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Abstract

In this study, 188 master-level students received training through a distance education course to conduct functional behavioral assessments (FBAs) and behavior support plans with 68 boys and 6 girls (aged 3-20 years) displaying persistent behavior problems in inclusive preschools, elementary and secondary schools. In the course, master-level students' scores on an FBA knowledge test increased from 13.2% to 68.8% correct. Changes in pupils' target behaviors were evaluated with a total of 114 AB single-subject designs and combined data with one-group pretest-posttest designs. Comparing medians of means, disruptive behaviors decreased by 77.8% and aggressive behaviors by 88.7% while task engagement increased by 91.5% after intervention. Nonparametric Wilcoxon signed-ranks tests for related samples showed that changes were statistically significant for all groups with sufficient sample sizes. Adjusted effect sizes ranged from $d = 0.5$ to 1.6. Results indicate that positive changes in student behavior problems can be attained with function-based interventions conducted by teams trained through a distance education course.

Keywords: Functional behavioral assessment, behavior problems, inclusion, positive behavior support, distance education

Distance Training in Function-based Interventions to Decrease Student Problem Behavior: Summary of 74 Cases from a University Course

Schools face the challenge of providing an increasingly diverse group of students with quality education in inclusive school settings. Many students, with or without disabilities, engage in challenging behavior, such as disruptiveness, non-engagement, or aggression, that significantly interferes with their learning and/or prosocial interactions with others (Beaman, Wheldall, & Kemp, 2007; Powell, Fixsen, Dunlap, Smith, & Fox, 2007). Without effective intervention, problems can escalate to the point of students dropping out of school, even despite average or above intelligence (Bradley, Doolittle, & Bartolotta, 2008). Moreover, student problem behaviors interfere with other students' learning and are considered among the most difficult aspects of teaching (Björgevinsdottir & Petursdottir, 2014; Westling, 2010).

Given the wide-ranging detrimental effects of persistent challenging behavior, effective approaches to decreasing those problems are crucial. Function-based interventions have been found to effectively reduce student behavior problems (Gage, Lewis, & Stichter, 2012; Goh & Bambara, 2012). However, comprehensive staff training in those methods with on-site expert guidance is not always feasible. This study set out to describe what changes could be attained through a distance education course, both in terms of graduate students' knowledge of function-based interventions and changes in pupils's problem behavior associated with teams of graduate students implementing those interventions without on-site expert consultation.

Function-based Interventions

Interventions based on a functional behavioral assessment (FBA) constitute an effective approach to decreasing student problem behaviors (Gage et al., 2012; Goh & Bambara, 2012). An FBA involves systematic collection of information and observations to identify triggering antecedents and maintaining consequences of problem behaviors as well as setting events that increase the likelihood of their occurrence (O'Neill et al., 1997). Determining the maintaining consequences is essential because they represent the function of the problem behavior for the student in a given situation. A main goal of function-based interventions is to teach or strengthen appropriate replacement behaviors that serve the same function as problem behaviors.

Research has shown function-based interventions to be more effective than interventions that do not take into account maintaining consequences of problem behavior (Bellone, Dufrene,

Tingstrom, Olmi, & Barry, 2014; March & Horner, 2002). Also, function-based interventions have been found to effectively decrease behavior problems and/or increase task engagement of students in general education environments at different school-levels: preschool (Blair, Fox, & Lentini, 2010; Blair, Umbreit, Dunlap, & Jung, 2007; Wood, Ferro, Umbreit, & Liaupsin, 2011), elementary school (Gage et al., 2012; Lane, Umbreit, & Beebe-Frankenberger, 1999; O'Neill & Stephenson, 2009; Petursdottir, 2011; Reid & Nelson, 2002) and high-school (Lane, Kalberg, & Shepcaro, 2009; Majeika et al., 2011; Whitford, Liaupsin, Umbreit, & Ferro, 2013). Thus, function-based interventions can reduce the need for segregated placements and serve as useful tools for inclusion (Benazzi, Horner, & Good, 2006).

Most studies cited above utilized single-subject designs, as does the current study. However, meta-analyses, such as the one by Goh and Bambara (2012) have confirmed positive effects of function-based interventions in school settings. They analyzed 83 studies on FBA-based interventions conducted in elementary, middle, or high school, involving 145 participants. Overall, the interventions were found moderately effective across diverse student populations both in segregated and inclusive settings, with interventions derived from team-based decision-making yielded larger effect sizes than others. In their meta-analysis of school-based studies, Gage and colleagues (2012), function-based interventions were found to decrease problem behavior of students with or at-risk for emotional and behavioral disorders by 70.5% on average.

School Staff Training in Function-based Interventions

Despite the effectiveness of FBAs and function-based BSPs, educators often lack the skills needed to conduct them (Couvillon, Bullock, & Gable, 2010; Crone, Hawken, & Bergstrom, 2007; McCahill, Healy, Lydon, & Ramey, 2014; Van Acker, Boreson, Gable, & Potterton, 2005), as evidenced in a lack of knowledge of FBA concepts, subjective definitions of target behaviors, overreliance on punitive and exclusionary strategies, and disregard for the function of problem behavior when creating BSPs (Conroy, Clark, Gable, & Fox, 1999; Van Acker et al., 2005). Comprehensive training can increase school staff's knowledge of FBAs and BSP, as demonstrated by Crone and colleagues (2007). In their study, teams in 10 elementary and middle schools were trained through a 2-day workshop and on-site consultation over a 3-year period. After training, school professionals reported improved skills in conducting FBAs and implementing BSPs, as also reflected in scores on the *FBA Knowledge Test* (Tobin & Crone,

2005) rising from a median of 39% to 79% correct answers.

However, there is evidence suggesting that increased educators' knowledge of FBAs through training does not necessarily translate into more effective intervention planning (Dukes, Rosenberg, & Brady, 2008) or improved student behavior. Thus, it is important to also assess changes in students' problem and/or appropriate behaviors to ensure that the desired effects of the training are actually attained. Renshaw, Christensen, Marchant, and Anderson (2008) trained four elementary school teachers in conducting FBAs and BSPs with typically developing students displaying moderately challenging behavior. Training lasted 10 weeks and consisted of four 1-hour group sessions, applied activities based on assigned readings, written feedback, and two private consultation sessions at school. Through the training, teacher's knowledge of function-based support increased from an average of 61% to 89% correct answers on a multiple-choice test. Also, student outcome measures on inattentive and on-task behavior showed improvements, albeit modest, for all four students. Similarly, intensive training including biweekly on-site meetings with behavior experts over 7 months, enabled teams to decrease student problem behavior and increase their replacement behaviors in a study by Lane, Lawrence, Barton-Arwood, and Kalberg (2007).

Thus, comprehensive training in school settings has been shown to increase the knowledge and skills of educators to successfully conduct function-based interventions, as reflected in decreased student problem behaviors. However, such thorough training demands considerable time and resources (Scott, Liaupsin, Nelson, & McIntyre, 2005) and is not always feasible. Also, training in conducting FBAs and BSPs would be most beneficial early in the career of educators or during their pre-service education so that they are prepared to prevent and/or effectively tackle student behavior problems (Couvillon et al., 2010).

Research on training pre-service educators to conduct function-based support in natural school settings is limited. In one of few studies of that sort, Gettinger, Stoiber, and Kosciak (2008) trained pre-service teachers in collaborative teaming, FBA, and positive behavior support, spread over two 16-week periods, using didactic lessons, written guidelines, field-based activities, written feedback on reports, and up to weekly on-site supervision and coaching. Teams assisted elementary school teachers in conducting FBAs and BSPs, resulting in improved students' behavior after 10 to 12-week interventions. In another university-based project, Lane, Oakes and Cox (2011) prepared graduate-level students to conduct function-based interventions. The 14-

week training involved independent readings, lectures, on-site assignments guided by detailed descriptions and a site-level coach, and weekly class meetings. Gains in graduate students' knowledge were not reported, but beneficial effects were observed on pupils' behavior and academic engagement, as reported in several articles (e.g. Majeika et al., 2011).

Attending on-campus classes can be problematic for students due to distance from home, work, or other personal commitments. Thus, there has been growing emphasis on providing distance education to accommodate a broader range of students. Distance education gives more flexibility in time and place of delivery than campus-based classes and can in some instances be equally effective (Steinweg, Davis, & Thomson, 2005). Research on training in function-based interventions through distance education is limited, but has shown increased students' knowledge and ability to conduct FBAs (Pindiprolu, Peterson, Rule, & Lignugaris/Kraft, 2003). However, research is lacking on whether increased knowledge of educators obtained through distance education actually leads to reduction of student behavior problems.

Thus, it is known that function-based interventions can effectively decrease student problem behavior (Gage et al., 2012; Goh & Bambara, 2012) and that intensive staff training with on-site guidance can lead to successful application of the methods with students, reducing their problem behavior (e.g. Lane et al., 2007). However, it remains to be explored what kind of changes in student problem behavior can be attained through a distance education university course in FBAs and BSP, without expert on-site consultation. At the University of Iceland, teachers' pre-service training in function-based interventions has been part of an elective graduate-level course on emotional and behavioral difficulties since 2009. The course has involved similar training as described in previous research (e.g. Crone et al., 2007; Renshaw et al., 2008). For example, teams of master-level students have practiced conducting FBAs and BSPs with students at different school levels in collaboration with practicing teachers. However, on-site coaching has not been possible, as is often the case with university courses. It is important to assess changes in student problem behavior associated with this type of training. The goal of this study was twofold. The primary goal was to assess gains in master-level students' knowledge and ability to conduct FBAs and BSPs related to attending a distance education university course. To further reflect their increased skills in this area, the secondary goal was to describe observed changes in problem behavior and task engagement of pupils at different school levels, associated with function-based BSPs implemented by the master-level

students during the course.

Method

Participants and Setting

A total of 188 master-level students in educational studies, mostly special education, participated in the study. They were predominately female ($n = 183$; 97.3%), aged 23 to 61 years ($M = 38.1$) and the majority had at least 2 years' experience teaching, mostly at the elementary level. They worked in teams with 74 pupils (68 boys and 6 girls) who had shown behavior problems for 1 to 18 years ($M = 3.9$). Pupils were 3 to 20 years old ($M = 9.5$) and were chosen by convenience by each team and collaborating teachers. The majority (77%) attended schools in the capital region of Iceland, the rest in rural areas. Preschool pupils were 19 (15 boys and 4 girls), aged 3 to 6 years ($M = 4.1$). Elementary pupils were 42 (41 boys and 1 girl), aged 6 to 13 years ($M = 9.8$). Secondary school pupils were 13 (12 boys and 1 girl), aged 13 to 20 years ($M = 14.8$). In addition to undiagnosed difficulties, 25 pupils had previously to the study been diagnosed with attention deficit hyperactivity disorder, 12 with a learning disability, 6 with an autism spectrum disorder, 6 with speech, language, or communication difficulties, 4 with anxiety disorders, 4 with oppositional defiant disorder, 3 with developmental delays, 2 with Tourette syndrome, 1 with depression and 1 with arthritis.

Measurement and intervention took place in those settings where each participant showed the most behavior problems, according to teachers, most often in their main classroom.

Measures

FBA Knowledge Test. The *FBA Knowledge Test* (revised version, Tobin & Crone, 2005) was translated to Icelandic with authors' permission and used to assess master-level students' knowledge of FBAs and BSPs. This revised and shorter version of the FBA knowledge test contained those two multiple-choice questions and eight essay questions on FBAs and BSPs, previously shown by Tobin and Crone to discriminate the best between trained and untrained groups. Test-retest and inter-coder reliability had been found to be acceptable as reflected in 92% and 95% agreement, respectively (Tobin & Crone). A teaching assistant scored participants' answers on the test in accordance with an "Answer Key" developed by Tobin and Crone. Participants could earn 1 point for answering each multiple-choice question correctly and 3 to 4 points for each of the essay questions, or 28 points in total.

Recording sheets. Teams were provided with sheets for recording the duration of task engagement in class and the frequency of disruptive or aggressive behavior. Recording sheets included definitions with ample examples of target behaviors but teams were free to add examples as needed. Task engagement was generally defined as behavior in accordance with teachers' instruction or directions, such as working on assignments, cooperating with others, raising hand or getting task-related materials. Disruptive behavior was defined as movements, noises or gestures that hampered the ability of students to learn or the teacher to teach. For example, each instance of talking out (when directed to be quiet), poking peers or throwing objects were recorded. Aggressive behavior was generally defined as attempting to or actually hurting someone through physical contact, yelling or upsetting words. For example, each instance of pushing, hitting, pinching, kicking or using hurtful words was recorded.

Inter-observer agreement. Inter-observer agreement (IOA) was assessed in 19.4% of 1081 observations by having two team members independently record target behaviors during baseline and intervention phases. Teams were instructed to check IOA in at least 30% of observations, but that proved not always possible due to long distances between members and restrictions in video-recording student behavior. Percentage agreement was calculated as per Kazdin (1982) by dividing number of agreements with combined number of agreements and disagreements, multiplied by 100%. Overall, IOA ranged from 60% (on very rare occasions) to 100% and averaged 90.1%.

Research Design

This study involved two independent variables: the elective university course on emotional and behavior difficulties, FBAs and BSPs (described below) and the team-developed and implemented function-based BSPs, which were products of the course. Changes associated with both independent variables were evaluated with one-group pretest-posttest designs. Four dependent variables were assessed. First, the dependent variable associated with the course was master-level students' knowledge gains regarding FBAs and BSPs as measured with the *FBA Knowledge Test* (revised version, Tobin & Crone, 2005; described above). The three other dependent variables were associated with master-level students' ability to conduct the procedures as reflected in changes in disruptive behavior (dependent variable 2), aggressive behavior (dependent variable 3) and task engagement (dependent variable 4) of pupils at three school

levels. Each team of master-level students collected data on at least one of the pupil behavior dependent variables on a minimum of three occasions during baseline (A) and intervention (B) phases, thus implementing AB single-subject designs (Kazdin, 1982). Baseline and intervention data was subsequently accumulated within one-group pretest-posttest designs to evaluate observed changes in pupils' persistent behavior problems after implementation of function-based BSPs at each school level.

Procedure

This study was conducted in accordance with act 77/2000 on the The Protection of Privacy as Regards the Processing of Personal Data and registered at the Icelandic Data Protection Authority. Data was collected during spring semesters 2009 to 2014 in an elective graduate course on emotional and behavior difficulties of children at the School of Education, University of Iceland. The course was taught by the same professor each year, only with slight modifications (such as adding the latest literature to the reading list). The course had three campus-based sessions, one at the beginning of semester, one after 5-6 weeks and the third at the end of the semester. The *FBA Knowledge Test* was administered in the first session (pretest, optional to students) and again in the second session (posttest, mandatory and part of course grade). The pretest was optional because it was administered unannounced in the first class and did not count towards the grade. Students only had access to the test during testing sessions.

At course onset, students formed teams with 2-4 members, making sure at least one member was a practicing teacher or had access to a school where a participant for their project (and this study) could be found. Students also had the option of doing a solely theoretical project, without fieldwork, but nearly all opted for the field-based project. School principals were asked to nominate pupils with persistent behavior problems (having lasted 1 or more years) for participation in the study and obtain parental and teacher's written permission for pupil participation. Teams then conducted FBAs and BSPs guided by lectures (live and recorded), reading materials, interview forms, recording sheets and step-by-step instructions based on a variety of sources (e.g. Bambara & Kern, 2005; Crone & Horner, 2003; O'Neill et al., 1997; Yell, Shriner, Meadows, & Drasgow, 2009). Procedures were divided into six parts (see Table 1) and each one was turned in for feedback and grading before being conducted with the participating pupil, his/her parents and teachers. Grades were based on the quality of each part

but did not depend on observed changes in target behaviors.

Table 1.

Steps of the FBA-BSP Process Taught in the Course.

<p>1. Identify student with behavior problems</p> <ul style="list-style-type: none"> • Ask school administrator to identify student and obtain parental and teacher consent. • Describe background information and three positive traits of student. • Define problem behavior and/or replacement behavior in objective and clear terms. • Ask teacher how long problem behavior has lasted, what strategies have been tried and when/where problem behavior is most likely to occur. • State reasons why individualized function-based BSP is needed.
<p>2. a) Plan FBA with direct observation</p> <p>Send in detailed plan outlining clear, objective operational definition of target behavior(s), examples and non-examples, dimension of behavior to assess, data recording sheet, ABC recording form, description of observation procedure (when, where and who) and method to assess IOA.</p>
<p>2. b) Conduct FBA with ABC recordings and frequency and/or duration assessment:</p> <ul style="list-style-type: none"> • Describe settings where data was collected. • Summarize findings of ABC recordings (pattern in antecedents and consequences). • Summarize findings of at least 3 baseline measures (list mean and range of scores). • Create line graph displaying baseline measures (based on examples in Excel file). • List range and mean of IOA findings (of at least 30% of measures).
<p>3. Conduct FBA with indirect assessment of factors influencing the problem behavior:</p> <ul style="list-style-type: none"> • Summarize relevant information from permanent records (e.g. psycho-logical assessments, grade reports, school records on student behavior). • Interview teacher(s), parent(s), and student with forms provided (step 1 and 2 in FBA-BSP protocol). Complete baseline and ABC recordings prior to student interview to avoid reactivity. • Summarize statements of hypothesized function of problem behavior based on different sources and determine congruence in antecedents and consequences (step 3-5 in FBA-BSP protocol).
<p>4. a) Create BSP as a team (including student's classroom teacher), based on the competing behavior pathway (steps 6 and 7 in FBA-BSP protocol) and describe:</p>

<ul style="list-style-type: none"> • Procedures targeting setting events. • Changes in antecedents to prevent problem behavior. • Strategies to directly teach appropriate/replacement behavior. • Reinforcement of appropriate behavior and extinction of inappropriate behavior. • Emergency plan (if student engages in tantrum or aggressive behavior). • Ways to evaluate treatment fidelity (see step 8 in FBA-BSP protocol). • Long term and short term goals in accordance with baseline measures.
<p>4. b) Implement BSP</p> <p>After receiving feedback and making appropriate changes to BSP, start implementation and assess procedural fidelity along with target behavior(s).</p>
<p>5. Describe treatment fidelity and the effects of BSP on target behavior(s):</p> <ul style="list-style-type: none"> • Summarize findings on treatment fidelity. • Present IOA findings (percentage of measures assessed, range and mean). • Depict findings in a line graph with baseline and intervention phases. • Evaluate effects by comparing target behavior(s) during baseline and intervention phases (describing level, trend, range, and mean). Describe student's reaction to BSP. • If effects of BSP are limited, describe possible reasons and make changes to BSP that might improve behavior and/or task engagement. Implement revised BSP.
<p>6. Plan for maintenance and generalization</p> <ul style="list-style-type: none"> • Describe how BSP effects will be maintained and BSP faded out (step 9 in FBA-BSP protocol). • Describe ways to maintain and spur generalization of improvements.

The first three parts of the assignment entailed describing the participating pupil's strengths, defining the target behavior(s), analyzing pre-existing information, direct observations in problematic school settings and FBA interviews with teachers and parents (see Table 1). Teachers were interviewed using an interview form based on those presented in Crone and Horner (2003) and Ervin and Radford (1997). Parents were interviewed with a form from Crone and Horner (2003) but focusing more on pupils' strengths, setting events and possible solutions to their behavior problems. Pupil participants were not informed about the study until after baseline measures were completed to minimize reactivity. Subsequently, their consent for

participation was obtained and interviews conducted using a modified form from Kern, Dunlap, Clarke, and Childs (1994). Each team chose at least one target behavior to measure in settings deemed most problematic, usually academic lessons.

The latter three parts of the project entailed conducting a BSP, assessing changes in target behaviors, and planning for maintenance and generalization (see Table 1) guided by FBA-BSP forms from Crone and Horner (2003). Teams analyzed data and prepared BSPs based on competing behavior pathways (O'Neill et al., 1997) with instructor supervision during campus-based sessions five weeks into the course. Each BSP contained procedures directed at: a) setting events, b) antecedents, c) teaching new skills, and d) reinforcement of appropriate replacement behavior and extinction of problem behavior. Effects of BSPs were assessed in the same settings and at the same time of day as during baseline. In total, teams had 13 weeks to conduct functional assessments, implement BSPs and collect data before presenting their findings at the last campus-based session at semester's end.

Data Analysis

Data on pupils' problem behavior and task engagement collected with direct observations were extracted from teams' reports and analyzed with Excel and SPSS. Excel was used to calculate descriptive statistics, such as means and standard deviations, for each dependent variable, across different school levels and experimental phases. Since the data was not normally distributed, a non-parametric test was required to test whether changes between baseline and intervention measures were statistically significant. Thus, the means of each pupil's measures were accumulated and non-parametric Wilcoxon matched-pairs signed-ranks tests run in SPSS to assess differences between the medians of means before and after intervention.

To statistically assess the magnitude of observed changes in target behaviors associated with the BSPs, adjusted "no assumption" effect sizes (NAES, Busk & Serlin, 1992) were calculated. NAES have been recommended for statistical analysis of single-subject data (Olive & Smith, 2005; Manolov & Solanas, 2008). NAES were calculated from means of the last three measures of baseline and intervention phases (see Swanson & Sachse-Lee, 2000), taking into account autocorrelation between repeated measures using Rosenthal's (1994) formula, $(X_{\text{intervention}} - X_{\text{baseline}}) / (SD_{\text{pooled}} / \sqrt{2(1-r)})$. In the formula, SD_{pooled} is the standard deviation of the three last measures of baseline and intervention phases pooled and r is the correlation between the last three measures of baseline and intervention phases. By using Rosenthal's

formula the NAES becomes comparable to Cohen's d (Riley-Tillman & Burns, 2009).

Results

Knowledge of FBAs and BSPs

In the pretest of FBA and BSP knowledge at course onset, that 87% of students opted to take, scores ranged from 0 to 20 points, out of 28 possible points. The average was 3.7 points or 13.2% correct (median 10.7%; range: 0-71.4%). If the answers from psychology students are removed, the average decreases to 2.4 points or 8.6% of questions answered correctly, with a highest score of 28.6% correct, reflecting a low level of prior knowledge among education students. After lectures, reading and practice in conducting FBAs and planning intervention, knowledge increased to an average of 68.8% correct (median 69.6%; range: 32.1 to 100%).

Changes in Disruptive Behavior

A total of 306 baseline measures were conducted to assess disruptive behavior of 14 children in preschool, 34 pupils in elementary school and 11 pupils in secondary school, revealing an average of 15.1 disruptive behaviors per 20-minute observation sessions. After function-based BSPs had been implemented, a total of 311 measures were conducted, showing that disruptive behaviors had decreased to an average of 3.6 per 20-minute sessions. Changes in the means of each pupil's disruptive behavior from baseline to intervention phase ranged from a decrease of 100% to an increase of 21.4%. Increases in disruptive behavior were only observed in two participants, whose task engagement increased at the same time. Comparison of medians of pupils' means revealed that disruptive behaviors decreased by 51.7% to 79.3% at different school levels or by 77.8% on average (see top part of Table 2 and Figure 1). Adjusted effect sizes of function-based BSPs on disruptive behaviors were $d = 0.5$ to 1.0 or $d = 0.9$ for participants in total. Thus, effects proved to be medium to strong according to Cohen's guidelines (1988), where effect sizes around 0.20 are considered weak, around 0.50 medium and above 0.80 strong.

Table 2.

Descriptive Statistics on the Effects of Function-based BSPs on the Disruptive Behavior, Aggressive Behavior and Task Engagement of Students with Results from Wilcoxon Signed Ranks Tests and Adjusted Effect Sizes.

	School level	<i>n</i> (#)	Baseline			<i>n</i> (#)	BSP			Change in	Adj. <i>d</i>
			<i>M</i>	<i>SD</i>	<i>Mdn of means</i>		<i>M</i>	<i>SD</i>	<i>Mdn of means</i>	<i>Mdn of means</i>	
Disruptive	Preschool	14(85)	13.1	21.5	6.8	14(101)	2.4	4.8	1.6	-77.3%**	0.8
	Elementary	34(155)	16.7	17.8	9.7	34(151)	3.6	5.0	2.0	-79.3%***	1.0
	Secondary	11(66)	13.9	13.9	9.7	11(59)	5.8	7.8	4.7	-51.7%**	0.5
	Total	59(306)	15.1	18.2	9	59(311)	3.6	5.7	2	-77.8%***	0.9
Aggressive behavior	Preschool	6(31)	5.3	7.1	6.8	6(28)	1.0	1.0	1.1	-84.5%*	1.0
	Elementary	1(3)	1.0	1.0	1.0	1(3)	0.0	0.0	0.0	-100.0%‡	0.6
	Total	7(34)	4.9	6.8	5.9	7(31)	0.9	1.0	0.7	-88.7%*	0.9
Task	Preschool	6(31)	39.6	25.3	36.2	6(26)	77.4	22.1	83.5	+130.7%*	1.3
	Elementary	31(122)	39.9	27.3	43.5	31(125)	77.7	19.6	83.0	+90.6%***	1.6
	Secondary	11(49)	43.7	25.6	41.3	11(46)	68.8	24.4	60.8	+46.0%**	1.1
	Total	48(202)	40.7	26.5	41.7	48(197)	75.6	21.4	79.6	+91.5%***	1.5

BSP: Behavior support plan; *n*: Number of participants assessed; #: Number of measures; *M*: Mean; *SD*: Standard deviation

* $p < .05$; ** $p < .01$; *** $p < .001$; ‡ Statistical significance not assessed due to small *n*.

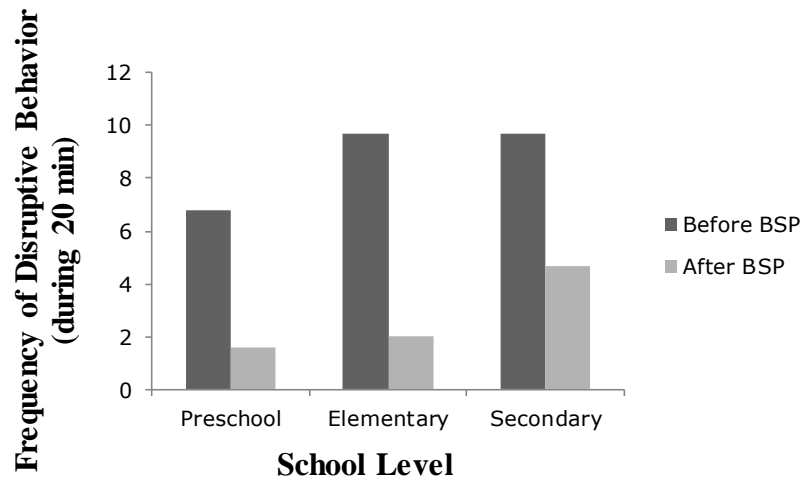


Figure 1. Median of means of disruptive behavior of preschool, elementary and secondary pupils before and after implementation function-based BSPs.

Changes in Aggressive Behavior

A total of 34 baseline measures were conducted to assess aggressive behaviors of 6 children in preschool and one pupil in elementary school, revealing an average of 4.9 aggressive behaviors per 20-minute observation sessions. After function-based interventions were implemented, a total of 31 measures revealed a decrease to an average of 0.9 aggressive behaviors per 20-minute observations. Decreases in the means of each pupil's aggressive behavior from baseline to intervention phase ranged from 38.5% to 100%. Comparisons of medians of pupils' means showed that aggressive behaviors decreased on average by 88.7%. Also, the average adjusted effect size turned out to be strong, or $d = 0.9$ (Cohen, 1988), see middle part of Table 2 and Figure 2.

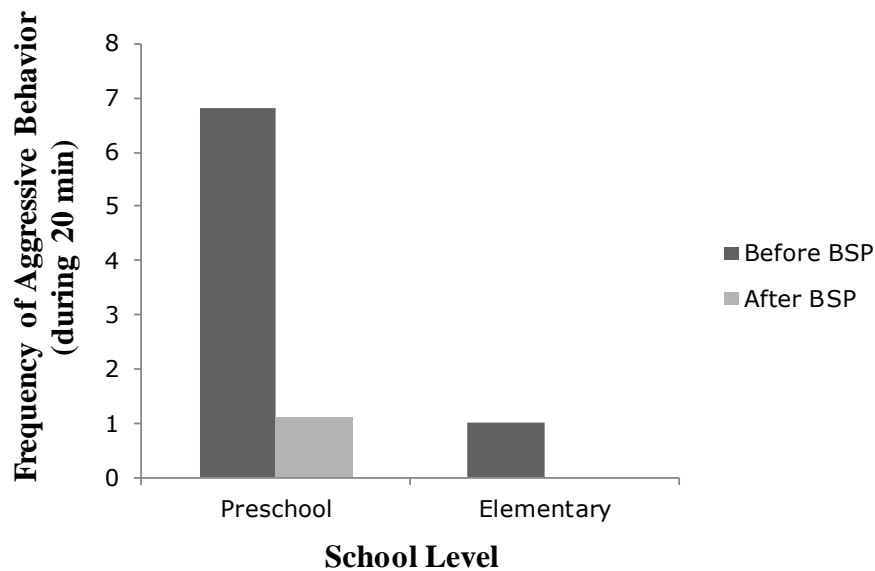


Figure 2. Median of means of aggressive behavior of preschool and elementary pupils before and after implementation of function-based BSPs.

Changes in Task Engagement

A total of 202 baseline measures were conducted to assess task engagement of 6 children in preschool, 31 pupils in elementary school and 11 pupils in secondary school, revealing that participants were on average engaged 40.7% of 20-minute observation sessions. After function-based BSPs had been implemented, a total of 197 measures were conducted, showing that task engagement had increased to an average of 75.6% of 20-minute sessions. Increases in the means of each pupil's task engagement from baseline to intervention phase ranged from 16.4% to 2392.5% (in the case when task engagement increased from 3.3 to 83%). Medians of pupils' engagement means increased by 46.0% to 130.7% at different school levels or by 91.5% on average. In preschool, medians of engagement means more than doubled, resulting in an increase larger than 100%. In all instances, adjusted effect sizes of function-based BSPs on task engagement proved to be strong according to Cohen's guidelines (1988), ranging from $d = 1.1$ to $d = 1.6$ or $d = 1.5$ for participants in total, see bottom part of Table 2 and Figure 3.

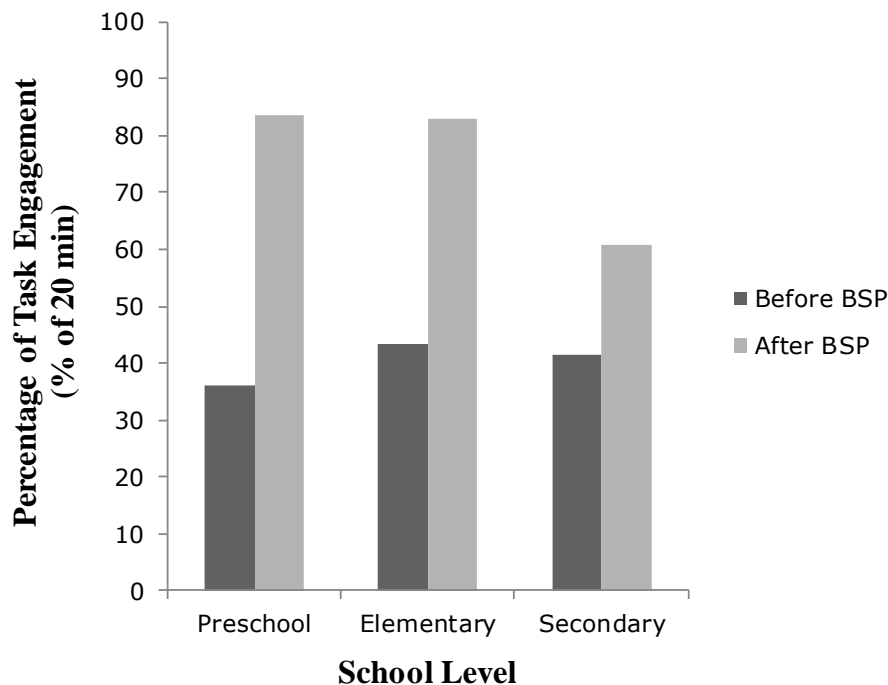


Figure 3. Median of means of task-engagement of preschool, elementary and secondary pupils before and after implementation of function-based BSPs.

Discussion

The goal of this study was to assess gains in graduate students' knowledge of FBAs and BSPs through attending a distance education university course and their ability to successfully conduct function-based BSPs as reflected in the impact on behavior problems of preschool, elementary and secondary pupils they worked with. Tests on FBA and BSP knowledge showed a distinct increase after graduate students participated in the course. Furthermore, combined data from repeated measures before and after intervention revealed significant decreases in pupils' disruptive and aggressive behaviors and increases in task engagement after teams implemented function-based BSPs as part of the distance education course.

Knowledge of FBAs and BSPs

At course onset, graduate students in educational studies seemed to have limited knowledge of FBAs and BSPs. Answers to questions on the pretest proved only 13.2% correct (and 8.6% correct with answers from psychology students omitted). Bearing in mind that the

outcome of an optional pretest probably is an underestimation, it is nevertheless strikingly low, particularly given that approximately half of the students were majoring in special education and had years of teaching experience. Their knowledge on the subject seemed to increase considerably by attending the course, as reflected in 69.6% of questions answered correctly in the posttest. With the caveat of different measures being used, it is interesting to compare these findings to those in other studies. In studies where the full version of the *FBA Knowledge Test* (Tobin & Crone, 2005) has been used, trained school professionals have been able to answer seven to eight questions out of ten correct (Crone et al., 2007; Tobin & Crone, 2005). That knowledge level is similar to the current findings, although participants in this study answered the revised version of the test, containing those items discriminating the best between untrained and trained staff. In the study by Renshaw and colleagues (2008), elementary school teachers correctly answered 61% of questions on FBAs and BSPs before training but 89% after training. It could be argued that the effects in the current study on participants' knowledge of FBAs and BSPs are comparable to those observed in previous studies, but that the knowledge base of school professionals in the United States seems to be stronger in this area than that observed among their Icelandic counterparts. In addition to different assessments of knowledge being applied in the studies (including the pretest being optional in this study), the fact that FBAs and positive behavior support are indicated by law in some instances in the US and not in Iceland, possibly plays a role in explaining this observed difference in knowledge. Presumably, FBAs and BSPs are covered to a larger extent in the US teacher pre-service education than in Iceland.

Changes in Pupils' Behavior and Task Engagement

The ultimate test of effective school staff training is whether it benefits the pupils they work with. To assess whether training provided through a university course is having its intended effects, it is important to have students practice implementing the new methods and to assess what kind of changes in their pupils' functioning they can achieve by doing so. In this study, pupils' changes in disruptive or aggressive behaviors as well as their academic engagement were assessed to reflect graduate students' ability to implement FBAs and BSPs effectively. Pupils participating in this study all had a long history of behavior difficulties. Not surprisingly, the great majority of participants were male, although the proportion (91.9%) is slightly higher than teacher estimates of 81% in previous research in Iceland (Sigurgeirsson & Kaldalons, 2006).

Some pupils had shown excessive problem behavior for most of their lives. Nevertheless, significant changes in behavior and/or task engagement were observed after function-based BSPs were implemented by the graduate students. Prior to intervention, participants on average showed around 15 instances of disruptive behavior during 20-minute observations, but after intervention only 3-4, which can be considered within a “normal” range, at least for the younger ones. The median of means of disruptive behaviors decreased on average by 77.8%, which is similar to the 70.5% reduction in problem behavior through FBA-based interventions observed in the meta-analysis by Gage and colleagues (2012). Aggressive incidents in preschool and elementary school decreased on average from around five to less than one per 20-minute observations. Task engagement at all school levels increased on average from 41% to 76% of the 20-minute observations, which can be considered an acceptable use of instructional time.

In general, findings are in accordance with previous research showing function-based interventions decreasing challenging behavior and increasing task engagement of preschool children (Blair et al., 2007; 2010; Wood et al., 2011), elementary students (Lane et al., 1999; O'Neill & Stephenson, 2009; Reid & Nelson, 2002) and secondary students (Majeika et al., 2011; Whitford et al., 2013). Large effect sizes were observed for all variables at different school levels, with the exception medium effects on disruptive behavior of students in secondary school. The smaller effect on older students' disruptive behavior could be due to a number of reasons. In their cases, problem behavior had lasted longer and thus become more resistant to change. Also, during the adolescent years, factors outside teacher control start playing a larger role in student behavior determination and class sizes tend to be larger, thus making the implementation of comprehensive BSPs harder. Nevertheless, disruptive behavior of secondary students decreased by over 50% which can be considered of practical significance. It should be noted that problem behavior targeted in this study was generally rather mild, such as disruptive behaviors rather than severe aggressive or self-injurious behaviors. Training school staff to tackle the most severe behavior problems, should include expert on-site guidance and supervision (Gage et al., 2012).

Anecdotal reports of teams indicate further positive effects of function-based BSPs, not formally assessed. For example, some pupils were partly taught in a segregated setting due to their persistent disruptive behavior in the general education environment, but were after the function-based intervention able to participate in their general classes to a greater extent, sometimes making segregated placements unnecessary. One such example is described in a case

study by Petursdottir, Arnadottir, and Björgvinsdottir (2012). Participants' perception of the intervention was not formally assessed, but some teams wrote down quotes from students, such as "I find it easier and more fun to study now that I have a star book, and I'm learning more than before". This positive perception is in accordance with previous findings on students' view of FBAs and BSPs (Arnadottir & Petursdottir, 2013).

Implications, Limitations, and Future Directions

In this study, graduate students learned to conduct FBAs and BSPs by attending a distance education course for one semester, collecting data indicating positive effects on behavior problems of pupils they worked with. Several characteristics of the course probably aided in achieving these results. First, a firm foundation was laid through lectures and in-class assignments on applied behavior analysis and then students were provided with detailed steps in conducting the procedures along a clear timeline, making the task manageable and achievable. Also, electronic assessment and intervention materials on the course website allowed teams easy access to everything needed to conduct FBAs and BSPs tailored to their pupils' needs and interest. Teacher feedback on each step prior to implementation increased the likelihood of each team conducting successful FBAs and BSPs.

However, in future training and research, it would be beneficial to require students to collect formal data on procedural integrity to ensure that FBAs and BSPs are actually conducted as intended. A more thorough assessment of procedural fidelity in this study could have aided in determining if poor implementation negatively influenced effect sizes observed at the secondary school level. Also, training could be improved by providing more intervention materials targeting older pupils specifically, in addition to resources for preschool and elementary school pupils, possibly assisting in obtaining larger effects for that age group.

Even though findings indicate positive changes in behavior and task engagement of students at different school levels in relation to function-based BSPs, this study has some methodological weaknesses that limit the generalizability of the findings. Pupils were selected by convenience, nominated for participation by school staff connected to graduate students in the study, and thus may not represent pupils with behavior problems in general. Also, pupils were only informed that they were being observed after completion of baseline measures. Thus, it is possible that participants' awareness of observations during the intervention phase affected their

behavior and that some of the changes were due to reactivity (Cooper, Heron, & Heward, 2007).

Relatedly, data was collected by team members who might have been influenced by their expectations of positive intervention effects. Assessing IOA guards against this to some extent, although the possibility that different observers became biased in a similar way cannot be ruled out. Possibly, having members from other teams assist in collecting data could reduce the risk of bias and aid in achieving higher proportions of IOA measures that sometimes proved hard to obtain due to long distances between members and restrictions in video-recording student behavior. Also, increasing team sizes or selecting pupils for participation only from places close to the residence of at least two team members could facilitate IOA assessment.

A considerable limitation is that AB designs and one-group pretest-posttest designs were used to evaluate observed changes in student behavior after function-based intervention, which is insufficient to demonstrate a true functional relationship between the variables and rule out other possibly influencing factors, such as maturation, history and testing. Due to time constraints and practical considerations, it was not possible to apply a control group or more sophisticated single-subject designs. AB designs are considered practical as a relatively quick and simple way to assess intervention effects and can despite their limitations provide useful findings (Cooper et al., 2007). In this study, students' behavior problems were reported to have lasted nearly four years on average prior to intervention despite various efforts. Even though the exact manifestation of students' behavior problems was different in each case, it wasn't until BSPs were implemented that clear improvements were observed in nearly all cases. Thus, one could say that each instance of positive change in target behavior following intervention provides a replication of effects of function-based BSPs demonstrated in previous research (e.g. Gage et al., 2012; Goh & Bambara, 2012). Still, future research should explore ways to incorporate stronger experimental control to more adequately evaluate the effects of distance education courses.

Overall, findings indicate that a distance education course without on-site guidance can enable master-level students to apply FBAs and BSPs to decrease persistent student behavior problems at different school levels. Further research is needed to confirm the findings with stronger methodology and to also assess maintenance and generalization, both of trainees' skills in applying FBAs and BSPs as well as that of students' behavior.

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Table 1.

Steps of the FBA-BSP Process Taught in the Course.

<p>1. Identify student with behavior problems</p> <ul style="list-style-type: none"> • Ask school administrator to identify student and obtain parental and teacher consent. • Describe background information and three positive traits of student. • Define problem behavior and/or replacement behavior in objective and clear terms. • Ask teacher how long problem behavior has lasted, what strategies have been tried and when/where problem behavior is most likely to occur. • State reasons why individualized function-based BSP is needed.
<p>2. a) Plan FBA with direct observation</p> <p>Send in detailed plan outlining clear, objective operational definition of target behavior(s), examples and non-examples, dimension of behavior to assess, data recording sheet, ABC recording form, description of observation procedure (when, where and who) and method to assess IOA.</p>
<p>2. b) Conduct FBA with ABC recordings and frequency and/or duration assessment:</p> <ul style="list-style-type: none"> • Describe settings where data was collected. • Summarize findings of ABC recordings (pattern in antecedents and consequences). • Summarize findings of at least 3 baseline measures (list mean and range of scores). • Create line graph displaying baseline measures (based on examples in Excel file). • List range and mean of IOA findings (of at least 30% of measures).
<p>3. Conduct FBA with indirect assessment of factors influencing the problem behavior:</p> <ul style="list-style-type: none"> • Summarize relevant information from permanent records (e.g. psycho-logical assessments, grade reports, school records on student behavior).

- Interview teacher(s), parent(s), and student with forms provided (step 1 and 2 in FBA-BSP protocol). Complete baseline and ABC recordings prior to student interview to avoid reactivity.
 - Summarize statements of hypothesized function of problem behavior based on different sources and determine congruence in antecedents and consequences (step 3-5 in FBA-BSP protocol).
4. a) Create BSP as a team (including student's classroom teacher), based on the competing behavior pathway (steps 6 and 7 in FBA-BSP protocol) and describe:
- Procedures targeting setting events.
 - Changes in antecedents to prevent problem behavior.
 - Strategies to directly teach appropriate/replacement behavior.
 - Reinforcement of appropriate behavior and extinction of inappropriate behavior.
 - Emergency plan (if student engages in tantrum or aggressive behavior).
 - Ways to evaluate treatment fidelity (see step 8 in FBA-BSP protocol).
 - Long term and short term goals in accordance with baseline measures.
4. b) Implement BSP
- After receiving feedback and making appropriate changes to BSP, start implementation and assess procedural fidelity along with target behavior(s).
5. Describe treatment fidelity and the effects of BSP on target behavior(s):
- Summarize findings on treatment fidelity.
 - Present IOA findings (percentage of measures assessed, range and mean).
 - Depict findings in a line graph with baseline and intervention phases.
 - Evaluate effects by comparing target behavior(s) during baseline and intervention phases (describing level, trend, range, and mean). Describe student's reaction to BSP.

- If effects of BSP are limited, describe possible reasons and make changes to BSP that might improve behavior and/or task engagement. Implement revised BSP.

6. Plan for maintenance and generalization

- Describe how BSP effects will be maintained and BSP faded out (step 9 in FBA-BSP protocol).
- Describe ways to maintain and spur generalization of improvements.

Table 2.

Descriptive Statistics on the Effects of Function-based BSPs on the Disruptive Behavior, Aggressive Behavior and Task Engagement of Students with Results from Wilcoxon Signed Ranks Tests and Adjusted Effect Sizes.

	School level	<i>n</i> (#)	Baseline			BSP			Change in		Adj. <i>d</i>
			<i>M</i>	<i>SD</i>	<i>Mdn of means</i>	<i>n</i> (#)	<i>M</i>	<i>SD</i>	<i>Mdn of means</i>	<i>Mdn of means</i>	
Disruptive behavior	Preschool	14(85)	13.1	21.5	6.8	14(101)	2.4	4.8	1.6	-77.3%**	0.8
	Elementary	34(155)	16.7	17.8	9.7	34(151)	3.6	5.0	2.0	-79.3%***	1.0
	Secondary	11(66)	13.9	13.9	9.7	11(59)	5.8	7.8	4.7	-51.7%**	0.5
	Total	59(306)	15.1	18.2	9	59(311)	3.6	5.7	2	-77.8%***	0.9
Aggressive behavior	Preschool	6(31)	5.3	7.1	6.8	6(28)	1.0	1.0	1.1	-84.5%*	1.0
	Elementary	1(3)	1.0	1.0	1.0	1(3)	0.0	0.0	0.0	-100.0%‡	0.6
	Total	7(34)	4.9	6.8	5.9	7(31)	0.9	1.0	0.7	-88.7%*	0.9
Task engagement	Preschool	6(31)	39.6	25.3	36.2	6(26)	77.4	22.1	83.5	+130.7%*	1.3
	Elementary	31(122)	39.9	27.3	43.5	31(125)	77.7	19.6	83.0	+90.6%***	1.6
	Secondary	11(49)	43.7	25.6	41.3	11(46)	68.8	24.4	60.8	+46.0%**	1.1
	Total	48(202)	40.7	26.5	41.7	48(197)	75.6	21.4	79.6	+91.5%***	1.5

BSP: Behavior support plan; *n*: Number of participants assessed; #: Number of measures; *M*:

Mean; *SD*: Standard deviation

* $p < .05$; ** $p < .01$; *** $p < .001$; ‡ Statistical significance not assessed due to small *n*.