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GROWING TOGETHER: ENHANCING ABA PRACTICES THROUGH HORTICULTURE TRAINING FOR PARENTS AND SPECIALISTS OF INDIVIDUALS WITH DISABILITIES

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ABSTRACT
The aim of the study was to measure the effectiveness of a program for parents and specialists that taught applied behavior analysis strategies and horticulture skills to use with individuals with disabilities. Pre- and post-assessments were used to measure the effectiveness of the training program. The results indicated that the program was effective in improving both parents' and specialists' skills.

1. INTRODUCTION

Applied behavior analysis (ABA) strategies can be used to improve learning and training (BACB, 2022). ABA is often used to teach individuals with autism spectrum disorder (ASD; Baer et al., 1968; Cooper et al., 2007). The reasons for its effectiveness include planning reasonable and measurable goals and assessment using direct and useful measurement to ensure that the goals are met. ABA training can be useful for parents (Fisher et al. 2020) as well as for professionals.

The literature has also shown that horticulture can have benefits for individuals with developmental disabilities. Beela and Thankappan (2021) examined the effectiveness of a horticultural therapy program to improve emotional intelligence in 44 children with ASD aged 10–15, and the results indicated that the intervention was effective. Nevil and Beela (2023) examined the effects of horticultural therapy on the social intelligence of 10 individuals with ASD aged 16–24 and found that six participants showed remarkable changes in social intelligence. Therefore, it can be concluded that horticulture can improve social intelligence in people with ASD. Horticultural activities can be used in different settings, such as home, school, care centers, and so on. However, the research is very limited when it comes to using ABA strategies to train professionals and parents to use horticulture. Therefore, the purpose of this study was to examine the effectiveness of an ABA training program using a horticulture lesson for parents and specialists working with individuals with disabilities.

1.1. Research Question:

What is the effectiveness of an ABA training program using a horticulture lesson for parents and specialists working with individuals with disabilities?

2. LITERATURE REVIEW

Research on effective instructional strategies for students with disabilities emphasizes structured, evidence-based interventions. Fisher et al. (2020) conducted research on ABA interventions for students with ASD and found that manualized ABA programs delivered 24% better outcomes for skill acquisition than nonstructured teaching approaches, which achieved 9% outcome improvement. The research also found that manualized program usage among ABA providers reached only 15%, although the study demonstrated their effectiveness in teaching skills. Hsiao and Petersen (2019) examined the extent of evidence-based practices (EBPs) in special education teacher training for ASD. Their survey of 63 teachers found that only 40% of the identified EBPs were effectively included in training programs. While 60% of participants reported that some EBPs were either "taught through direct instruction" or "discussed," 20% of the EBPs remained unaddressed. This suggests gaps in both pre-service and in-service teacher training. These studies collectively indicate that structured, evidence-based approaches and horticulture-based activities can improve learning and social outcomes for students with disabilities. However, gaps in teacher and therapist training must be addressed to maximize these benefits.

3. METHODOLOGY

This study used a case experimental design, which can be used to test the effectiveness of an intervention in a small group of participants. An intervention is sequentially introduced, followed by data analysis using statistics (Krasny-Pacini & Evans, 2018). In this study, the intervention was the training program, and a web-based pre- and post-test as well as researcher observations were used to collect the primary data needed to achieve the research objectives. The test questions were designed based on Cooper et al. (2019).

3.1. Participants

Parents and specialists interested in attending the training program were invited to register via WhatsApp and support groups. Out of 60 attendees, 45 of participants were 12 parents and 33 specialists chose to participate in the study.

3.2. Ethical Considerations

This study was approved by the Scientific Research Ethics Committee

3.3. Research Procedure

Before beginning the training program, we explained that the program aimed to train participants while assessing their knowledge through a test designed for parents and specialists. The online pre-test was then administered to the participants. A post-test was conducted after completing the training to assess the knowledge gained and the effectiveness of the intervention. Both tests were completed online through a web-based.

The test introduction clarified that its purpose was to assess knowledge of using ABA and training in horticultural skills for future use in teaching students with disabilities. Participants were informed that the test would take approximately 10 minutes, and they had the freedom to complete or withdraw at any time. Additionally, the introduction emphasized confidentiality, ensuring that all collected data would be used solely for scientific research purposes. The training program was then delivered to all attendees. After completing the training, participants retook the online test to evaluate the effectiveness of the program in skill acquisition.

3.4. Setting

The study was conducted in a large conference room (46.93 m^2). This setting was chosen because it met the needs of the training and contained tables for the participants.

3.5. Materials and Tools

The materials for the horticulture activities included five tables placed in the corners of the training room, gardening gloves and tools, potting soil, pots, seeds, vegetables and fruits with seeds, and water. Other materials included data sheets (containing goals, prerequisite skills, a task analysis table, a correction table, discriminative stimuli, and total calculation), the pre-/post-assessment, and a procedural fidelity data sheet.

3.6. Dependent and Independent Variables

The independent variable in this study was the training program based on ABA. The dependent variables were (a) the pre- and post-test scores and (b) the percentages of correct responses on the data sheets.

3.7. Data Collection

3.7.1. Pre-Intervention Phase

The participants were divided into five groups. Each group was asked to use the data sheet available on their table to plan a gardening lesson and complete the following requirements on the sheet:

1. Write measurable behavioral goals.
2. List the prerequisite skills for the target behavior.
3. Write a task analysis step.
4. Demonstrate the prompt hierarchy and record it.
5. Calculate the % of correct independent responses.

No prompt was given at this point. The participants were told that this was a pre-test and that after completing the training, they would have a chance to repeat the task and compare results.

3.7.2. Intervention Phase

During the intervention phase, two trainers modeled the task step by step. One trainer acted as a teacher and the other as a student. The teacher started the session by demonstrating how to plan for the session and fill out the sheet, beginning with the long-term goal and how to write a measurable goal that contained the necessary points. They then moved to the perquisite skills needed based on the goal, then demonstrated how to write task analysis steps and how to modify them based on students' needs. Next, they demonstrated how to teach the student based on the task analysis, how to use the prompt and prompt fading procedure, how to record the responses, and how to provide reinforcement and change it based on the response. Finally, they taught participants how to calculate the student's performance in % and graph it.

3.7.3. Post-Intervention Phase

The post-intervention phase was identical to the pre-intervention phase. The participants in each group were asked to use a new copy of the same data sheet to plan for a gardening lesson and complete the same list of requirements.

3.7.4. Checklist (Observation Form)

We observed each group's performance during all three phases and recorded scores via a checklist based on the pre-intervention data sheet.

3.8. Interobserver Agreement

Both researchers independently observed and recorded the groups' responses throughout the training program. Interobserver agreement between the two researchers was measured using the point-by-point method (Cooper et al., 2007), dividing the number of agreements by the total number of opportunities and then multiplying the result by 100. The final interobserver agreement percentage was 100%.

3.9. Procedural Fidelity

Procedural fidelity was assessed for the delivery of the training program, and the final score was 100%. The number of "Yes" responses, indicating correct implementation of the program, was divided by the number of total elements, then multiplied by 100.

3.10. Social Validity

Social validity was evaluated through a survey that measured participants' overall satisfaction with the program, as well as asking if participants were going to apply what they learned from the program and if they had any additional suggestions for the program.

4. RESULTS

The results of this study are discussed in two parts: first, the statistical analysis for the participants' pre- and post-test scores, and second, the scores for the five groups' completion of the data sheets.

4.1. Statistical Analysis about self-reported knowledge of ABA and horticulture

The Statistical Package for the Social Sciences (SPSS) version 28 was used to code the test items and analyze the responses. Descriptive and inferential statistical methods were used. Cronbach's alpha coefficient of 0.791 indicated that the test had a high level of reliability to collect the primary data needed in this study.

4.1.1. Participants' Demographic Characteristics

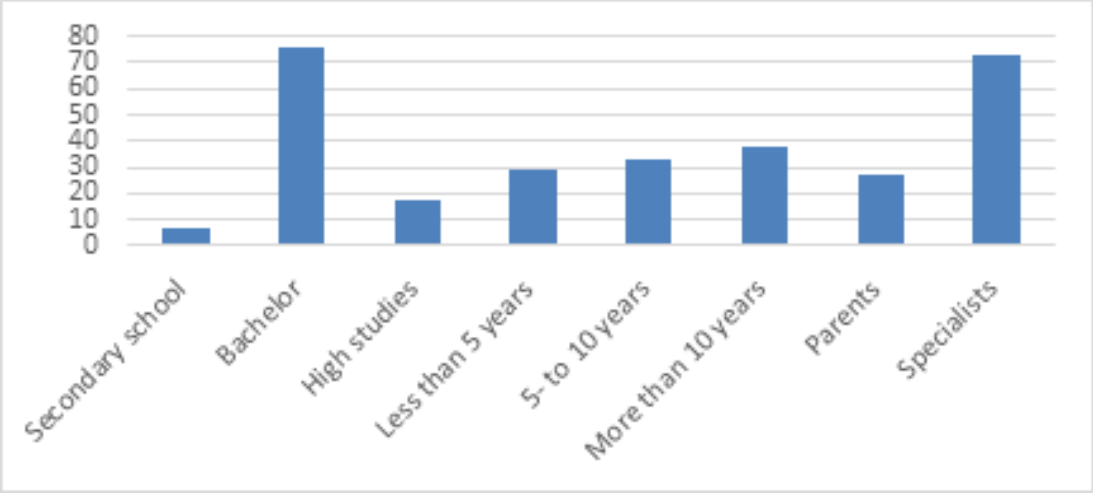

Figure 1: *Demographic Characteristics*

4.1.2. The Effectiveness of the ABA Training Program

T-test techniques were used to assess the mean test scores for all participants before and after the training program (Table 1).

Table 1: *Pre- and Post-Test Score Statistics*

Measurement	Mean	*SD*	*t*-test	Degrees of freedom	*p*-value
Pre-training	6.71	6.43	-31.36**	88	0.00
Post-training	37.96	1.83			

**Indicates that the difference is significant at (0.01).

The *t*-test statistic was -31.36, which was statistically significant at the 0.01 level. Thus, there was a significant difference between the mean test scores before and after the training program. Therefore, we concluded that the results supported the effectiveness of the training program.

An additional *t*-test was run to answer the questions "Are there significant differences between pre-test and post-test scores regarding ABA/ scores regarding horticulture activities? The results confirmed that there were significant differences between the pre- and post-test mean scores for both ABA and horticulture activities (Table 2).

Table 2: *Pre- and Post-Test Score Statistics by Topic*

Measurement	Mean	*SD*	*t*-test	Degrees of freedom	*p*-value
Applied behavior analysis					
Pre-training	4.45	3.68	-27.95**	88	0.00
Post-training	21.07	1.51			
Horticulture activities					
Pre-training	2.68	3.53	-24.784**	88	0.00
Post-training	16.89	1.51			

** Indicates that the difference is significant at (0.01).

4.1.3. Comparing ABA Scores Between Parents and Specialists

The results of the A *t*-test showed no significant difference between parents' and specialists' mean scores, as the *p*-value was greater than 0.05.

Table 3: *Post-Test ABA Score Statistics for Parents and Specialists*

Subject	Mean	*SD*	*t*-test	Degrees of freedom	*p*-value
Parents	21.00	1.80	-0.176	43	0.86
Specialists	21.09	1.42			

4.1.4. Education Level

The analysis of variances (ANOVA) test was run. Significant differences were found in pre-test scores, but not in post-test scores. Thus, education level had no influence on individuals' performance in regards to ABA strategies on the post-test.

Table 4: *ANOVA to Examine Significant Variations in Education Level*

Source	**Sum of squares**	***df***	**Mean squares**	***F***	***p*-value**
Pre-test					
Between groups	112.182	2	56.091	4.885*	.013
Within groups	470.727	41	11.481		
Total	582.909	43			
Post-test					
Between groups	5.271	2	2.635	1.159	.324
Within groups	95.529	42	2.275		
Total	100.800	44			

*Indicates that the difference is significant at the (0.05) level.

4.2. Completion of Data Sheets

Figure 2 shows the five groups' scores on the data sheets before and after the training intervention. The blue is pre-intervention and orange is post.

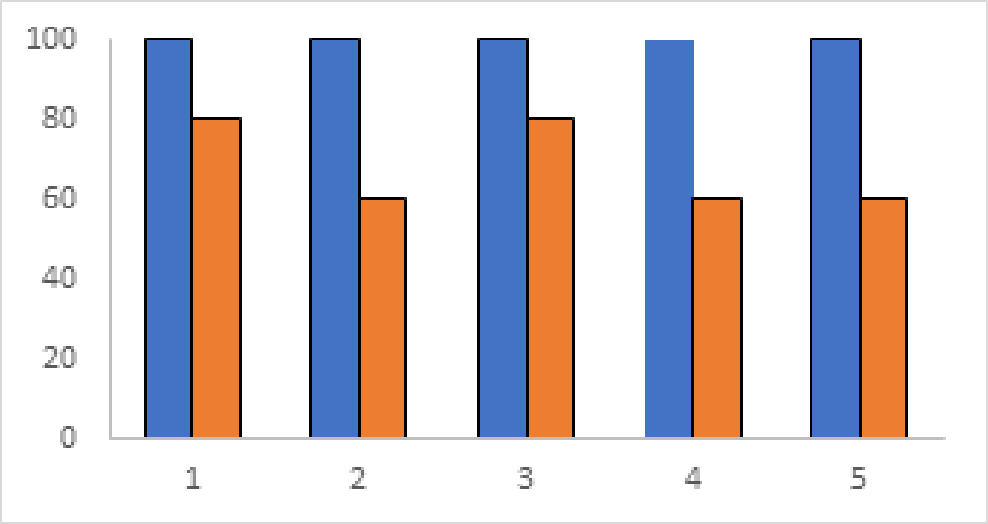

Figure 2: *Data Sheet Completion Scores Pre- and Post-Intervention by Group*

4.3. Social Validity

The results of the social validity survey indicated that 95% of the participants were satisfied with the program. In addition, 85% reported that they were going to apply what they learned from the program.

5. DISCUSSION

Overall, the research findings indicated that participants demonstrated better comprehension and implementation of ABA strategies after the training program. This study adds to the body of literature regarding horticulture training using ABA for individuals with disabilities. The ABA-based training improved both knowledge levels and skill development for specialists and parents. Data analysis showed that the participants demonstrated significant competency gains after the training. These results are consistent with those of Ingersoll et al. (2020), who found that ABA training substantially improved caregivers' ability to execute behavioral interventions. Our findings are also consistent with those of Fisher et al. (2020), who established the effectiveness of virtual ABA training by showing a 42% improvement in parent implementation accuracy from an online training program. The results from the current study, which used face-to-face training, showed a 31.25-point increase in mean test score after the program, suggesting that in-person training delivers results similar to online training. Unlike Hsiao and Petersen (2019), the current study found that the training's effectiveness remained consistent across education levels. Hsiao and Petersen (2019) reported that direct instruction in ABA practices occurred only in 60% of teacher education and in-service training programs. The current study's ANOVA analysis revealed significant differences by education level on the pre-test but not on the post-test.The success of the ABA training was not dependent on participants' academic background, thus demonstrating its capability to serve learners of various educational levels.

5.1. Implications of Findings

The results from both the online assessment and researcher observations showed that the ABA-based training in this study successfully improved participants' ability to teach horticulture lessons to students with disabilities. Parents and specialists achieved similar outcomes on the post-test after the training program. This result supports the notion that ABA training works equally well for learners regardless of their educational background, thus enabling its broad application scope.

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