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## Using project based learning to teach applied behavior analysis knowledge and skills to pre-service teachers: A pilot study

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### Abstract

Teachers often face burnout due to stress. One stressor that can lead to burnout is classroom management and discipline problems. Applied Behavior Analysis (ABA) strategies can improve classroom management, however, there is a lack of research on teaching ABA skills. One approach to teaching new skills is Project Based Learning (PBL). This study was implemented in an undergraduate course in which participants completed a project that incorporated ABA knowledge and skills. The pre and post assessment showed positive increases, indicating that by participating in this course, participants gained a better knowledge about ABA and classroom management strategies. Results indicate participants felt more comfortable implementing ABA strategies and designing data collection procedures. In addition, this project helped participants increase professional skills.

**Keywords:** Classroom management, applied behavior analysis, project based learning

### Introduction

#### Statement of Problem

Teacher burnout is defined as, “a psychological syndrome emerging as a prolonged response to chronic interpersonal stressors on the job” (Maslach & Leiter, 2016, p. 103) [18]. Internationally many teachers face the problem of teacher burnout, which brings significant negative consequences for the teacher regarding their own health, mental health, and job satisfaction (Skaalvik, & Skaalvik, 2017; Saloviita & Parkarinen, 2021) [31, 28]. In addition, teacher burnout is linked to negative consequences for student achievement, emotional wellbeing, classroom behavior, and social skills (Garwood, *et al.*, 2018; Skaalvik, & Skaalvik, 2017; Saloviita & Parkarinen, 2021) [9, 31, 28]. Research indicates one type of stressor that often leads to teacher burnout is classroom discipline problems (Aloe, *et al.*, 2014; Dicke *et al.*, 2014; Klassen & Chiu, 2011; Klassen *et al.*, 2013; Papastylianou, *et al.*, 2009; Skaalvik & Skaalvik, 2011) [2, 7, 15-16, 27, 32].

Historically there has been a lack of comprehensive research-based classroom management strategies in teacher preparation programs and empirical research studies show they continue to be deficient (Bengy *et al.*, 2006; Moore, *et al.*, 2017; Owens *et al.*, 2017) [3, 21, 24]. Regarding management of student behavior and classroom discipline many teachers do not feel prepared and identify these as areas of concern and need (Coggshall, *et al.*, 2012; O’Neil & Stephenson, 2012; Peterson-Ahmad, *et al.*, 2018; Poznanski, *et al.*, 2018) [5, 23, 25, 26]. Although many teachers refer students for additional behavioral assessment with a school psychologist or behavior interventionist the classroom teacher is most often responsible for implementing the resulting function-based interventions (Flower, *et al.*, 2017) [13]. Interventions based on Applied Behavior Analysis (ABA) principles have been recognized as important guides for teachers to manage classroom behavior for groups of students and individual students. ABA strategies can be applied to interventions that focus on reducing problem behaviors such as, aggression, bullying, disruption, off-task behavior and property destruction (Trump, *et al.*, 2018) [33]. Some maladaptive classroom behaviors occur because the student has difficulty with skills such as communication, academic performance, safety skills, and social skills. Interventions based on ABA strategies have been effective in increasing skill acquisition in these areas. ABA includes effective teaching strategies for academics and behavior, such as descriptive praise statements, direct instruction, opportunities to respond, self-monitoring, task analysis, and video modeling (Trump, *et al.*, 2018) [33].

## Review of literature

“Behavior analysis is a natural science that seeks to understand the behavior of individuals,” (Association for Behavior Analysis International, n.d.). Behavior analysts study factors that influence the behavior of individuals and implement strategies that will help improve an individual’s behavior. There is evidence that the use of Applied Behavior Analysis (ABA) has improved student’s communication and language skills, social interactions and academic skills (Makrygianni, *et al.*, 2018) [17]. ABA includes a wide range of strategies and practices that have been well established through research as effective such as discrete trial training, reinforcement, the Picture Exchange Communication System, and task analysis (Wong, *et al.*, 2015) [38]. ABA emphasizes individualized methods of assessment and interventions that are achievable and can be implemented by relevant stakeholders such as teachers (Trump, *et al.*, 2018) [33]. In addition, ABA strategies have been effective when implementing group interventions within the general education classroom (Kamps, *et al.*, 2011) [14]. For example, the Good Behavior

Game (GBG) is an ABA classroom management strategy has an extensive research base regarding its use in decreasing disruptive behavior (Bowman-Perrott, *et al.*, 2015) [4]. Implemented the GBG and found that disruptive student behavior decreased, the use of teacher praise increased, and overall positive interactions increased.

Although there is evidence-based research to support ABA strategies for classroom management and academics, many teachers are not exposed to these strategies during their college preparation programs (Moore, *et al.*, 2017; Trump *et al.*, 2018) [21, 33]. On the other hand, research shows that pre-service and teachers can successfully learn and implement ABA strategies. For example, Grey, *et al.* (2005) [11] implemented an ABA training program and results indicate all the teachers were able to conduct a functional assessment and design a behavior intervention plan. In addition, parents reported a noticeable positive change in their children (Grey *et al.*, 2005) [11]. A recent study conducted by Mrachko, *et al.*, (2017) [22] who used behaviorally-based professional development and daily email feedback to focus on teachers’ responses to student problem behavior that was maintained by teacher attention. This training provided teachers a replacement response to problem behaviors and led to a more positive classroom environment, increased teacher motivation and increased student motivation (Mrachko, *et al.*, 2017) [22]. Although there is a robust amount of research to support the effectiveness of ABA for students with and without disabilities there is a research-to-practice gap that is likely to become more significant in the future (Valentino, *et al.*, 2020) [34]. Therefore, it is even more important for pre-service teachers to be exposed to these evidence-based practices during their coursework and teacher training program.

Regarding teacher preparation, Scott (2017) [29] identified the following challenge, “the current challenges in teacher education is to consider the skills and activities necessary to adequately train teachers to manage behavior in a manner that maximizes student engagement and achievement, and to consider the likely challenges that will be confronted” (p. 98). One promising approach to train pre-service teachers and in-service teachers in new skills, such as behavior management and ABA strategies, is Project-Based Learning (PjBL). PjBL is, “a teaching method where teachers guide

students through a problem-solving process which includes identifying a problem, developing a plan, testing the plan against reality, and reflecting on the plan while in the process of designing and completing a project,” (Wurdinger *et al.*, 2007, p. 151) [36]. PjBL supports learning and research indicates preservice teachers develop research skills, collaborative skills, and learn to take responsibility for their learning (Dag, *et al.*, 2017) [6]. Wurdinger & Qureshi (2015) [37] found that in-depth projects increased student life skills, such as, time management, problem-solving, self-direction, collaboration, communication, creativity, and work ethic. In addition, Du Tiot, *et al.*, (2016) [8], reported PjBL helped participants link learning to real-life situations and helped them develop critical thinking skills. Pre-service teachers engaged in PjBL activities reported they were pleased with gains in their learning progress, increases in their knowledge base, and they were able to successfully use knowledge gained in their practice (Dag, *et al.*, 2017) [6].

Historically PjBL has not been included in teaching or implementing ABA strategies. However, the many advantages of PjBL such as, enhanced student motivation, learning of various skills, good preparation for a professional career, suitability for a wide range of students and learning styles, suitability for the information age, changes in the roles of lecturers and students, collaborative work, and utilization of various evaluations, could be conducive to teaching ABA strategies (Shpeizer, 2019) [30]. The purpose of this research project was to evaluate the use of PjBL to increase students’ ABA knowledge of ABA strategies. It is expected that teaching pre-service and in-service teachers ABA strategies through PjBL could enhance their knowledge of ABA strategies and increase implementation of ABA strategies in the classroom setting which could lead to decreased problem behaviors, increased student engagement, increased student achievement, greater job satisfaction, and reduced teacher burn-out.

## Research questions

1. Would participants increase their knowledge of ABA strategies through the completion of a Behavior Change Project (BCP) that incorporated PjBL learning strategies?
2. Would participants become more comfortable designing and implementing interventions that incorporated ABA strategies through the completion of a BCP that incorporated PjBL learning strategies?

## Methods

### Participants

Twenty-two participants were undergraduate students who were enrolled in a regional university. Participants were enrolled in a sixteen-week undergraduate online Applied Behavior Analysis course. An email was sent out to all students containing details of the research study and requested students’ permission to use their survey responses. If students chose to participate, they signed a consent form and submitted the consent form to a drop box located within the course. With the consent rate of 52%, twenty-two participants signed consent to participate including twenty-one females and one male. Fifteen (68%) participants worked in a school setting, day care setting, or therapy setting. All course material, interactions, and assignments were disseminated and submitted in an online format. Race/ethnicity and age data was not collected.

### **Description of research project**

Throughout sixteen-week asynchronous online course participants attended online lectures, accessed recorded lectures, accessed instructional materials, and completed the BCP. All course materials were available for reference during the entire course. Assignments were submitted on a weekly basis and participants accessed the course independently. Participants submitted assignments to discussion boards and a course drop box. Participants received feedback from peers and the professor. For the BCP participants were required to plan, implement, and revise an intervention to affect change on a functional living skill of an individual in their environment based on data. Examples include, getting a child to complete homework independently, helping an individual stop biting their fingernails, getting an individual to put clothes in the clothes hamper, helping child sleep in their own bed. Components of the BCP and assignments related to the BCP are described below. All assignments were collected through the Desire to Learn<sup>®</sup> platform.

### **Behavior change project components and assignments subject and behavioral objective**

For this component of the BCP participants submitted two assignments, a discussion board assignment and dropbox assignment. Participants submitted their behavior objective to a class discussion board and submitted an additional assignment to a drop box. The behavior objective submitted to the discussion board participants were required to write an objective that consisted of four components: Learner, target behavior, conditions, and criteria. Participants had to specifically identify the learner, for example, John. The target behavior had to be stated in specific, measurable, and observable terms, such as place clothes in hamper or complete homework. Participants were required to identify the conditions in which the target behavior would occur, such as when changing clothes or when given one verbal prompt. Finally, participants had to identify the criteria for success. The criteria set the standard for minimally acceptable performance and specified the level of student performance that would result from the intervention (Alberto & Troutman, 2017)<sup>[1]</sup>. Examples of criteria include, complete all steps, 100% accuracy, and label all 15 objects. Once participants submitted their behavior objective to the discussion board, they were required to respond to one peer's post by giving feedback on the peer's behavior objective.

In addition, the participants submitted an assignment to a drop box. For this assignment participants described the topic of their BCP, the importance of the topic, and the behavioral objective. The participants were required describe their topic and state the functional importance of increasing the target behavior or a replacement behavior. Next, participants were required to develop an operational definition of the target behavior, in which they provided, "observable and measurable characteristics of the motor performance of the behavior," (Alberto & Troutman, 2017)<sup>[1]</sup>. For the final part of the assignment participants submitted the same behavior objective they submitted to the discussion board. The behavior objective was required to include four components: Learner, target behavior, conditions, and criteria. For this assignment participants received feedback and guidance from the professor. After viewing feedback from the discussion board assignment and

dropbox assignment participants revised their behavior objective as needed based on feedback from peers and the professor.

### **Recording method**

Participants identified the recording method that would be used for the BCP. Participants were required to submit a data collection assignment to a dropbox and they received feedback from the professor. The assignment required participants to submit their revised behavior objective, a narrative description of the proposed data collection method, and an example of the data collection chart. Examples of data collections method included: Permanent product recording, observational recording, event recording, duration recording, and latency recording. Participants were required to justify why they chose a specific data collection method. For example, a participant chose latency recording to record the number of minutes it took their subject to begin getting dressed each morning after they were given a prompt to wake up. The participants received feedback from the professor and participants revised their data recording system as needed. After receiving feedback, participants began collecting baseline data.

### **Baseline graph and Narrative**

Participants were required to submit a graphing assignment to a drop box. For the assignment participants created two baseline graphs in a computer program. Participants were required to create line graphs, label the x-axis, label the y-axis, and give the graph a title. For the Baseline Narrative participants were required to provide a description of their baseline data, such as the target behavior increased, decreased or remained stable. Participants received feedback from the professor.

### **Description of intervention and description of reinforcement**

Once baseline data was collected, participants developed and implemented an intervention to increase the target behavior or a replacement behavior. Participants were required to describe their intervention, the type of reinforcement used, and the schedule of reinforcement that would be used. The intervention had to be age appropriate. The participant was required to use positive reinforcement. The reinforcer was required to have a history of increasing the target behavior or the replacement behavior and the reinforcer had to of value to the subject. Examples of reinforcers included, edibles, praise, stickers, activities, and tokens that could be exchanged for an item or activity. In addition, the proposed schedule of had to be appropriate. Participants could use a continuous schedule of reinforcement or an intermittent schedule. Participants were encouraged to initially use a continuous reinforcement, in which the subject received reinforcement after every occurrence of the target behavior or pre placement behavior. The assignment was submitted to a drop box and participants received feedback from the professor.

### **Intervention graph and Narrative**

Once the intervention was implemented participants began data collection. Participants were permitted to modify the intervention, reinforcement, or reinforcement schedule. If participants modified any of these aspects, they were to note the date of the change so that the intervention graph would

reflect the changes. Once participants collected data for at least four weeks of the intervention phase they provided an intervention graph. For the intervention graph, participants were required to create a line graph that contained at least two phases, the baseline phase and intervention phase. The line graph had to contain a graph title, x-axis label, y-axis label, baseline data, intervention data, a vertical dashed line separating each phase. In the baseline narrative, participants described their results and any changes that were made during the course of the project. This section of the BCP was submitted within the final project submission in a drop box. The participants did not receive feedback before the final BCP was due.

**Narrative on changes**

Participants submitted this section of the BCP in the final project submission in a drop box and they did not receive feedback before the final BCP was due. Participants were required to describe any changes made during the BCP in order to increase the target behavior or replacement behavior. For example, they may have changed the reinforcer from stickers to an edible. If the participant did not make changes during the intervention phases they described possible changes that could be made for a different subject.

**Self-management**

The participants were required to describe possible strategies for self-management and generalization of the target behavior, such as, introducing natural maintaining contingencies, goal setting, teaching the subject to track their own behavior, and self-reinforcement. Participants submitted this section of the BCP in the final project submission in a drop box and they did not receive feedback before the final BCP was due.

**Self-evaluation**

For the final section, participants provided a description of their BCP’s strengths and weaknesses. They addressed concerns and described changes and alternative strategies they could possibly use in the future. Participants submitted this section of the BCP in the final project submission in a drop box and they did not receive feedback before the final BCP was due.

**Data collection and analysis**

Participants completed a Project Survey before the project began as a pre-assessment. At the end of the course, participants completed a Post-Project Survey. These two surveys were identical, consisting fourteen multiple choice

questions in which participants rated their familiarity with ABA, functional behavior assessments (FBA), behavior intervention plans (BIP), classroom management strategies, and data collection methods on a four-point Likert scale, ranging from “Not familiar at all” to “Very familiar.” Participants were also asked to rate their level of comfort about conducting a FBA, developing a BIP, implementing a BIP, implementing classroom management strategies, designing data collection procedures to address academic concerns, designing data collection procedures to address behavior concerns, collecting data on a four-point Likert scale ranging from “Not comfortable at all” to “Very comfortable.” In addition, the survey asked participants the importance of collecting data on academic performance and student behavior on a four-point Likert scale, ranging from “Not important at all” to “Very important.”

The quantitative data analyses were conducted using the SPSS statistical package (version 27). The Wilcoxon Signed Rank test was used to compare the differences in participants’ responses on both pre- and post-survey. It is hypothesized that participants have significant increase in their knowledge and confidence in ABA strategies. Alpha level of .5 is used to determine the significance level.

**Results**

Once participants completed both the pre- and post-project surveys, Wilcoxon Signed Rank Test was used to determine if there was a statistically significance between pre- and post-project survey results. The average scores of participants’ responses for both pre-survey and post-survey are presented in the table below (See Table 1). Regarding the first research question, “Would participants increase their knowledge of ABA strategies through the completion of a Behavior Change Project (BCP) that incorporated PjBL learning strategies,” Wilcoxon Signed Rank Test showed that there was no significant difference between pre- and post-survey. In regards to second research question, “Would participants become more comfortable designing and implementing ABA interventions that incorporated ABA strategies through the completion of a BCP that incorporated PjBL learning strategies,” Wilcoxon Signed Rank Test showed that although participants felt more confident and comfortable, these increases in their confident level or comfort ability level are not statistically significant. Overall, Wilcoxon Signed Rank Test showed that there was no significant difference between pre-survey and post-survey. The post-project survey showed slightly increasing on items 3, 5, 6, 8, 9, 10, 12, 13.

**Table 1:** Behavior Change Project Results

Behavior Change Project	Pre-test Mean (1-4)	Post-test Mean (1-4)
1. How familiar are you with Applied Behavior Analysis?	1.96	1.96
2. How familiar are you with Functional Behavior Assessments (FBA)?	1.77	1.73
3. How comfortable are you with conducting a FBA?	2.00	2.04
4. How familiar are you with Behavior Intervention Plans (BIP)?	2.58	2.58
5. How comfortable are you with developing a BIP?	2.23	2.27
6. How comfortable you with implementing a BIP?	2.77	2.85
7. How familiar are you with classroom management strategies?	2.62	2.62
8. How confident are you with implementing classroom management strategies?	2.81	2.85
9. How comfortable are you with designing a data collection procedure to address academic concerns?	2.27	2.31
10. How comfortable are you with designed a data collection procedure to address behavior concerns?	2.38	2.42
11. How comfortable are you with collecting data in regards to student’s academic performance?	2.46	2.46

12. How comfortable are you with collecting data in regards to student behavior?	2.85	2.88
13. How important is collecting data on student's academic performance?	3.62	3.69
14. How important is collecting data on student's behavior?	3.62	3.62

**Discussion**

ABA strategies and practices have shown to be effective in improving student's classroom behavior, communication and language skills, social interactions, and academics (Smith, 1999) [39]. However, many teacher preparation programs do not provide participants with instruction on behavior management or assessment practices (Begeny & Martens, 2006) [3]. Hence, it is not surprising that many teachers do not feel prepared to design and implement student intervention plans or classroom discipline strategies (Coggshall, et al., 2012; Giallo & Little, 2003; Melnick & Meister, 2003; Melnick & Meister 2008; O'Neil & Stephenson, 2012; Veenman, 1984) [5, 10, 19-20, 23, 35].

While these results do not show statistical significance in participants gaining knowledge or becoming more familiar with ABA, FBAs, BIPs, and classroom management, they do indicate participants felt more confident and comfortable when implementing ABA strategies. Specifically, participants felt more confident and comfortable with conducting a FBA, conducting a BIP, implementing a BIP, implementing classroom management strategies, designing data collection procedures, and collecting data after completing the BCP. The BCP required participants to gather data, develop an object, implement a BIP, record data, and make decisions based on the data. Throughout the BCP participants received feedback from the professor and peers. Through completing the BCP and collaborating with peers, participants reported they were more comfortable implementing classroom management strategies. This adds to previous research indicating that pre-service and in-service teachers can learn ABA strategies, conduct an FBA, and design a BIP (Skinner & Hales, 1992 & Grey, et al., 2005).

**Limitations and Recommendations**

These small increases could be due to the fact that the researchers did not take into consideration that most of the participants were already employed as a paraprofessional in a school system and had come into some contact with behavior management terms and strategies. There is the possibility the participants were overconfident in their knowledge of ABA and skills. Therefore, on the pre-project survey they could have overestimated their knowledge and skills. To help with this possibility, participants could have been provided with a description or example of each rating category. For example, "a rating of very comfortable means you can conduct an FBA without assistance." Also, participants could indicate their years of experience in an educational setting on the surveys and this information could be used in the data analysis.

The results could have been impacted by the inconsistency of the Likert rating scales. Using statements of degree of agreement for all survey questions, such as "strongly agree, agree, disagree, and strongly disagree," would allow for more consistency throughout the survey.

The ABA course was only offered in an online format due to the SARS-CoV-2 (COVID-19) pandemic. The ABA course could also be offered in a face-to-face format in which students work on their projects in small groups during the class time. Working in a face-to-face format could

increase participation within the group and enhance the PjBL aspect of the BCP, therefore possibly making the BCP more effective in enhancing knowledge of ABA strategies and increasing development and implementation of interventions that incorporate ABA strategies. Future research could focus on implementing this type of project in both an online and face-to-face format and comparing results.

Finally, research indicates project-based learning enhances student motivation, time management, problem-solving, collaboration, creativity, and critical thinking skills (Shpeizer, 2019; Wurdinger & Qureshi, 2015; Du Tiot, 2016) [30, 37, 8]. However, the surveys did not access any project-based learning skills. Although the BCP did include some communication between peers through discussion boards, the project did not require students to meet in groups or do any in-depth discussions and analysis of the project components. In the future, the BCP could be include grouping students into small groups and requiring a more in-depth analysis of project components. In addition, the surveys should include questions to access possible skills gained through the PjBL process.

**Conclusions**

Teachers report they do not feel prepared to implement BIPs or classroom management strategies and identify this as an area of need. ABA provides a vehicle that will help teacher's implement intervention strategies. By completing a BCP that focused on ABA skills and strategies participants felt more confident and comfortable with conducting a FBA, conducting a BIP, implementing a BIP, implementing classroom management strategies, designing data collection procedures, and collecting data after completing the BCP. Future research needs to focus on implementing ABA projects and developing more effective surveys. Using a project, such as the BCP, teachers could enhance valuable skills such as time management, problem-solving, collaboration, and critical thinking skills. Future research should focus on incorporating more collaboration between peers and accessing PjBL skills. Overall, this pilot study demonstrated that the BCP helped pre-service teachers to become more confident and comfortable with implementing behavior management strategies.

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