Executive Functioning Interventions for Individuals with Autism Spectrum Disorder

Students at the University of Waterloo created this report while being trained in the systematic review methods of Knowledge Impact Strategies. Authors are listed in alphabetical order.

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Executive Functioning Interventions for Individuals with Autism Spectrum Disorder

Take Home Message

- Most of the interventions found were aimed at school-age children; there is limited research on executive functioning interventions aimed at adolescents and adults.
- Nine studies detailed interventions for adolescents with ASD. Promising findings include greater independence during a food preparation task aimed at improving self-monitoring skills, and Assisted Cycling Therapy which improved inhibition, planning, working memory, and mental flexibility.
- Most interventions were aimed at children between ages 6 and 12. We cannot determine whether these participants were selected out of age-specificity or out of research convenience. Many interventions should have potential to be adapted for older age groups.
- Most studies addressed one or several components of executive functioning as opposed to the construct as a whole
- Metacognitive ability and problem-solving appear to be the keys to improving other aspects of executive functioning
- Cognitive Behavioural Therapy was the most common type of intervention

Overview

This project was initiated during the Spring 2015 term by students in an upper-level Psychology course, Community-Based Research, at the University of Waterloo, and completed in March 2016. The students involved are: Sarah Gibbon, Sai Kalvapalle, Vanessa Morris, Sarina Trac, and Patrick Zhou. Sai Kalvapalle, Vanessa Morris, and Patrick Zhou were responsible for completing the project by reapplying the database search and associated procedures for recent articles published even up to early 2016. They were assisted by the course instructor Dr. Kathleen Bloom, and Research Assistant Supreet Sandhu. The community partner organization for this project was Autism Services of Waterloo Region (ASWR). Established in 2009, ASWR is an organization composed of autism service providers, parents, school boards, and community partners. Autism Spectrum Disorders are neurodevelopmental disorders typically identified in early childhood that impair the ability for the affected to form social relationships and communicate. The organization directs clients to appropriate autism services in addition to answering questions related to schooling, developmental stages of the condition, and funding. Its partnership with the University was coordinated by Dr. Christine Zaza, a representative from ASWR.
Dr. Zaza spoke to the students of *Community-Based Research* about the deficits in executive functioning in individuals with autism. Crucially, Dr. Zaza stressed the life of teenagers, and the relationship between typical adolescent development and autism effects. Executive functioning (EF) is an umbrella term for many cognitive processes including but not limited to working memory, inhibition, and metacognition. These processes are integral to more complex actions that individuals have to undertake (such as social interactions), and are thus all the more important to investigate. ASWR expressed their interest in learning whether there are interventions that target executive functions in particular, since the majority of available research centers on social skill interventions. Identification of relevant interventions may help individuals with autism develop effective coping strategies to manage both simple and complex tasks. Dr. Zaza also highlighted the areas of research she wanted us to focus on in our systematic review, and indicated that the information we gathered may be used to create a toolkit. This toolkit can then be distributed to members of the community, including individuals with autism and their caregivers.

**What Was Studied?**

Research on executive functioning interventions for teens and young adults with ASD reported in peer reviewed journals published from 2010-2015 was reviewed using systematic methods. The goal was to determine what kinds of interventions are available to aid or improve the executive functioning in adolescents with ASD, and which of those programs are effective.

**How Was It Studied?**

The search strategy below was first run in May 2015 and was then re-applied in December 2015. A literature search was conducted using the Scopus database which compiles peer-reviewed articles from over 21,000 academic journals. The search strategy was:

( TITLE-ABS-KEY (autism ) AND TITLE-ABS-KEY ( intervention OR program ) AND TITLE-ABS-KEY ("executive function" OR "working memory" OR "cognitive control" OR inhibition OR flexibility OR shift OR plan OR regulat OR "problem solv" OR monitor OR organi OR metacogn ) ) AND PUBYEAR > 2009 AND ( LIMIT-TO ( LANGUAGE , "English" ) )

The first search was conducted on May 25th, 2015 and was then run a second time in January of 2016. The searches resulted in the identification of 1061 research articles. To ensure the relevance of the articles to the research question, articles that met the following criteria were excluded from the review:

- No mention of executive functioning
- Use of a drug treatment

136 research articles remained after the above criteria were applied. A second set of exclusion criteria were applied to these articles. Articles were excluded from further analysis if they:

- Assessed low functioning autism
- Used participants out of our age range (i.e., participants under the age of 6)
Interventions for Improving Executive Functioning in Individuals with Autism

- Focused on medical, genetic or biological explanations or research

48 research articles were included in the final review. Detailed analyses of these articles are included in the spreadsheet attached to this report.

To assess reliability and quality control of the analyses of the articles, a small number of articles were independently reviewed by two or more students. Any discrepancies were resolved through group discussion and consensus. Criteria for the analysis of the articles were established.

Landscapes of Articles

Here is a visual breakdown of the relevant articles we found.

**Article Types**

![Distribution of article types](image)

Out of the 48 articles we found and coded, presented is the distribution of the different types of articles and study designs. Pretest-posttest was the majority, which would be expected for a clinical topic such as ASD, and it is followed in frequency by Randomized Control Trials. The reviews, correlational studies, and case study help to consolidate information and reveal potential links to be explored in the future. Assessment validations can be valuable, as claims of improvement are dependent on access to valid, accurate results.

**EF Components**

We decided to code for these 9 EF components, which were selected based on support in the literature as well as the research direction we were positioned in.

Metacognition, the ability to notice and monitor one’s own thoughts, was the EF component mentioned most frequently in our articles. The focus was not necessarily on improving metacognition, but rather training participants in self-monitoring, self-regulating strategies to improve other EF components. Metacognition seems to be the key to improvement in many other types of EF deficits as a necessary tool in those interventions.

**Number of interventions relevant to each EF component**

![Number of interventions relevant to each EF component](image)
Articles coded as relevant to Problem Solving were more oriented toward practical, real life applications of EF improvement. There is much overlap with other components and these studies do not isolate for a specific component as much.

Emotional Regulation was an area that many non-EF autism articles overlapped with, for instance, in topics such as reducing aggression. We, however, chose not to include any of the non-EF findings, especially since the topic is well explored in mainstream ASD research.

Initiation seems to be very scarce in the existing body of literature. Initiation is an extremely important component for problem solving, since the ability to quickly and independently execute the correct script or strategy for different situations is crucial in real life scenarios. Further research in Initiation in individuals with ASD should be encouraged in the future.

**Age Statistics**

The amount of literature on executive functioning in adolescent and adult ASD populations is fairly lacking. During our search process we included studies with participants as young as, but no younger than, 6 years of age. Our reasoning was that schoolchildren are encouraged and required to demonstrate executive functioning skills in social situations, and hopefully interventions that targeted younger individuals have some potential to be scaled up if needed to serve older individuals with ASD.

The majority of mean ages in the studies we found were below 12. The findings are especially scarce beyond a mean age of 15.

*Note: The outlier mean age statistic between ages 1-3 is due to the nature of the article, which was a longitudinal study that recruited toddlers to screen for variables that would predict their abilities in young adulthood.*

**Intervention Types**

Each intervention fit into one or more of these five categories.

The majority of the interventions used a CBT (Cognitive Behavioural Therapy) or CBT-like approach. Participants were introduced to a concept, taught a strategy, and then rehearsed that strategy in practice. They would have time to use their skills in real life before being re-evaluated on their abilities.
Interventions coded as *Technology* involved the use of specialized equipment to aid participants in improvement.

*Behavioural* interventions used principles of feedback and conditioning to affect the participants.

*Self-monitoring* interventions required the use of components of metacognition and had some overlap with CBT methods.

Finally, *Exergaming* interventions were about technology-aided goal-oriented physical activity, pairing up the structure of a video game with exercise.

### Relationships between Intervention Types and EF Components

<table>
<thead>
<tr>
<th></th>
<th>Meta-cognition (16)</th>
<th>Problem Solving (15)</th>
<th>Planning (10)</th>
<th>Working Memory (9)</th>
<th>Emotional Regulation (9)</th>
<th>Inhibition (9)</th>
<th>Mental Flexibility (7)</th>
<th>Organization (6)</th>
<th>Initiation (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT (14)</td>
<td>9</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Technology (10)</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Behavioural (9)</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Self-monitoring (6)</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Exergaming (3)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<td>2</td>
<td>2</td>
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</tbody>
</table>

This chart sums up the number of articles containing each combination of intervention type and EF component. At a glance, trends in the findings and current directions in the research can be noticed. For example, it makes sense that 6 out of 6 self-monitoring interventions involved metacognition. Findings of interest will be described in the *Highlights of Results* section.

### Survey of Articles

Two main questions were asked of each of the 48 articles:

- What was studied?
- What was found?

Information on the following factors was also extracted from each of the articles:

- Citation
- What was studied?
- Study Design
  - Review
  - Correlational
  - Pre-Test Post-test (PTPT)
  - Randomized Controlled Trials (RCT)
  - Case Study
  - Assessment Validation
- Intervention Category
Interventions for Improving Executive Functioning in Individuals with Autism

- Behavioral
- Cognitive Behavioral Therapy (CBT)
- Technology
- Exergaming
- Self-monitoring

- Intervention Description
- Sample Size
- Mean Age
- Age Range
- Gender
  - Male
  - Female

- Executive Function Components
  - Metacognition
  - Working memory
  - Planning
  - Organization
  - Inhibition
  - Problem solving
  - Initiation
  - Emotional regulation
  - Mental flexibility

- Executive Function Measure
  - Standardized
  - Unstandardized

- Comorbidity
- What was found?

Highlights of Results

There were only 9 EF interventions targeting ASD participants that had mean ages greater than 12. The majority of articles had mean ages in the 6-12 range. The current landscape of research does not have an abundance of answers specific to EF improvements in adolescents with ASD, but there are still many promising results, especially if looking past the adolescent age-group to study samples with some younger schoolchildren.

Some of those interventions could potentially scale to an adolescent age group. Some interventions are clearly targeted towards young children while others seem more generalizable. It seems that the field of ASD research focuses more on and has better access to younger participants. Some researchers may have picked their participants out of convenience rather than specific need.

Overall trends in relationships between intervention types and EF components are unclear but most interventions are identified to directly improve specific EF components in young people with
ASD. We encourage a look at the various articles we gathered, and hopefully you will be able to make the best use of the information with the expertise that we lack.

- A summary of some relevant findings:
  - Work by Emily Bouch et al., (2014) showed improved self-monitoring skills in three teens, ages 13 - 15, with ASD. The participants completed a food preparation task using either a high-tech (iPad) or low-tech system (paper). All students demonstrated an increase in independent task performance between baseline and intervention phases while decreasing the number of prompts needed to complete the task. Students were also able to maintain these levels of independence.
  - Assisted Cycling Therapy, originally developed for use with Parkinson’s disease patients, has been demonstrated to cause improvements in inhibition, planning, and set-switching (mental flexibility and working memory) in adolescents with ASD even after a brief 20 minute exposure. Stronger, long-term effects are expected to result from more exposure. (Ringenbach et al., 2015)
  - Though not specific to teens, in one study, adults were explicitly taught the components of a strategy to help them generate accurate inferences while reading, and then practiced this strategy with feedback. The results showed that after the intervention, participants displayed improvement in their ability to generate inferences, as well as some metacognitive skills (Murza, 2014).

- Some statistics about the relationships between EF components and intervention types in the articles we found:
  - While only 3 Exergaming interventions were explored, they often led to improved working memory, planning, inhibition, and mental flexibility. The interactive methods could be more interesting to youth than other intervention types.
  - 2 out of the total of 3 initiation-related interventions were behavioural in method.
  - Articles using behavioural interventions were related to working memory more often than to any other EF component.
  - 67% of the articles related to organization skills and 57% of the articles related to mental flexibility skills incorporated a CBT-type intervention, a higher frequency than any other intervention type for these two EF components.
  - Initiation skills were only targeted in CBT, technology, and behavioural interventions.
Conclusions

The examination of interventions that specifically target EF deficits in individuals with autism is a very new and exciting area of research that is only just starting to be explored in the literature. Much of the research in this review is composed of pilot studies, or preliminary research with small sample sizes. Now that a variety of promising interventions have been proposed, the next steps can be taken to validate these interventions on a larger scale and establish their applicability to real-life situations. To this end, more recent studies have parents and teachers administer the intervention while outcomes are assessed with independent, standardized, and objective measures (Kenworthy, 2014). In addition, while the majority of interventions were aimed at younger school children, researchers have recognized the dearth of studies addressing adolescents and adults, and are starting to put more of a focus on this older age group (Murza, 2014).

Acknowledgements

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Disclaimer

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Citation

http://www.kimpact.ca/whatwedo/

For more information, please contact:
Kathleen Bloom, PhD
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<table>
<thead>
<tr>
<th>Citation</th>
<th>What was studied</th>
<th>Study Design</th>
<th>Intervention Category</th>
<th>Intervention Description</th>
<th>Sample size</th>
<th>Mean Age</th>
<th>Age Range</th>
<th>Gender</th>
<th>EF Components</th>
<th>EF Measure</th>
<th>Comorbidity</th>
<th>What was found</th>
</tr>
</thead>
</table>
| Borgi, M., Loliva, D., Cerino, S., Chiarotti, F., Venerosi, A., Bramini, M., & Bisacco, F. (2016). Effectiveness of a Standardized Equine-Assisted Therapy Program for Children with Autism Spectrum Disorder. *Journal of autism and developmental disorders*, 46(1), 1-9. | How therapeutic sessions consisting of structural activities with horses (such as working with them on the ground like grooming & riding them) influenced social functioning, motor abilities, & executive functioning | X | X | * EAT sessions were held once a wk for 6 months w/a total of 25 sessions for each patient | 15(26) | 8.6 | 6 to 12 | 28 | 0 | X | X | X | Improvement in social functioning, mild effect on motor abilities, & improved executive functioning (reduced planning time in a problem-solving task)
* 60 – 30 days prior to the start of the EAT sessions
* Suggested generalizability to problem solving task in which they were instructed to put into place a series of actions (rearrange balls in some pegs) to achieve the goal arrangement |

* Ten 90 minute or twenty 45 minute gpp sessions over 10 wks

* Used as seen fit over 10 wks | 60 (69) | 9.82 | 7-12 | 64 | 5 | X | X | X | Structured SAS program (follow guidelines) was more effective than unstructured (use program as you see fit).

* Emotional regulation & social skills generalized to the home environment, not just the school environment |

* For Aspergers, hypothesis P's will score higher in an interpersonal problem-solving task, parent-reported socialisation skills, & self-reported work personality profiles at post treatment. | X | X | * Interpersonal Problem-Solving Skills for Workplace Adaptation Programme (SC-Labour)

* 75 minute sessions, once a wk over 10 wk period.

* Gaps of 4-6 led by therapist. | 50 (100) | 19.54 | 16-29 | 43 | 7 | X | X | X | Scores on reports by parents show higher at post treatment in social problem-solving task & socialization skills.

* Treatment is acceptable to families.

* High subject adherence. |
This study evaluated the functional relationship between I-Connect, a technology-delivered self-monitoring program, and decreases in the level of stereotypy for two students with ASD in the school setting utilizing a withdrawal design with an embedded multiple baseline across participants. Operational definitions of stereotypic behaviors for Barry included: (1) non-functional hand gestures (i.e. hand flapping, waving hands in front of face); (2) placing hands in mouth; and (3) vocalizations not directed at another individual (i.e. grunts, repetitive laughing, and repeating words and phrases). The operational definitions for Carl’s stereotypic behaviors included: (1) vocal language not directed to a communication partner and (2) placing hands or objects in mouth.


Children with ASD randomly assigned to an adaptive working memory (WM) training, an adaptive cognitive-flexibility training, or a non-adaptive control training.


Exploring engagement & learning in a technology-based extracurricular program (called iSTAR) for youth with autism centered on the fact that there is little information about programs to promote social engagement & to explore potential career interests for youth with autism.

The current study extended the research on Implementation Planning & evaluated the effectiveness of parents implementing a behavioral intervention at home within a Conjoint Behavioral Consultation model. The behavioral intervention aimed to increase compliance & decrease aggression for two children with ASD at home.

- The intervention included antecedent, teaching, & consequence strategies (only the antecedent & consequence strategies were delivered daily)
  - Antecedent strategies: children were reminded of three positively stated behavioral expectations that were to be followed in order to access a daily reward [(a) follow directions, (b) be a friend (both requiring to increase compliance), (c) keep my cool (aimed at decreasing aggression)]
  - Teaching strategies included brief teaching sessions about the visual schedule, behavior expectations, & reinforcement system.
  - The consequence strategies included utilizing a posted "stoplight" behavior warning & reinforcement system

- Initially, parents struggled to deliver the intervention consistently; however, after Implementation Planning, parents' treatment integrity increased & subsequently, child outcomes improved.
  - 71.8% increase for both participants on Implementation Planning


Evaluating the effectiveness of therapeutic horseback riding (THR) on self-regulation, socialization, communication, adaptive, & motor behaviours in children with autism spectrum disorder (ASD).

- Participants were randomized to 1 of 2 grps for 10 wks: THR intervention or a barn activity (BA) control grp without horses that used similar methods.
- Participants were evaluated on measures within 1 month pre- & post- intervention by raters blinded to intervention conditions & unblinded caregiver questionnaires.

- Significant improvements in the THR grp compared to the control grp on measures of irritability & hyperactivity. Significant improvements in the THR grp were also observed on a measure of social cognition & social communication, along with the total number of words & new words spoken during a standardized language sample.


Evaluation of whether "Superheroes Social Skills" is an intervention that promotes accurate use of discrete social skills in training as well as generalizing to real scenarios.

- 1.5hr grp sessions 2 times a wk over 5 wks
- DVD clip shown depicting superhero explaining a skill, peers demonstrating the skill
- Reviewed skill, getting a self-monitoring cards to record skill usage
- Role play & social games to reinforce/test skill usage before reviewing again with a comic

- Intervention caused abrupt improvements in skill accuracy in both training & generalization conditions.
  - Ps not only learned how to behave in different social situations in training, but demonstrated that they were choosing the right skill for real scenarios.
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Title</th>
<th>Journal</th>
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### ACT (Assisted Cycling Therapy)
- ACT (Assisted Cycling Therapy) is a novel intervention for Parkinson's Ps.
- Study assesses its effects on adolescents with ASD.
- Ps completed 20min ACT, VC (voluntary cycling), & NC (no cycling) interventions in randomized order separated by 2 days each. Pretreatment & posttest performed on each intervention.
- ACT involved pedaling while looking at a simulation video of cycling on a screen while motors help maintain a 80rpm rate. In VC Ps cycled at their own rate, & in NC Ps only watched the simulation video.
- ACT significantly improved inhibition, planning, & set-switching (flexibility/working memory) while VC & NC didn't.
- ACT appears to benefit EF in ASD patients even after a single session, but chronic intervention required to have stronger, long-lasting improvements.

### CBT intervention
- A CBT intervention was assessed on improvements to emotion regulation & depression symptoms in ASD patients.
- Through 3-4 person grps, 2 clinical psychologists delivered 11 wkdly 1-hr sessions each to each grp. Sessions explored self-awareness tools, physical tools, pleasure tools, thinking tools, social tools, & relaxation tools that adolescents could use to manage depression symptoms.
- No significant differences posttest on BDI or Emotional Regulation Questionaire, but significant effect in DASS measure. Mixed preliminary results for depression symptoms, but insignificant results for emotion regulation EF.

### VLSS (Virtual Learning Environment with Social Stories)
- 40 experts tested & evaluated usability of prototype VLSS virtual learning environment to potentially improve social problem-solving in ASD Ps.
- VLSS is rated highly on usability, potential, & satisfaction. Social stories reported to provide smooth transition between general & specific presentations & escalating difficulty in subject.
- This virtual environment can easily be adapted for different social stories & other variety of uses to suit client needs.

### ReAttach intervention
- Evaluation of the effectiveness of ReAttach intervention using pretreatment methodology on ASD participants after 5 sessions over 12 wks. The goal of intervention is to reduce problems in daily functioning in people with ASD.
- First step involves multisensory stimulation and regulation of arousal levels. Second step is aimed to modify cognitive bias through continuing the multisensory stimulation & performing conceptual thinking.
- ATEC (Autism Treatment Evaluation Checklist) scores significantly improved after intervention through improvement of emotion regulation skills.
- Ps from whole range of autism spectrum benefited.
- Despite complexity of procedure, even newly trained professionals got reliable improvements in patients.
<table>
<thead>
<tr>
<th>Banda, D. R., &amp; Alzrayer, N. M. (2014). The inference generation strategy may be effective for some adults with high functioning autism spectrum disorder, but methodological issues limit its relevance to clinical practice. Evidence-Based Communication Assessment and Intervention, 8(3), 142-146.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of a reading intervention on those with ASD</td>
</tr>
<tr>
<td>The intervention program aimed to develop five main metacognitive skills in order for the P's to be able to use the reading intervention program independently.</td>
</tr>
<tr>
<td>These skills included developing an awareness of making inferences, asking questions about the text, assimilating background knowledge with the text, focusing on language cues at each level of complexity, &amp; applying knowledge/skills strategically.</td>
</tr>
<tr>
<td>Results on the Reading Inference Generation subtests on the WGCTA suggested that the intervention was effective in improving reading inferences of the treatment grp.</td>
</tr>
<tr>
<td>The results of the MIRI showed that the treatment grp exceeded the control grp in their ability to use metacognitive skills before, during, &amp; after reading. The results of TASIT &amp; GRADE posttests indicated that there were no positive significant differences between the treatment &amp; control grp.</td>
</tr>
<tr>
<td>Those with ASD used either iPad vs pencil-paper for a &quot;self-monitoring&quot; task in order to increase independence &amp; less need for aid &amp; monitoring by others</td>
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<tr>
<td>Students with ASD completed food preparation tasks while self-monitoring using a low-tech treatment (pencil/pencil) &amp; high-tech treatment (iPad)</td>
</tr>
<tr>
<td>The intervention led to immediate increase in on-task behavior.</td>
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<tr>
<td>High levels of on-task behavior maintained after intervention removal at follow-up above baseline.</td>
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<tr>
<td>Evaluation of WatchMinder: whether it promotes self-monitoring to increase on-task behavior, to view effects of self-monitoring using iPad application, to observe maintenance of self-monitoring skills when intervention removed</td>
</tr>
<tr>
<td>Assisting WatchMinder: vibrating prompt watch, self-graphing on-task behavior of students with ASD in elementary school setting.</td>
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<tr>
<td>Intervention led to immediate increase in on-task behavior.</td>
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<tr>
<td>High levels of on-task behavior maintained after intervention removal at follow-up above baseline.</td>
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<tr>
<td>The study investigated whether an exergaming intervention called &quot;Makoto Arena&quot;, a light &amp; sound-speed-based game, had effects on response speed, EF, &amp; motor skills in children.</td>
</tr>
<tr>
<td>Makoto Arena Exergaming intervention</td>
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<tr>
<td>30 sessions</td>
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<tr>
<td>P’s must hit the sensors that light up in random sequence within a limited time.</td>
</tr>
<tr>
<td>While all EF components were tested, significant improvements seen in working memory &amp; metacognition, as well as strength &amp; agility motor skills.</td>
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<tr>
<td>EF &amp; motor skills closely correlated</td>
</tr>
<tr>
<td>Sample had weaker motor skills deficits than most ASD patients. Potentially greater benefit to those with more motor skill deficits? Potentially unavailable to use with severe motor deficits?</td>
</tr>
</tbody>
</table>
- Lessons on physical mental flexibility, goal setting & planning; what they are, why they're important & how to develop these skills  
- Unstuck & On Target  
- 20 lessons, 30-40 min each, delivered during school in geps of 3-6 students  
- Games, visual supports, role-plays, & positive reinforcement  
- Practice using self-regulatory scripts  
- Includes training for parents & teachers on reinforcing lessons  
67 (67) 9.49 7-11 59 8 X X X X X  
- Significant improvements in problem-solving, flexibility, & planning/organization compared to a similarly administered social skills intervention.  
- Adults with ASD were taught a strategy to improve inference generation when reading, metacognitive ability, general reading comprehension, & social inference ability  
- Mnemonic strategy: ACT & Check  
- Explicit instruction of components of inference generation & practice of strategy use  
- 1-hr sessions, twice a wk, for a total of 6 wks  
25(25) 22-34 22 3 X X  
- The strategy was effective at improving inference generation & some aspects of metacognitive ability, but not reading comprehension or social inference ability.  
- Evidence-based intervention to improve problem-solving in college students with ASD  
- Therapists provided psychoeducation on ASD in relation to problem solving  
- Students were taught how to recognize problems when they occur, how to challenge dysfunctional attitudes toward problem solving, how to regulate negative emotions, & how to use their emotions to facilitate problem solving effectiveness.  
5(5) 21.27 18-23 5 0 X X  
- Anecdotally, Ps found it a helpful program; gave them a more positive outlook to problem-solving.  
- Improving emotional competence in school-age children with ASD  
- Employed the EBSST (Emotion-Based Social Skills Training) to teach children with ASD how to understand their own & other’s emotions, emotional problem-solving, & emotional regulation skills.  
- EBSST is a comprehensive curriculum, which utilizes a multi-faceted approach to cater to the learning needs of children with ASD  
217 (217) 9.4 7-13 195 22 X X X X  
- Significantly improved emotional competency skills, increase in scores for treatment grp not statistically different from control grp  
- Results supported the practical utility of the EBSST in schools, but not in the home environment. |
<table>
<thead>
<tr>
<th>Article</th>
<th>Participants</th>
<th>Time</th>
<th>ADHD</th>
</tr>
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<tbody>
<tr>
<td>Wood, J. J., Fuji, C., Renno, P., &amp; Van Dyke, M. (2014). Impact of cognitive behavioral therapy on observed autism symptom severity during school recess: A preliminary randomized, controlled trial. Journal of Autism and Developmental Disorders, 44(9), 2566-2570.</td>
<td>X</td>
<td>X</td>
<td>- This study compared cognitive behavioral therapy (CBT) &amp; treatment-as-usual (TAU) in terms of effects on observed social communication-related autism symptom severity during unstructured play time at school for children with ASD.</td>
</tr>
</tbody>
</table>

• This pilot study evaluated the efficacy of the Tic-Tac software tool at decreasing anxiety during waiting periods for adults with ASD & learning difficulties

• The Tic-Tac software represents time visibly, audibly & tangibly (with vibration), accompanying these representations with pictures to identify the current activity or waiting period.

• Ps used the Tic-Tac software during waiting periods for two months

• The use of Tic-Tac resulted in lower levels of anxiety related behaviour in all three Ps, compared to the baseline


• Examined use of a mnemonic strategy & graphic organizer to teach children with high-functioning ASD planning & self-regulation skills necessary to write a persuasive essay

• Six 45 min lessons

• Self-regulated strategy development (SRSD): instruction of a mnemonic-based self-regulation strategy

• Participants continued to use the essay planning & self-regulation strategies when tested after the intervention, & wrote higher quality essays


• Using positive reinforcement as an intervention to improve working memory in ASD patients

• P’s were promised & given temporary access to items that they wanted, but were restricted access to outside of the study (video games, candy, movies, etc.) for correct responses

• Positive reinforcement significantly improved performance on ‘digit span backwards’ task

• This difference was maintained in post-test without further reinforcement, & generalized to a slightly different task


• Follow-up study to (Baltruschat, 2011); evaluated whether positive reinforcement could improve performance on a ‘digit span backwards’ working memory task for children with ASD

• Participants were given access to a preferred item (eg. video game, candy, stickers) as positive reinforcement whenever they got an answer correct

• This type of reward structure resulted in large improvements in working memory & generalized to untrained stimuli & responses


• Examined the effects of a planning & self-regulation strategy on the story writing ability of young children with ASD

• Self-regulated strategy development (SRSD) was used in order to teach Ps how to plan & tell stories

• 6 stages of instruction

• Included the use of mnemonic devices

• Results from this study revealed that instruction in planning & story writing utilizing the SRSD approach improved the quality of story writing for young children with ASD

• The Ps were able to learn & apply the targeted strategies, & this resulted in better writing on posttreatment & maintenance fictional story probes.
<table>
<thead>
<tr>
<th>Article</th>
<th>Summary</th>
<th>Interventions</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bal, V. H., Kim, S. H., Cheong, D., &amp; Lord, C. (2015). Daily living skills in individuals with autism spectrum disorder from 2 to 21 years of age. Autism, 19(7), 774-784.</td>
<td>* Examine predictors of Daily Living Skills attainment and trajectories of separate DLS domains (using a mixed model) in a longitudinal sample of children referred for possible ASD at about 2 yrs of age. Also looked at early predictors (like demographics, diagnosis, cognitive &amp; language skills at age 2) on DLS outcomes. They predict that kids not on ASD would show the highest DLS gains, but even within sample of kids with ASD, those not impaired in non-verbal mental age &amp; language will make more gains.</td>
<td>* Early childhood nonverbal mental age was the strongest predictor of daily living skills attainment for both ASD and NS diagnostic grps. Gap-based modeling suggested two distinct trajectories for individuals with ASD: High-DLS grp gained approx 12 yrs in DLS from age 2 to 25, whereas Low-DLS grp's DLS improved 3-4 yrs over the 16-19 yr study period. Both groups remained considerably below age level expectations. NVMA, receptive language, &amp; social-communication impairment predicted membership in High vs Low DLS grps. Receiving &gt;20 hrs of parent-implemented intervention before age 3 also associated with DLS trajectory. Article also emphasizes that DLS should be a focus of treatment plans particularly for adolescents.</td>
<td>X X (152) 179 2.44 2-21 133 19 X X X X</td>
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<tr>
<td>Liew, S. M., Thevanaja, N., Hong, B. Y., &amp; Magiati, I. (2015). The relationship between autistic traits and social anxiety, worry, Obsessive-Compulsive, and depressive symptoms: Specific and non-specific mediators in a student sample. Journal of Autism and Developmental Disorders, 45(3), 858-872.</td>
<td>* Autistic traits have a positive correlation with anxiety symptoms; five mediators were proposed to mediate this relationship: social problem-solving, social competence, teasing experiences, prevention/punishment for preferred repetitive behaviours, &amp; aversive sensory experiences.</td>
<td>* Autistic traits positively correlated with both anxiety &amp; depressive symptoms.</td>
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Exploring the individual, social, & community barriers to physical activity (PA) experienced by children with autism spectrum disorder (ASD) that make participation more difficult & may contribute to increased screen time (i.e., time spend with electronics).

Parents of children with ASD reported significantly more barriers than parents of TD children. Based on parent-report, children with ASD required too much supervision compared with. Parents of children with ASD were more likely to report that adults lack skills needed to include their child, that their child has few friends, & that other children exclude their child. The number of parent-reported barriers to PA was inversely correlated with the hours spent in PA per yr and positively related to total screen time. Findings indicate the need for community-based PA programs designed to meet the special requirements of this population & policies that compel schools & other government-supported organizations for inclusion and/or targeted programming.


A review looking at a diverse range of topics relevant to DRR to the ASD population, including methodological and procedural refinements, technology applications, challenging behavior, & methods for teaching particular relational sciences.

Although ABA-based intervention for children with ASD has become widely known for being effective and evidence-based, the common misconception still remains that ABA is only effective for teaching basic key skills & ignores advanced language and cognition. Even at the most basic theoretical and philosophical levels, this myth is untrue. However, it is not enough to state that a science can be applied to complex skills and behaviors; a robust program of research must also bear this out.


A review of the literature on the most common co-occurring psychiatric symptoms in youth with ASD & current trends in intervention for these disorders. General guidelines for the assessment of psychiatric symptoms in youth with ASD have also been provided as well as the emerging research on emotion regulation interventions.

Findings from emotion regulation interventions indicate that improvements in underlying emotion regulation skills may reduce the impact and likelihood of co-morbid psychopathology in youth with ASD.
• There is a need to support the development, examination, & use of these interventions in “real-world” clinical settings, such as schools and community-based practices.
• Program developers & researchers can use a bidirectional model of practice to help ensure that these psychosocial interventions are feasible, effective, & sustainable in practice settings.


Study investigates deficits in visual attention shifting in ASD patients, as well as relationships between visual attention shifting & set shifting (flexibility/working memory).

• Results suggest inefficient top-down influences over prefrontal visual processing in ASD. Insufficient attention shifting may be related to restricted & repetitive behaviors rather than social communication deficits.

• ASD-specific memory impairment theorized to arise from hippocampal failure. Study uses a pattern separation memory task known to depend on hippocampus to tease out differences between ASD Ps & neurotypicals.

![Data Table]


• Describing the operation of a Communication Coaching Program, which was designed to provide support to students with ASD attending the University of Rhode Island.

![Data Table]


• A review of the behaviour & social communication monitoring strategies used in 40 autism intervention research studies that involve parents, teachers, & other caretakers as data collectors.

![Data Table]


• A review of how making Evidence Based Interventions more flexible & integrative may help improve their utility & may increase their uptake by stakeholders in community mental health & school settings.

![Data Table]


• Assessing the validity of the Emotion Regulation & Social Skills Questionnaire for young people with ASD.

![Data Table]
The report addresses these three questions: First, what appears to be the area of focus in Individual Education Plan goals for students with autism? Second, what seem to be trends in goals & objectives as students with autism enter adolescence? Third, do IEP goals & objectives appear to vary by student placement in inclusion & noninclusion settings?

In elementary school, IEP teams developed more total goals; by middle school, curriculum becomes more abstract & is delivered at a faster pace, & students are expected to work independently & demonstrate adult-like work habits; IEP teams have lesser expectations of student ability to participate in the core general education curriculum over time.

Students in inclusion & noninclusion programs both had a high number of IEP goals & services & had limited success in attaining each of their goals. This suggests that with more goals, students become less likely to make sufficient educational progress to meet their goals.

A comprehensive, complex program model approach is necessary for effectively preparing students with ASD for the post-school world.

The "implementation science now" program provides the frameworks & tools for supporting adoption of such models in public school systems.

Disorder-specific treatment of emotional problems results in oversight of main underlying maladaptive processes that lead to co-occurring disorders with ASD.

Parts of the transdiagnostic framework are relevant in treating maladaptive processes common in youth with ASD.

Disorder-specific treatment of emotional problems results in oversight of main underlying maladaptive processes that lead to co-occurring disorders with ASD.
<table>
<thead>
<tr>
<th>Narzisi, A., Muratori, F., Calderoni, S., Fabbro, F., &amp; Urgesi, C. (2013). Neuropsychological profile in high-functioning autism spectrum disorders. Journal of Autism and Developmental Disorders, 43(8), 1895-1909.</th>
<th>22 (66)</th>
<th>9.77</th>
<th>5-16</th>
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<th>• Compared developmental neuropsychological profiles for high functioning ASD vs. control grps in children to see trends in performance &amp; deficit. • Visuospatial processing is spared in HFASD. • Deficits shown in attention &amp; EFs (inhibition, initiation, shifting), language, learning &amp; memory, &amp; sensori-motor processing. • Theory-of-mind (metacognition) difficulties in verbal tasks but not in understanding emotional contexts, suggesting appropriate contextual contextual cues will help emotional understanding in HFASD children.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granlund, G. J., Granlund, M., &amp; Kottorp, A. (2011). Assessment of time processing ability and daily time management in children with and without developmental disabilities. Learning and Memory Developments and Intellectual Disabilities, 269-280.</td>
<td>118 (262)</td>
<td>8</td>
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<td>• Validation of KaTid, an assessment of Time Processing Ability for children. • Evidence that time perception, time orientation, &amp; time management are sub-components of the overarching concept of Time Processing Ability, &amp; that KaTid is a valid way of assessing TPA. • Important step toward development of a TPA intervention.</td>
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<td>Pre-test post-test (PTPT)</td>
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<td>Randomized Controlled Trials (RCT)</td>
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<td>Case study</td>
<td>A detailed consideration to the development of a specific person, group, or situation over a period of time.</td>
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<td>Assessment Validation</td>
<td>The focus of the study was to gauge the validity of an assessment tool and whether it accurately and reliably measures the intended construct.</td>
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<td>Intervention</td>
<td>Behavioral</td>
<td>Uses behaviourism approach to changing behaviour, i.e. classical or operant conditioning. Encouraging behaviour with rewards, discouraging with punishments, pairing stimuli with</td>
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<td>Cognitive Behavioral Therapy (CBT)</td>
<td>A form of psychotherapy targeting cognition change that involves assessment, reconceptualization, skills acquisition and training, generalization and maintainance, and/or</td>
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<td>Technology</td>
<td>Uses technology as a primary component of intervention (video, watch, iPad, video games, etc.)</td>
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<td>Exergaming</td>
<td>Interactive activities that involve exercise as well as a game</td>
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<td>Self-monitoring</td>
<td>Involves the ability to regulate behavior to accommodate behavior</td>
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<td>Mean Age</td>
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<td>The average age of all participants in the study</td>
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<td>Range</td>
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<td>The variation of the participant's age distribution from lowest to highest</td>
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<td>Gender</td>
<td>Male</td>
<td>Indicate number of participants in study that are male</td>
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<td>EF component</td>
<td>Metacognition</td>
<td>The ability to notice, observe, and monitor one's own thoughts.</td>
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<td></td>
<td>Working Memory</td>
<td>The capacity to hold information in mind for the purpose of completing a task</td>
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<td></td>
<td>Planning</td>
<td>The ability to manage current and future-oriented task demands and make decisions to affect predicted outcomes</td>
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<td>Organization</td>
<td>The ability to impose order on work, play, storage spaces, or ideas.</td>
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<td>Inhibition</td>
<td>The ability to stop one's own behavior at the appropriate time, including stopping actions, and thoughts.</td>
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<td>Problem Solving</td>
<td>The ability to recognize a problem, develop and initialize a solution, and evaluate its effectiveness</td>
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<td>Initiation</td>
<td>The ability to begin a task or activity and to independently generate ideas, responses, or problem-solving strategies</td>
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<td>Emotional Regulation</td>
<td>The ability to control one's own emotions</td>
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<td>Mental flexibility</td>
<td>The ability to adapt to the changing demands or a situation by shifting from one thought or action to another.</td>
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<td>EF Measure</td>
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<td>Unstandardized</td>
<td>The measure was used has not been extensively validated</td>
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