

A Pilot Study Evaluating “Dojo,” a Videogame Intervention for Youths with Externalizing and Anxiety Problems

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Abstract

Objective: Externalizing problems, which are the main reason for youth referrals to mental health agencies, are highly persistent and predict a range of negative outcomes. Youths with externalizing problems are also frequently comorbid with anxiety. Among the most widely recognized evidence-based treatments is cognitive behavioral therapy (CBT). Although CBT principles seem to be sound, effect sizes remain moderate, suggesting improvements could be made to this conventional treatment approach. The main premise of the current pilot study is to investigate the feasibility of implementing a videogame intervention (“Dojo” [Gamedesk, Los Angeles, CA]) that incorporates CBT principles and aims to address the limitations of conventional CBT delivery models, with the ultimate goal of improving outcomes for this difficult-to-treat population.

Materials and Methods: “Dojo” is an emotion management game that helps youths to recognize and control their physiological and emotional arousal. We explored the implementation and user experience of “Dojo” in a sample of eight adolescents in residential treatment for both externalizing and anxiety problems.

Results: Participants attended all sessions without complaints. They evaluated “Dojo” very positively and exhibited high compliance during the training sessions. We encountered some problems with session scheduling and obtaining mentor reports. Quantitative data show the predicted decrease in three out of four measurements.

Conclusions: The smooth implementation, high user satisfaction, high self-reported compliance during training sessions, and initial outcome results all indicate the high potential “Dojo” holds as an innovative intervention. If additional rigorously designed randomized controlled trials prove to be successful, “Dojo” can be a cost-effective way to engage high-risk youths in effective intervention.

Background

EXTERNALIZING BEHAVIOR PROBLEMS are the most common reason for youth referrals to mental health agencies.¹ Early externalizing problems tend to increase in rate and severity throughout adolescence and adulthood^{2–4} and predict adverse outcomes such as school dropout, unemployment, social maladjustment (e.g., marital violence), mental health problems (e.g., psychiatric disorders, substance abuse), and criminality.^{5,6} Despite extensive attention given to the development of treatments for externalizing problems, effect sizes remain moderate at best,^{7,8} and 25–35 percent of youths fail to respond to treatment at all.⁹

There are two concomitant factors that may make some youths with externalizing problems hard to treat. First, individuals diagnosed with intellectual disability (ID) are even

more likely to show externalizing problems than their typically developing peers; they constitute 3 percent of the population¹⁰ but account for 20–25 percent of all referrals.¹¹ These youths have a lower IQ and lack adequate social skills,¹² which increases the likelihood of problems in social information processing and problem solving.¹³

Second, many youths exhibit clinical levels of anxiety in addition to their externalizing problems (referred to herein as aggressive-anxious youths); in clinical samples, comorbidity rates range from 60 to 85 percent.^{14–18} Aggressive-anxious youths tend to focus on negative and provocative stimuli, showing strong reactivity in return, and they experience difficulty controlling these responses.^{19,20} The cognitive (e.g., hostile attribution bias) and emotional (e.g., emotion regulation problems) deficits may result in impulsive, defensive reactions to real or perceived provocation or threat.²¹

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Limitations of treatment programs

The most widely recognized, evidence-based treatment is cognitive behavioral therapy (CBT),^{22–24} although CBT for externalizing problems still has its shortcomings. The most important limitations include the didactic teaching format,²⁵ the limited generalizability,²⁵ and the lack of attention paid to comorbidities, in particular anxiety.²⁶ Didactic learning relies on imparting psychoeducational information and requires some high-level cognitive processing. This complicates CBT for youths with ID, and there is little evidence that CBT has any beneficial effect on these youths.²⁷ Moreover, didactic teaching tends to be less intrinsically motivating: Engaging youths is one of the most challenging tasks faced by clinicians.²⁸ Another well-known limitation of CBT is the disparity between theory and practice—although youths may know about acceptable behavior, they often do not act upon that knowledge in emotionally challenging situations. Many treatment programs incorporate exercises such as role play,²⁹ but these rarely manage to provoke genuine emotional experiences akin to those that arise during “real life” conflicts. Finally, CBT treatment programs for externalizing problems focus mainly on aggression and largely ignore anxiety,²⁶ although the majority of these youths also exhibit anxiety.^{14–18} This is unfortunate because anxiety may play an important role in the development of externalizing behavior³⁰ and has even been suggested as the eliciting mechanism.²⁶

“Dojo”: a videogame intervention

The main objective of this pilot study is to examine the practical application of a videogame intervention as an initial step toward a full-scale randomized controlled trial (RCT). “Dojo”³¹ (developed by Gamedesk, Los Angeles, CA) focuses on emotion regulation and is intended to help youths to recognize and control their physiological and emotional arousal.

“Dojo” was developed with the aim to address several limitations of conventional treatment. First, videogames are able to impart the same knowledge as CBT but with *less thinking* and *more doing*. Not only do youths learn best by doing instead of memorizing,³² but also the cognitive load placed on players is less—unlike conventional CBT programs²⁴—which has the potential to benefit youths with ID in particular. Second, the in-game environment offers the opportunity to practice acquired strategies, fostering generalization of learned behaviors to contexts outside of the game. Third, videogames are fun, engaging, and able to elicit powerful emotions.²⁵ Thus, these games can provide the occasion for eliciting negative, often difficult-to-manage emotions, and they provide players with training opportunities for learning to regulate those emotions.

“Dojo” was designed to be a playful training to help high-risk youths learn to manage their negative emotions. Specifically, “Dojo” incorporates relaxation tutorials and integrates the teaching of emotion regulation techniques within the game. Players are provided with real-time feedback through biofeedback hardware (IOM; Wild Divine [Boulder City, NV]) that monitors heart rate and displays this information to them, which reinforces their relaxation abilities and helps them master the techniques.³³ Controlling physiological reactions facilitates success in the game, which encourages the player to learn to recognize the association between emotional arousal and physical

reactivity and to regulate physiological arousal more effectively as the game progresses.

“Dojo” has three rooms (fear, frustration, and anger), each with one or two relaxation tutorials and a challenging game that is designed to trigger the emotion in question and offers the opportunity to practice the acquired techniques. The relaxation tutorials are CBT techniques that are well validated and commonly used in treatment programs (deep-breathing techniques, progressive muscle relaxation, positive thinking, and guided imagery).^{24,34–38} The “Fear Dojo” (Fig. 1) teaches the player deep-breathing techniques before the player needs to navigate a maze in which he or she must evade an angered spirit. The character is able to outrun the spirit so long as the player’s heart rate remains low. In the “Frustration Dojo” (Fig. 2), the player is taught muscle relaxation techniques and must then navigate through another complex maze without hitting the walls. When the player’s heart rate goes up, the ball grows larger, which makes it more difficult to successfully navigate the maze. Lastly, the “Anger Dojo” (Fig. 3) teaches positive self-talk and guided “safe place” imagery. Here, the player must take part in a hand-slapping contest and dodge the Dojo Master’s efforts. Again, the game reinforces the practical use of the relaxation techniques: the higher the player’s heart rate, the faster the Dojo Master slaps. Table 1 shows a summary of the game characteristics.

To our knowledge, only one other study has focused on a videogame designed for youths with externalizing problems. “RAGE-Control” has successfully been incorporated in a CBT-based program to teach youths emotion regulation techniques and decrease their levels of anger.^{39–41} A case illustration showed that acquired relaxation techniques were retained between sessions and used in everyday life.⁴⁰ The main difference between “RAGE-Control” and “Dojo” is that the former was designed to practice and strengthen the techniques learned during therapy sessions with a therapist, whereas “Dojo” teaches the CBT skills directly in the game and could be potentially used as a stand-alone intervention, given the right contexts.

Our primary aim in this pilot study was to assess the feasibility of “Dojo” as an intervention for high-risk aggressive-anxious youths in residential treatment, as well as to understand their experience of playing the game. Although this was not a treatment outcome study, we also aimed to examine the outcomes on externalizing behavior and anxiety. It was expected that participants would report high satisfaction with “Dojo” and that posttest scores on externalizing behavior and anxiety would show decreases compared with baseline.

Materials and Methods

Participants

The sample consisted of eight adolescents (five males, three females) with a mean age of 14.38 years (standard deviation [SD] = 1.60). Inclusion criteria consisted of clinical levels of externalizing problems and anxiety, based on clinician assessments. Clinicians were asked to refer eligible participants. All male participants were diagnosed with mild ($n = 3$) to moderate ($n = 2$) ID. The female participants had no ID. Participants received 10 euros after the posttest measurement. All approached participants and their legal guardians gave written consent. Participants were told that



FIG. 1. “Fear Dojo.” Color images available at www.liebertonline.com/g4h

“Dojo” was designed to help them learn to regulate their emotions. They were not informed about the specific expectations regarding externalizing problems and anxiety. Ethical review and approval were provided by the Faculty of Social Sciences, Radboud University Nijmegen, Nijmegen, The Netherlands under protocol ECSW2013-1811-154.

Study design and procedure

This study was conducted in two residential treatment centers that offer 24-hour care for youths with severe mental health problems. Participants had eight 30-minute sessions during which they played “Dojo” on a laptop. The sessions



FIG. 2. “Frustration Dojo.” Color images available at www.liebertonline.com/g4h



FIG. 3. “Anger Dojo.” *Note:* Hou je van de kleur blauw? = Do you like the color blue? (Color images available at www.liebertonline.com/g4h)

took place twice a week for four consecutive weeks. The game sessions were supervised by a researcher who was trained to explain the game to the participants and guide them through the tutorials and challenges. Three participants had a 2-week break in the middle of the intervention, due to scheduling problems. We have included these participants in the sample because outcome differences were minimal and did not affect our conclusions.

Measurements were conducted in the week before and after the intervention and consisted of participants’ self-report and mentor report (by the group care worker with whom they had the most contact). The self-report measures were scored in an interview to insure comprehension (some participants had difficulties with reading).

Measurements

User evaluation. Participants rated statements regarding their satisfaction with the game on a 5-point scale (e.g., I liked playing “Dojo”). Additionally, they were offered the opportunity to give comments and suggestions for improvements to the game.

Training evaluation. Participants’ compliance was assessed by self-report on a 7-point scale (e.g., How would you rate your compliance during the breath relaxation training?).

Externalizing behavior. The Dutch language version of the Strengths and Difficulties Questionnaire^{42,43} was used to measure self-reported and mentor-reported externalizing behavior. We used the externalizing subscales Conduct Problems (e.g., I fight a lot), Hyperactivity-Inattention (e.g.,

I am easily distracted), and Peer Problems (e.g., I am usually on my own), each consisting of five items. We calculated a total score of externalizing behavior by summing up these three subscales. The Strengths and Difficulties Questionnaire was successfully used in a sample of youths with ID,⁴⁴ has good validity, and correlates highly with other established questionnaires that measure externalizing behavior.⁴⁵

Anxiety. The Dutch language version of the Spence Children’s Anxiety Scale⁴⁶ was used to measure self-reported and mentor-reported anxiety (e.g., I worry about things, I am scared of the dark). This translated version has successfully been used in another study among Dutch children.⁴⁷ The Spence Children’s Anxiety Scale has 45 4-point items and is composed of six subscales: Separation Anxiety, Social Phobia, Obsessive–Compulsive Disorder, Fears of Physical Injury, and Generalized Anxiety. It has good reliability and validity and shows high correlations with other anxiety questionnaires.⁴⁸ The Spence Children’s Anxiety Scale has not yet been tested among youths with ID but is suitable for children as young as 8 years old,⁴⁶ so no problems were expected in a sample of adolescents with ID.

Analyses

All data are reported via descriptive statistics (mean and SD). Given the explorative nature and small sample size of this study,² no statistical analyses were performed. We calculated η^2 values as a measure of the differences between baseline and posttest scores.

TABLE 1. CHARACTERISTICS OF A VIDEOGAME FOR HEALTH (“Dojo”)

<i>Characteristic</i>	<i>Specifics for “Dojo”</i>
Health topics	Emotion regulation
Targeted age group(s)	Adolescents
Other targeted group characteristics	Residential care, emotion regulation problems, clinically elevated levels of externalizing problems and anxiety
Short description of game idea	An emotion management game that teaches players how to recognize and control their physiological and emotional arousal
Target player(s)	Individual
Guiding knowledge or behavior change theory(ies), models, or conceptual framework(s)	Engaging instead of didactic learning, practicing instead of memorizing, targeting anxiety in addition to externalizing problems
Intended health behavior changes	Decrease in externalizing problems and anxiety
Knowledge element(s) to be learned	Improved emotion regulation
Behavioral change procedure(s) (taken from Michie inventory) or therapeutic procedure(s) used	Deep breathing techniques, muscle relaxation techniques, positive self-talk, and “safe place” imagery
Clinical or parental support needed?	Yes, clinician or practitioner support needed to run game sessions.
Data shared with parent or clinician	Yes
Type of game	Active, casual, educational
Story	
Synopsis	The player experiences “Dojo” through the viewpoint of a person who is going through a hard time and is reflecting on recent events. The story represents the player’s real life.
How the story relates to the targeted behavior change	
Game components	
Players game goal/objective(s)	Finish all three games and become a true “Dojo” Master
Rules	“Fear Dojo”: Collect eight bones and bring them to the chest. “Frustration Dojo”: Navigate the maze and make it to the end. “Anger Dojo”: Stay in the hand-slapping game for 3 minutes.
Game mechanic(s)	“Fear Dojo”: Navigate a maze to collect the bones and evade an angered spirit. The player is able to outrun the spirit so long as the player’s heart rate remains low. “Frustration Dojo”: Navigate a complex maze without hitting the walls. When the player’s heart rate goes up, the ball grows larger, which makes it more difficult to successfully navigate the maze. “Anger Dojo”: The player must take part in a hand-slapping contest and dodge the Dojo Master’s efforts. Again, the game reinforces the practical use of the relaxation techniques—the higher the player’s heart rate, the faster the Dojo Master slaps.
Procedures to generalize or transfer what’s learned in the game to outside the game	The games are able to elicit powerful emotions and offer the opportunity to practice relaxation techniques. Controlling physical reactions facilitates success in the game, which encourages the player to learn to recognize the association between emotional arousal and physical reactivity, as well as to regulate physiological arousal.
Virtual environment	
Setting	The game has three rooms (fear, frustration, and anger), each with a relaxation tutorial and a challenging game that is designed to trigger the emotion in question.
Avatar	
Characteristics	NA
Abilities	NA
Game platform(s) needed to play the game	Computer/laptop
Sensors used	IOM (Wild Divine) biofeedback hardware
Estimated play time	4 hours, divided into eight sessions of 30 minutes of gameplay

NA, not applicable.

Results

User experience

All approached participants were willing to participate and completed eight game sessions without issue. User

evaluation outcomes are presented in Table 2. Satisfaction with “Dojo” was high. It was noted that participants enjoyed playing “Dojo” and liked the use of a videogame as a form of therapy. Four participants commented on the limited number of rooms in the game (they would have preferred more).

TABLE 2. USER EVALUATION ($N=8$)

	Mean (SD)
Liked playing “Dojo”	4.13 (0.35)
Thinks other youths will like playing “Dojo”	3.88 (0.64)
Liked “Dojo” being a videogame intervention	4.13 (0.84)
“Dojo” is useful in daily life	3.75 (0.89)

SD, standard deviation.

Participants reported high compliance during the training sessions. The average score for self-reported effort was 5.25 out of 7 for positive self-talk ($SD=1.49$), 5.00 for muscle relaxation ($SD=1.31$), 5.00 for guided imagery ($SD=1.17$), and 4.63 for deep-breathing techniques ($SD=1.41$).

Externalizing behavior and anxiety

The quantitative data for externalizing behavior and anxiety are presented in Table 3. Participants’ self-report scores showed a decrease from baseline to posttest on externalizing behavior. The η^2 values show medium to large effect sizes.⁴⁹ Mentors did not report change in youths’ externalizing behavior. For anxiety, both self-reported and mentor-reported scores showed a decrease from baseline to posttest. The η^2 values show large effect sizes.⁴⁹ One mentor’s posttest measurements was completely missing, and another only completed the Strengths and Difficulties Questionnaire.

Discussion

Key findings

The main aim of this pilot study was to provide a feasibility investigation of “Dojo” as an intervention for aggressive-anxious youths in residential care. We assessed the implementation and user experience to explore new ways of intervening with these high-risk youths. Treatment adherence is usually problematic—with dropout rates for treatment programs targeting externalizing problems as high as 50 percent.⁷ One of our most promising findings is that all

approached participants took part and completed all “Dojo” sessions. These adherence results suggest that videogames in general, and “Dojo” in particular, may be a compelling strategy that keeps youths motivated, engaged, and practicing the skills they need to make automatic in order to use them in their everyday life. Participants’ overall satisfaction was high: We observed almost a ceiling effect, which suggests that the game reached its goals of being fun, engaging, and appealing to this target population. This is promising because motivation is an important factor in treatment adherence.⁵⁰

Participants’ most common criticism of “Dojo” was the limited number of rooms in the game they could explore; during the intervention, participants had to repeat one or more of the rooms after they had already “solved” or completed it. Although iterations are part of the processes underlying automatization,⁵¹ it would be desirable to have more tutorials and games that train the same skills to offer players more variety in gameplay. With more funding, it may be feasible to program additional game experiences without compromising the structure and basic design of what may be an effective training game. Participants’ main complaint about the game was that it did not have *enough* rooms, which indicates that they really enjoyed the experiences they *did* have. This is one of the most promising parts of these perceived criticisms: Youths were asking for *more* of what “Dojo” offered them, not something different or the opportunity to avoid the game.

Participants’ high compliance during the training sessions indicates the promise of “Dojo” to effectively teach relaxation techniques to youths who would otherwise not be motivated to learn these techniques. “Dojo” provides a more engaging environment to practice relaxation techniques compared with a therapist’s office. In the absence of the game environment, relaxation techniques may feel unnatural for youths, and it is often difficult for them to see the usefulness of these techniques.³⁹ While playing “Dojo,” participants practiced the techniques together with the in-game Dojo Masters and the researcher, which arguably mitigates feelings of self-consciousness. Immediately after the training sessions, participants played the game and were stimulated to use the techniques to make progress in the game. This helped them to see the value of applying relaxation techniques and regulating their emotions.

TABLE 3. MEASUREMENT SCORES BEFORE AND AFTER INTERVENTION

	Self-report				Mentor report			
	Baseline	Post-test	n	η^2	Baseline	Posttest	n	η^2
Externalizing behavior	11.63 (4.00)	10.75 (3.15)	8	0.25	13.71 (2.29)	13.43 (3.55)	7	0.00
Conduct problems	2.88 (2.42)	3.38 (2.26)	8	0.14	4.00 (2.38)	3.57 (2.57)	7	0.09
Hyperactivity	6.38 (2.45)	5.25 (1.67)	8	0.44	6.29 (1.89)	6.29 (2.29)	7	0.00
Peer problems	2.38 (1.69)	2.13 (1.64)	8	0.06	3.34 (2.07)	3.57 (1.62)	7	0.00
Anxiety	23.25 (19.59)	16.38 (14.12)	8	0.36	27.17 (10.09)	19.33 (9.00)	6	0.70
Separation anxiety	4.00 (3.38)	2.25 (1.49)	8	0.28	4.00 (1.79)	2.67 (1.86)	6	0.21
Social phobia	3.87 (1.99)	2.75 (1.58)	8	0.33	8.33 (2.58)	5.50 (2.51)	6	0.32
OCD	4.37 (4.27)	3.50 (5.01)	8	0.21	3.50 (2.43)	2.17 (1.60)	6	0.31
Panic, agoraphobia	3.88 (4.85)	2.38 (3.74)	8	0.23	3.67 (2.25)	2.33 (2.07)	6	0.20
Fears of physical injury	2.25 (3.77)	2.00 (2.78)	8	0.31	3.83 (1.94)	3.67 (1.63)	6	0.28
Generalized anxiety	4.88 (4.58)	3.50 (2.98)	8	0.63	3.83 (2.48)	3.00 (2.19)	6	0.28

Data are mean (standard deviation) values. The η^2 values are interpreted as small ($\eta^2=0.01$), medium ($\eta^2=0.06$), or large ($\eta^2=0.14$) effects.⁴⁹

OCD, obsessive-compulsive disorder.

The quantitative data are encouraging in that scores on self- and mentor-reported anxiety and self-reported externalizing behavior showed the predicted decrease with medium to large effect sizes. These results are promising and seem to warrant further RCTs to rigorously test the effects of “Dojo” in this hard-to-treat population.

Herein, we have demonstrated the potential of “Dojo” as an intervention, but we do not propose this as a stand-alone form of therapy; it seems that the game may be best delivered as a beneficial addition to regular treatment. “Dojo” is most likely to make an impact when a practitioner supports and guides the youths through the game. Youths with clinical problems—and especially those with ID—require some help to grasp the link between mastering the relaxation techniques and successful completion of the game. Moreover, clinicians may find it particularly useful and effective to individualize treatment by relating youths’ experiences during the game to their real-life experiences. When used in conjunction with conventional therapy, “Dojo” may reduce the number of therapy sessions needed.

Strengths, limitations, and future work

This study was conducted in a clinical setting, a context in which research on interventions is critical to establish effectiveness. Future RCTs should follow this same “real world” approach to evaluation in order to require minimal translation to implement results in practice if they turn out to be equally positive. For this pilot study, the combination of quantitative measures and qualitative observations provided us with a rich source of information, from the perspectives of participants and researchers.

Unfortunately, we cannot attribute causality to the qualitative data because of the lack of a control group and the small sample size. Participants knew that “Dojo” was designed to help them to regulate their emotions, although they were not aware of the expected decrease of externalizing problems and anxiety. Also, some of our participants had other forms of therapy in conjunction with “Dojo” (e.g., social skills training) that could have affected the quantitative measurements.

We are currently running a full-scale RCT that compares “Dojo” with treatment as usual (i.e., the control group receives the treatment that is normally being delivered in their respective situations). This RCT will incorporate measurements at baseline, posttest, and follow-up to assess short- and long-term effects. Only by running rigorously designed RCTs with proper control groups can we feel confident that “Dojo” could be an effective, and perhaps superior, treatment than what is currently being delivered in residential treatment centers.

Another important avenue to pursue in further research is to evaluate the effects of specific “Dojo” elements. The game saves log files that provide the opportunity to keep track of the player’s gameplay. Although in this study participants rated to what extent they considered the game useful in daily life, it would be interesting to explore how long players engaged in the different tutorials/games, how immersed they were in each, and subsequent relations to outcome measures. Moreover, the game specifically targets emotion regulation. It would be useful to test whether the decreases in outcome measures are actually mediated by improved emotion regulation skills.

Conclusions

This pilot study provides a preliminary evaluation of “Dojo” as an intervention for aggressive-anxious youths. Although RCTs with adequate sample sizes and control groups are required, our goals were met in terms of establishing evidence for the feasibility of an innovative videogame intervention in this high-risk population. The smooth implementation, positive evaluations, and initial outcome results all demonstrate the high potential “Dojo” holds as an intervention for youths with severe behavioral problems. If rigorously designed, large-scale evaluations prove equally successful, we will have identified an innovative, cost-effective means by which one of the most difficult-to-treat populations can be engaged in effective intervention.

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Author Disclosure Statement

No competing financial interests exist.

References

1. Rice BJ, Woolston J, Stewart E, et al. Differences in younger, middle, and older children admitted to child psychiatric inpatient services. *Child Psychiatry Hum Dev* 2002; 32:241–261.
2. Frick PJ, Viding E. Antisocial behavior from a developmental psychology perspective. *Dev Psychopathol* 2009; 21:1111–1131.
3. Loeber R. Development and risk factors of juvenile antisocial behavior and delinquency. *Clin Psychol Rev* 1990; 10:1–41.
4. Moffit T. Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychol Rev* 1993; 4:674–701.
5. Odgers CL, Caspi A, Broadbent JM, et al. Prediction of differential adult health burden by conduct problem subtypes in males. *Arch Gen Psychiatry* 2007; 64:476–484.
6. Odgers CL, Moffitt TE, Broadbent JM, et al. Female and male antisocial trajectories: From childhood origins to adult outcomes. *Dev Psychopathol* 2008; 20:673–716.
7. Conner DF, Carlson GA, Chang KD, et al. Juvenile maladaptive aggression: A review of prevention, treatment, and service configuration and proposed research agenda. *J Clin Psychiatry* 2006; 67:808–820.
8. Weisz JR, Doss AJ, Hawley KM. Youth psychotherapy outcome research: A review and critique of the evidence base. *Annu Rev Psychol* 2005; 56:337–363.
9. Eyberg SM, Nelson MM, Boggs SR. Evidence-based psychosocial treatments for children and adolescents with disruptive behavior. *J Clin Child Adolesc Psychol* 2008; 37:215–237.
10. Leonard H, Wen X. The epidemiology of mental retardation: Challenges and opportunities in the new millennium. *Ment Retard Dev Disabil Res Rev* 2002; 8:117–134.
11. van Nieuwenhuijzen M. *De (her)kenning van jongeren met een licht verstandelijke beperking*. Amsterdam; SWP; 2010.
12. Schalock RL, Borthwick-Duffy SA, Bradley VJ, et al. *Intellectual Disability: Definition, Classification, and Systems of Supports*, 11th ed. Washington, DC: American Association on Intellectual and Developmental Disabilities; 2010.
13. van Nieuwenhuijzen M, Vriens A. (Social) cognitive skills and social information processing in children with mild to borderline intellectual disabilities. *Res Dev Disabil* 2012; 33:426–434.

14. Boylan K, Vaillancourt T, Boyle M, Szatmari P. Comorbidity of internalizing disorders in children with oppositional defiant disorder. *Eur Child Adolesc Psychiatry* 2007; 16:484–494.
15. Granic I, Meusel L, Lamm C, et al. Emotion regulation in children with behavior problems: Linking behavioral and brain processes. *Dev Psychopathol* 2012; 24:1019–1029.
16. Lewis MD, Granic I, Lamm C, et al. Changes in the neural bases of emotion regulation associated with clinical improvement in children with behavior problems. *Dev Psychopathol* 2008; 20:913–939.
17. Woltering S, Granic I, Lamm C, Lewis MD. Neural changes associated with treatment outcome in children with externalizing problems. *Biol Psychiatry* 2011; 70:873–879.
18. Stieben J, Lewis MD, Granic I, et al. Neurophysiological mechanisms of emotion regulation for subtypes of externalizing children. *Dev Psychopathol* 2007; 19:455–480.
19. Frick PJ. Developmental pathways to conduct disorder: Implications for future directions in research, assessment, and treatment. *J Clin Child Adolesc Psychol* 2012; 41:378–389.
20. Frick PJ, Morris AS. Temperament and developmental pathways to conduct problems. *J Clin Child Adolesc Psychol* 2004; 33:54–68.
21. Vitaro F, Brendgen M, Barker ED. Subtypes of aggressive behaviors: A developmental perspective. *Int J Behav Dev* 2006; 30:12–19.
22. de Lange M, Matthys W, Foolen N, et al. *Richtlijn ernstige gedragsproblemen voor de jeugdzorg*. Utrecht, The Netherlands: Nederlands Jeugdinstituut; 2013.
23. Kazdin AE. Evidence-based treatment research: Advances, limitations, and next steps. *Am Psychol* 2011; 66:685–698.
24. Weisz JR, Kazdin AE. *Evidence-Based Psychotherapies for Children and Adolescents*, 2nd ed. New York: Guilford Press; 2010.
25. Granic I, Lobel A, Engels RCME. The benefits of playing video games. *Am Psychol* 2014; 69:66–78.
26. Granic I. The role of anxiety in the development, maintenance and treatment of childhood aggression. *Dev Psychopathol* 2014; 26:1515–1530.
27. Sturmey P, Hamelin JP. Psychological treatments. In: Tsakanikos E, McCarthy J, eds. *Handbook of Psychopathology in Intellectual Disability. Research Practice, and Policy*. New York: Springer; 2014: pp. 325–357.
28. Crenshaw DA. *Therapeutic Engagement of Children and Adolescents: Play, Symbol, Drawing, and Storytelling Strategies*. Lanham, MD: Rowman & Littlefield Publishers; 2008.
29. Kendall AE. *Child and Adolescent Therapy: Cognitive-Behavioral Procedures*. New York: Guilford Press; 2011.
30. Burbier JL, Drabick DAG. Co-occurring anxiety and disruptive behavior disorders: The roles of anxious symptoms, reactive aggression, and shared risk processes. *Clin Psychol Rev* 2009; 29:658–669.
31. Gamedesk. Dojo. 2013. www.gamedesk.org (accessed June 24, 2015).
32. Vygotsky L. *Mind in Society: The Development of Higher Psychological Functions*. Cambridge, MA: Harvard University Press; 1978.
33. Critchley HD, Melmed RN, Featherstone E, et al. Brain activity during biofeedback relaxation: A functional neuroimaging investigation. *Brain* 2001; 124:1003–1012.
34. Sukhodolsky DG, Scahill L. *Cognitive-Behavioral Therapy for Anger and Aggression in Children*. New York: Guilford Press; 2012.
35. Glancy G, Saini MA. An evidence-based review of psychological treatments of anger and aggression. *Brief Treat Crisis Interv* 2005; 5:229–248.
36. Albano AM, Kendall PC. Cognitive behavioural therapy for children and youths with anxiety disorders: Clinical research advances. *Int J Psychiatry* 2002; 14:129–134.
37. Barrett PM. Evaluation of cognitive-behavioral group treatments for childhood anxiety disorders. *J Clin Child Psychol* 1998; 27:459–468.
38. Rapee RM, Wignall A, Hudson JL, Schniering CA. *Treating Anxious Children and Adolescents: An Evidence-Based Approach*. Oakland, CA: Harbinger; 2000.
39. Kahn J, Ducharme P, Travers B, Gonzalez-Heydrich J. RAGE Control: Regulate and gain emotional control. In: Bushko RG, ed. *Strategy for the Future of Health*. Amsterdam: IOS Press; 2009: pp. 3335–343.
40. Ducharme P, Wharff E, Hutchinson E, et al. Videogame assisted emotional regulation training: An ACT with RAGE-Control case illustration. *Clin Soc Work J* 2012; 40:75–84.
41. Kahn J, Ducharme P, Rotenberg A, Gonzalez-Heydrich J. “RAGE-Control”: A game to build emotional strength. *Games Health J* 2013; 2:53–57.
42. Goodman R. The Strengths and Difficulties Questionnaire: A research note. *J Child Psychol Psychiatry* 1997; 38:581–586.
43. van Widenfelt BM, Goedhart AW, Treffers PDA, Goodman R. Dutch version of the Strengths and Difficulties Questionnaires (SDQ). *Eur Child Adolesc Psychiatry* 2003; 12:281–289.
44. Kaptein S, Jansen DEMC, Vogels AGC, Reijneveld SA. Mental health problems in children with intellectual disability: Use of the Strengths and Difficulties Questionnaire. *J Intellect Disabil Res* 2008; 52:125–131.
45. Muris P, Meesters C, van der Berg F. The Strengths and Difficulties Questionnaire (SDQ). Further evidence for its reliability and validity in a community sample of Dutch children and adolescents. *Eur Child Adolesc Psychiatry* 2003; 12:1–8.
46. Spence SH. A measure of anxiety symptoms among children. *Behav Res Ther* 1998; 36:545–566.
47. van Starrenburg MLA, Kuijpers RCWM, Hutschemaekers GJM, Engels RCME. Effectiveness and underlying mechanisms of a group-based cognitive behavioural therapy-based indicative prevention program for children with elevated anxiety levels. *BMC Psychiatry* 2013; 13:183–189.
48. Muris P, Merckelbach H, Ollendick T, et al. Three traditional and three new childhood anxiety questionnaires: Their reliability and validity in a normal adolescent sample. *J Behav Assess* 2002; 40:753–772.
49. Cohen JW. *Statistical Power Analyses for the Behavioral Sciences*, 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1998.
50. Deci EL, Ryan RM. The ‘what’ and ‘why’ of goal pursuits: Human needs and the self-determination of behavior. *Psychol Inc* 2000; 11:227–268.
51. Aarts H, Verplanken B, van Knippenberg A. Predicting behavior from actions in the past: Repeated decision making or a matter of habit? *J Appl Soc Psychol* 1998; 28:1355–1374.

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