phase. Formative evaluations provide data on the basis of which to revise and improve the materials, and the operation of the entire instructional system [27, 28, 29]. If the evaluation shows that the training module has shortcomings, those shortcomings are fed back to be analyzed again. Further design and development efforts follow until the module meets organizational needs.
- Summative evaluation, consisting of operational tryouts conducted as the last step of

validation in the development phase. It is an evaluation that documents the extent to which the training program meets the organization's needs. Its purpose is to permit conclusions to be drawn about how well the instruction has worked [27,28,29].

- In summary, the unique concern on performance in the field is complemented and informed by the application of the ADDIE model. Training specialists find the ADDIE framework of particular interest for systematic analysis and intervention to improve human performance in organizations [24].

2.1. Study Setting

This training session was set in an engineering department at a Tier 1 research university that recently started offering online graduate programs. The training program in this study was newly developed and focused on the training of GTAs who worked as TAs and instructional designers (IDs) for newly launched online graduate course work. These GTAs exclusively worked for the online programs and were responsible for navigating the terrain of online course development. New graduate teaching assistants (GTAs) were paired with experienced graduate assistants to learn the required skill sets necessary for running the program successfully.

2.2. Job Description of GTAs

GTAs in this department essentially worked as IDs who assisted faculty in designing and developing courses suited for online audiences. These GTAs also worked as teaching assistants (TAs) and assisted faculty in grading assignments, updating grade books, and acting as mediators between faculty and students. Therefore, they were also required to be well versed in the learning management system (LMS) moodle (moodle.org).

3. Methodology

Action research and a case study research design from qualitative research methodology was adopted in this study as the scope of case study is based on a phenomenon that is

investigated in its real context [30]. The purpose of action research is to change three things: the practitioners' practice, their understanding of their practice, and the conditions in which they practice [31]. Qualitative inquiries. in the form of observations and interviews were deemed appropriate to guide the investigation because of the opportunity to observe interactions and to listen to the views expressed by the participants during the interactions [32]. Observation is a method that facilitates the capturing of tacit knowledge (nonverbal communications, artifacts, symbols, or hidden cultures) that are an integral part of participants' daily lives [33, 34]. Additionally, the semi-structured interviews allowed the presentation of details of their experiences to reflect their multifaceted and complex realities [35].

3.1. Sample

Based on the purpose of the study in assessing the effectiveness of the training of the GTAs, all newly appointed GTAs (n=3) and the experienced GTA (n=1) were included in the study. Due to the relatively small sample size, the demographics information is not included in the article.

3.2. Data Collection Procedure

Two methods of data collection were used for this study: observation and interviews.

Observation: Three members of the research team observed and participated in a training course for newly appointed GTAs. A total of three training sessions were observed: two at the beginning and a third after six weeks, each session lasting for 6 hours on average. The training session constituted the main medium of learning about the job descriptions of the GTAs as well as being immersed in the department's and larger university culture and their approach to build new online learning programs. Though the use of participant observation is a relatively underused approach to study, it enabled us to gain first-hand experience of how the interaction between trainers (experienced GTAs) and trainees (newly appointed GTAs) went, in ways that would not

have been possible using any other method [36, 37]. During these actions, the researcher also used everyday conversation as an informal interview technique [36,38].

Interviews were used as the other data collection method. Both trainer (n=1) and trainees (n=3) were interviewed. The goal of interviewing the trainer was to understand the process of preparing training sessions and materials. The researchers gathered the information by interviewing the trainer before the training sessions began. There were three interviews conducted with the trainer lasting over three weeks. On average, these interviews took 40 – 70 minutes. The interviews were semi-structured. Finally, the researcher conducted a 75-minute interview session with the trainees (n=3). This interview occurred after trainees had the opportunity to apply the newly learned skills for six weeks. The trainees were asked about their experiences during the training session as well as the usefulness of the training for completing their jobs successfully.

3.3. Data Analysis

The three researchers who observed the training session took field notes, and they were read thoroughly by the project leader. The notes reflected the active interactions as well as non-verbal cues during the interactions. After reading the field notes, all authors discussed organizing the field notes as per the ADDIE model to monitor the training session adherence to the model.

The interviews were coded and analyzed using thematic deductive and inductive analysis according to the guidelines developed by [39]. After initial coding, themes and sub-themes were developed through researchers' immersion in the data. Resulting themes were then categorized using the ADDIE model. The researchers maintained thorough agreement throughout the process of data collection and consensus of categories, themes, and sub-themes. Therefore, standards of

trustworthiness in the research design were met through credibility, dependability, confirmability, and transferability of findings [40].

4. Results

The goal of this research was to understand the flow and effectiveness of training regarding the trainees' abilities to perform their jobs successfully. We used the ADDIE model as a framework for analyzing and critiquing this training. The ADDIE model provides high-level guidance for the development and revision of all sorts of training programs. The phases of the ADDIE model are the following: analyze, design, develop, implement, and evaluate. These phases are sequential; each depends on upon the successful completion of the preceding phase [22].

In the *analysis phase*, the trainer wrote the details of the job responsibilities based on their own experience as a GTA and further divided the job responsibilities into various tasks. Based on task analysis, the stakeholders were identified, which included the trainees, trainer, administrator, and faculty. This was then used to develop the objective of the training session. This was in accordance with ADDIE model principles [22]. This objective guided the resources that were deemed adequate to meet the objectives. The trainer identified the following as resources for the training session that all trainees needed before the beginning of the training session(s): Internet connection, moodle, articulate storyline, email address, academic calendar of the online programs and course preparation schedule, contact of key people at the department and the university, and documents related to course module development gathered from faculty. The trainer also conducted the activities to determine the competencies of the trainees by asking probing questions regarding their experience as TAs and IDs. All the trainees had different levels of competencies; however, none of the trainees said that they had advanced skill sets, so the

trainer decided to start at the basic competency level. From the analysis phase, the method of delivering training was determined. At this stage, it was concluded that it was necessary to use on-the-job training as the training delivery method. On the job training has been shown to be effective training delivery method [41]. The additional training materials were considered important supplemental materials, but demonstrating the skills while performing the job was considered most important. In the design stage, the trainer refined the materials based on the feedback from stakeholders notably the online learning coordinator, whom all GTAs reported to.

The *design* phase is the next step in the ADDIE model. In this phase, the trainer concentrated on how the design of the training can be effective in ways that facilitates the trainees' learning and interaction with the materials created for the training sessions. Furthermore, in this phase the training evolved and utilized the data that was collected in the previous phase. A carefully planned approach, documented in a training outline, was prepared by the trainer. Also, behavioral objectives were specified in the design phase by defining what skill set the trainees would master by the end of each training session. Based on the job responsibilities, the objectives of the training were identified:

- Understanding the basic function of LMS
- Uploading documents, quizzes, and other course materials on LMS
- Designing interactive e-learning courses
- Setting up the grade book
- Grading the discussion board and other assignments requiring manual grading
- Contacting and replying to students on a real-time basis
- Collecting course feedback
- Analyzing data for accreditation purposes

Since the training sessions were conducted while the trainees were on the job, a participatory training method of teaching and demonstrating tasks was selected for training delivery. The role of participatory training method has been demonstrated to be successful in academic setting [42]

The *development* phase depends on the first two phases, which are the analysis and design phases. If the previous phases are performed correctly, the development phase will be easier. In this third phase, the training materials and the assessment materials were developed by the trainer from input of all the stakeholders identified in the analysis phase. In this step, the trainer created the materials in order to show all the stakeholders, and made sure that the training material was meeting the expectations of the stakeholders. The logistics arrangements were made in advance, which included contacting all the stakeholders and registering the training for online learning consortium training. All the training materials were prepared and printed for the training session based on previous phases. The table below describes the tasks that need to be completed by GTAs before launching a course.

Table 1: Tasks that need to be completed by GTAs before launching a course

Deliverables	**Specific Tasks**
Moodle training	Preparing weekly template on moodle
	Uploading weekly content-related documents on moodle
	Designing and uploading quizzes and other assessment on moodle
	Setting up discussion board
	Grading discussion board
	Grading other assignments
	Grading self-grading assessment

	Setting up grade book
Articulate storyline training	Gathering power-point material from faculty
	Developing quizzes within articulate storylines
	Requesting voice overs
	Uploading
Accreditation purposes	Collecting questions meeting course objectives
	Calculating the number of students scoring above 80%
Other	Developing timeline before launch of course
	Contacting all stakeholders to inform them about timeline and needs from them

The *implementation* phase is crucial because in this phase, the preparation and planning get put into action. Generally, in the implementation phase, the training materials are rolled out, either provisionally in a pilot implementation or in a final implementation [21]. In this study, implementation was final. The training was conducted on the job. During the implementation phase, the team of researchers observed three training sessions. The technology needed to conduct successful training was available due to successful phases that were completed previously. Training sessions were hands-on, demonstrative, and interactive. The trainees were given the opportunity to replicate the skills learned. This ensured transfer of training. Since it was on-the-job training, the learning environment was an active, face-to-face, and hands-on experience. The trainees had the opportunity to ask questions while working on the assignments.

During the first observation, the trainer introduced the new trainees to all stakeholders such as the department coordinator, faculty, and university technology center. This exchange was not observed. This took three hours, and then the job training began with the trainer explaining the actual day of work. The first task was to share the

email address (already shared with the trainees) and job responsibilities of each stakeholder. During this time, the trainer also shared tips on how to contact each stakeholder, the response times, etc. Trainees took notes and asked a few follow-up questions. The follow-up questions were answered satisfactorily. It was then lunch time, so the trainer and trainees had a team lunch. The researcher decided not to join due to exclusivity of the lunch.

The post-lunch session started with training on LMS (moodle.org). The trainer showed the trainees the current running course as well as the future course template. The trainer demonstrated various aspects of moodle (moodle.org) such as the introduction to 'getting started week' and what materials needed to be collected for that week. At this point, the trainer emailed an example of the welcome letter and syllabus. After this, the trainer again did moodle (moodle.org) training, which included uploading documents on moodle (moodle.org) and using various sections on moodle (moodle.org) such as overview, developing quizzes, and uploading audio and video. The trainer demonstrated every function. The trainees had a few follow-up questions, which were satisfactorily answered by the trainer. The trainees didn’t get the opportunity to apply the skills learned immediately. The trainer decided to provide that opportunity the next day. The trainer then started training on specific software needed for content development. It was a very brief training that lasted less than 20 minutes. The trainer introduced the program and how it worked. The trainer also showed how to design quizzes and other aspects of the articulate storyline. After this, the trainer shared some training resources to learn more about the articulate storyline. At this time, the trainees did not have any follow-up questions. The trainees started working on the 'articulate storyline'. There were some

issues in creating articulate storylines, and trainees had to be shown how to set up certain features. Overall, the post-lunch session had more follow-up questions and needed more demonstrations than the pre-lunch session, but there were no major hurdles. Other observations included how the trainer and trainees interacted regarding the issues noticed in earlier semesters. They brainstormed what could be done about them. At the end of the brainstorm session, they came up with some solutions together.

The third observation coincided with the end of a semester and the beginning of a new semester. So, there was an opportunity to learn end-of-semester tasks. The researchers wanted to learn about interactions and training for remaining job descriptions. The trainees needed assistance with the process of collecting data for the accreditation process. The trainer demonstrated all the steps for collecting data. The trainer sent some interaction emails for collecting data and encouraged the trainees to contact the course instructors. The trainees then contacted the instructors in order to complete the task of accreditation. The trainer also taught the process of submission of accreditation to the stakeholders responsible for the accreditation process. Concurrently, the trainees were also preparing for the next module launch where they were supposed to grant access to enrolled students and contact new students with enrollment keys. This process did not require any demonstration; however, the trainer did immediately address concerns and questions asked by the trainees.

The final process in developing instructional material following the ADDIE model is the *evaluation phase*. For this study, we discuss both formative evaluation and summative evaluation. Formative evaluation provides data on the basis of which the training materials and approach were revised and improved. Formative evaluation happened immediately after each

phase, which the trainer achieved by continuously checking in with all the stakeholders about the training objectives, training materials, etc., and gathering feedback and adjusting the materials based on the feedback. The results of formative evaluation are discussed in each phase above. The summative evaluation was conducted to evaluate the effectiveness of the training. This step was undertaken to understand the perception and experience of the trainees. In order to understand the training effectiveness, the researchers interviewed the trainees after they had opportunities to apply the skills for six weeks.

All the trainees liked the trainer's training method and personality. The trainees often praised the trainer for transferring knowledge and instructing in a detailed yet concise manner. "[trainer name] always provided all information briefly and succinctly. He has all big talent, and, of course, knowledge. He is a great guy to work with." On the basis of the feedback received from the trainees, it was also possible to assess if the information provided was perceived as relevant by the trainees, met the job requirements, and was useful or applicable for them. The earlier research has showed that trainer's delivery technique and personality does affect the trainees learning [43].

All three trainees also stated that their confidence had increased not just due to the skills training but also due to the fact that the trainer explained the nuances of interacting with various stakeholders. One of the trainers said, "I liked the on-the-job training as I got a chance to learn the skills but mostly how does the department and university work together was very important to know. Here how to approach someone and build relationship is very important. I couldn't have learned it by watching a video or by reading a manual." The trainees also said that the way the training was structured increased the collaboration among GTAs. One of the trainees said, "We share the information with each other as we learn." They also received encouraging emails

from faculty and students, showing how GTAs contribute to the targeted outcome of training – successfully performing their tasks and assisting students and faculty. They said that their interactions with faculty and students had greatly improved compared to when they started the job. “I think, I can see wide-ranging improvement in my confidence and abilities. My skill has definitely improved and encouraging feedback from faculty and students has boosted my confidence to perform even better.” This finding has been demonstrated in earlier research on GTAs training, where GTAs noticed increase in ability to perform job [44]

5. Discussion and Recommendations

The training program under this study is a newly developed training program focused on the training of GTAs who work as TAs and instructional designers for newly launched online graduate course work. These GTAs exclusively worked for the online programs and were responsible for navigating the terrain of online course development. The goal of this research was to understand the flow and effectiveness of the training, and how it affected the trainees’ ability to perform their jobs successfully. In doing so, it allowed us to develop a cohesive training program by identifying the aspects of the program that needed updates in order to make it more relevant, useful, and valuable to the GTAs.

An important cornerstone in achieving the desired results was a high-quality training program. To address this challenge, we used the ADDIE model to understand the process of designing and developing a training program. This model was chosen because previous research found it particularly effective in providing developers with a generic systematic framework that was easy to use and applicable to a variety of settings [45].

This article reviews the possibilities of formative evaluation of training programs as well as any other kind of program, within the framework of the ADDIE model. It can be concluded that the formative evaluation of training programs can utilize qualitative research methodology [22]. In this paper, the possibilities of employing adaptive designs have been considered. The data gathered in that evaluative effort can at the same time be made available to decision makers during the course of the training process to allow decisions to be made about program improvement. The formative evaluation of the training module can continue until management has decided that the needs of the organization have been met. Once the formative evaluation has been completed and all necessary changes to the module have been made, it is time to move to final implementation of the training program [22].

This study also demonstrates the utilization of summative evaluation under the ADDIE framework. All the trainees were able to put their new competencies into practice immediately. The trainees independently served as TAs for multiple courses. The summative evaluation conducted through interviewing all the GTAs after six weeks provided evidence of successful learning and application of competencies., thereby meeting the goals set for the design, development, and implementation of training programs for GTAs.

5.1. Limitations and Recommendations for Future Studies

This study offers evidence for the utilization of the ADDIE model in understanding the flow and effectiveness of training programs and the trainees' ability to perform their jobs successfully. The qualitative research method was chosen due to the aim of the study and small sample size. Nonetheless, this study had a number of limitations that warrant additional research. Recommendations are presented for further research. First, quantitative data should be included in the research to support the qualitative description so that the results become more

representing. Second, this study only involved a trainer and trainees. For future studies, the participants should involve staff from other departments so that the outcome can serve more generalized evidence. Finally, longitudinal research should also examine the long-term effects of GTA training programs.

6. Conclusion

This study was undertaken in order to understand the design, implementation, and evaluation of a GTA training program at a southern university using the ADDIE model. Generally, the ADDIE model is used in instructional design domain to develop and implement a curriculum or module. Applying the ADDIE model in this case is a novel way of utilizing a training program that has historically not received much attention. Based on the research findings obtained after the Analysis, Design, Development, Implementation, and Evaluation processes, it can be concluded that the training model developed is quite effective in increasing the ability of trainees to perform their jobs successfully and efficiently.

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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