**Disclosure belangen spreker**

<table>
<thead>
<tr>
<th>(potentiële) belangenverstrengeling</th>
<th>Geen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voor bijeenkomst mogelijk relevante relaties met bedrijven</td>
<td>Niet van toepassing</td>
</tr>
<tr>
<td>- Sponsoring of onderzoeksgeld</td>
<td>• geen</td>
</tr>
<tr>
<td>- Honorarium of andere (financiële) vergoeding</td>
<td>• geen</td>
</tr>
<tr>
<td>- Aandeelhouder</td>
<td>• geen</td>
</tr>
<tr>
<td>- Andere relatie, namelijk ...</td>
<td>• geen</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Enhancing Skills in Individuals with Autism Spectrum Disorder through Technology-mediated Interventions

PhD Thesis
Doctoral Programme 3035
Research in Psychology

Patricia Pérez-Fuster

Supervisors:
Dr Antonio M. Ferrer Manchón & Dr Aglaia-Lila Kossyvaki

Kannerlezing - Cultural Center Rozet. Arnhem, 11th of September 2017
Autism Spectrum Disorder (ASD)

Difficulties in:

Social communication and social interaction across multiple contexts

Nonverbal communicative behaviours used for social interaction

[American Psychiatric Association, 2013]
Joint Attention (JA)

The shared focus of two individuals on an object or event

[Scaife & Bruner, 1975; Seibert, Hogan & Mundy, 1982]
Joint Attention (JA)

* Typically developing children
  
  Participate: 6-12 months
  Gaze follow and point: <24 months

  [Moore & Corkum, 1998; Mundy & Gomes, 1998]

* Children with ASD
  
  Difficulties in:
  - Initiating JA (IJA)
  - Responding to JA (RJA)

  [Mundy, Sigman, Ungerer, & Sherman, 1986]
Technology and ASD

Visual information

Sensory-friendly

Customisable:
- Abilities
- Interests

Predictable

Technology-Mediated Interventions (TMI)

Narrative reviews

Systematic reviews

Meta-analyses

[Grandin, 2006; Bogdashina, 2003; Mesibov, Shea, & Schopler, 2005; Rogers & Dawson, 2010]

[Goodwin, 2008; Fletcher-Watson, 2014; Grynszpan, Weiss, Pérez-Díaz, & Gal, 2014]
Technology and ASD

Technology’s lifecycle and research studies

[Herrera, 2015]
Evidence-Based Practice (EBP)

Determining whether a specific intervention programme...

- has been grounded on available evidence, and
- it has used good quality research
- to gain enough empirical support

... for adequately concluding about its effectiveness

[Adapted from Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996; Anderson, 2006]
Research questions

Study 1

Which are the **general trends** in state-of-the-art of TMI research with individuals with **ASD**?

Study 2

Which are the **trends** in state-of-the-art of TMI research with individuals with **ASD** with regard to **JA skills**?

To what degree can existing TMI research on **JA skills** in the field of **ASD** be considered **EBP**?

Study 3

To what extent can the use of a **novel technology** be effective in improving **JA skills** in children with **ASD**?

To what extent can a **real-world TMI** contribute to the promotion of **EBP** in the **ASD** field?
To describe the current research trends in TMI studies for individuals with ASD
Search procedure

Electronic databases

Keywords

Autis* - Autism Spectrum Disorder / ASD - Autism Spectrum Condition / ASC - Asperger Syndrome - Pervasive Developmental Disorder / Pervasive Developmental Disorder Not-Otherwise Specified / PDD*

&

Technolog* - Technology Enhanced Learning / TEL - Computer* - Computer Assisted Technology / CAT - Virtual* - Robot*

Title & abstract of papers published in:

- English
- Peer-reviewed journals
- January 2000 - December 2015
Selection of the studies

Inclusion criteria:

✴ IV: an intervention programme (> 2 sessions) with a piece of technology

✴ DV: any skill related to ASD symptoms, curriculum or individuals’ wellbeing

✴ At least one participant with:
  ▸ PDD
    - Autism
    - Asperger’s Syndrome
    - PDD-NOS
  ▸ ASD

| PDD & Autism & Asperger’s Syndrome | PDD-NOS & ASD | DSM-IV-TR & ICD10 | DSM-5 |
Selection of the studies

2000-2014

PsycINFO N=775
ERIC N=298
PubMed N=775
WoS N=2,681

Identified studies N=4,529

Duplicates N=1,588

Screening of titles and abstracts N=2,941

Excluded: clearly not relevant N=2,428

Assessment of full-text papers N=513

Excluded: do not match criteria N=374

Studies included N=139

Duplicates N=6

Hand-searched studies N=7

Total studies included N=178

2015

PsycINFO N=130
ERIC N=20
PubMed N=59
WoS N=393

Identified studies N=602

Duplicates N=182

Screening of titles and abstracts N=420

Excluded: clearly not relevant N=290

Assessment of full-text papers N=130

Excluded: do not match criteria N=92

Studies included N=38

Consensus:
Observer 1
Observer 2
100%
Extraction of information

- Participant characteristics
  - Number
  - Gender
  - Age
  - Diagnosis
- IV: technology
- DV: target skill

- Research design
  - Setting
  - Country
  - Year
  - Journal

Consensus:
 Observer 1 - 98.7%
 Observer 2 - 100%
 Observer 3
Participant characteristics

1850 participants

1317 males (71%)
139 females (13%)
294 unknown (16%)

Early years (2-4 years old): 28 (16%)
Primary (5-11 years old): 112 (66%)
Secondary (12-17 years old): 74 (44%)
Post-secondary (18+ years old): 29 (17%)

ASD: 56 (32%)
Autism: 51 (29%)
Asperger’s Syndrome: 26 (15%)
Combination: 41 (23%)
Technology: hardware

<table>
<thead>
<tr>
<th>HW</th>
<th>Description</th>
<th>Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal computer (PC)</td>
<td>Any laptop or desktop PC with any operative system (OS) (e.g., Microsoft Windows OS, Apple OS X, Linux). It can be accompanied by the use of a range of computer input peripheral devices (e.g., keyboard, mouse, touchscreen, joystick, gamepad, video camera, microphone, eye tracking system and motion sensing input device), and computer output peripheral devices (e.g., monitor, projector, TV screen, virtual glasses, speakers and headphones).</td>
<td>95</td>
</tr>
<tr>
<td>Tablet</td>
<td>Any tablet computer with any OS (e.g., Google Android, Apple iOS, Microsoft Windows). It can be accompanied by the use of accessories such as keyboard and digitized pen.</td>
<td>29</td>
</tr>
<tr>
<td>Smartphone/small handheld device</td>
<td>Any smartphone with any OS (e.g., Google Android, Apple iOS, Microsoft Windows). Also Personal Digital Assistants (PDAs) and advanced MP4 devices of any trademark.</td>
<td>17</td>
</tr>
<tr>
<td>Robot</td>
<td>Any robot of any appearance (i.e., humanoid and non-humanoid). It can be accompanied by the use of additional items, which can be embedded on the robot or be peripheral, such as video camera, microphone, eye tracking system and motion sensing input device.</td>
<td>15</td>
</tr>
</tbody>
</table>
# Technology: software

<table>
<thead>
<tr>
<th>SW</th>
<th>Description</th>
<th>Papers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic</td>
<td>Any type of commercially available SW (including free SW) to be used by general population (e.g., text processors, video players, slide show SW).</td>
<td>68</td>
<td>38%</td>
</tr>
<tr>
<td>Special needs</td>
<td>Any type of SW that has been specially designed for individuals with special needs (e.g., ASD-specific educational SW) that is currently commercially available or it has been available in the past (it includes free SW).</td>
<td>52</td>
<td>29%</td>
</tr>
<tr>
<td>Research</td>
<td>Any type of SW that has been developed for the purpose of the study and it has not been commercialized anyhow, at least, not at the time the study was carried out.</td>
<td>51</td>
<td>29%</td>
</tr>
<tr>
<td>None</td>
<td>No SW is used (e.g., a conventional player that is used with video tapes).</td>
<td>7</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>178</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Technology: medium of delivery

<table>
<thead>
<tr>
<th>MoD</th>
<th>Description</th>
<th>Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive sequence</td>
<td>SW is used by the participant to view/listen/interact with sequences of visual/auditory items or to play with games, for practising a target skill (e.g., digital stories, problem solving tasks).</td>
<td>55     31%</td>
</tr>
<tr>
<td>Prompting</td>
<td>SW is used to deliver prompts for the participant (e.g., to do a task, to engage with an activity) through video modelling, video/picture/text instruction or video feedback.</td>
<td>35     20%</td>
</tr>
<tr>
<td>Interactive agent</td>
<td>Virtual characters, avatars, robots or real persons recorded in video segments to provide initiations and responses according to participant’s actions.</td>
<td>22     12%</td>
</tr>
<tr>
<td>Simulation</td>
<td>SW shows virtual environments (2D/3D) that simulate real-life situations for the participant to navigate through.</td>
<td>21     12%</td>
</tr>
<tr>
<td>Sentence composition and speech generation</td>
<td>SW is used by the participant to compose a sentence from a catalogue of words or pictures so that the sentence is read and/or presented visually by the SW.</td>
<td>21     12%</td>
</tr>
</tbody>
</table>
Target skills

- Social communication and social interaction: 44%
- Academic: 25%
- Life: 19%
- Multiple: 12%

PhD Thesis - Patricia Pérez-Fuster
## Research design

<table>
<thead>
<tr>
<th>Research design</th>
<th>Single-subject design</th>
<th>Group design</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple baseline</td>
<td>37 28%</td>
<td>52 28%</td>
<td>100%</td>
</tr>
<tr>
<td>Multiple probe</td>
<td>35 26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternating treatment</td>
<td>20 15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>16 12%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reversal</td>
<td>10 7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination</td>
<td>9 7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploratory</td>
<td>7 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(SSD total)</strong></td>
<td>134 72%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With control group</td>
<td>Randomised 18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not randomised</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Without control group</strong></td>
<td>25 50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(Group design total)</strong></td>
<td>52 28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Research design

Number of technology-mediated intervention papers in ASD

- SSD
- Group design

Number of participants
Setting

Real-world settings: 146 (82%)
Laboratory settings: 13 (7%)
Combination: 5 (3%)
Unknown: 14 (8%)

Exclusively: 92 (52%)
In combination: 106 (60%)
# Enhancing Skills in Individuals with ASD through TMIs: A Systematic Review

**Objective**

**Method**

**Results**

**Discussion**

<table>
<thead>
<tr>
<th>Country</th>
<th>Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>107</td>
</tr>
<tr>
<td>UK</td>
<td>11</td>
</tr>
<tr>
<td>New Zealand</td>
<td>7</td>
</tr>
<tr>
<td>Taiwan</td>
<td>7</td>
</tr>
<tr>
<td>Australia</td>
<td>6</td>
</tr>
<tr>
<td>Canada</td>
<td>6</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>6</td>
</tr>
<tr>
<td>Israel</td>
<td>4</td>
</tr>
<tr>
<td>Italy</td>
<td>3</td>
</tr>
<tr>
<td>Japan</td>
<td>3</td>
</tr>
<tr>
<td>Romania</td>
<td>3</td>
</tr>
<tr>
<td>Spain</td>
<td>3</td>
</tr>
<tr>
<td>Brazil</td>
<td>1</td>
</tr>
<tr>
<td>France</td>
<td>1</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
</tr>
<tr>
<td>Ireland</td>
<td>1</td>
</tr>
<tr>
<td>Korea</td>
<td>1</td>
</tr>
<tr>
<td>Portugal</td>
<td>1</td>
</tr>
<tr>
<td>Singapore</td>
<td>1</td>
</tr>
<tr>
<td>Sweden</td>
<td>1</td>
</tr>
<tr>
<td>Thailand</td>
<td>1</td>
</tr>
<tr>
<td>Turkey</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>178</td>
</tr>
</tbody>
</table>

*Country data from a systematic review on the effectiveness of Transcultural Mindfulness Interventions (TMIs) in enhancing skills in individuals with Autism Spectrum Disorder (ASD).*
Enhancing Skills in Individuals with ASD through TMIs: A Systematic Review

**Objective**

**Method**

**Results**

**Discussion**

PhD Thesis - Patricia Pérez-Fuster
## Journal

<table>
<thead>
<tr>
<th>Journal</th>
<th>Papers</th>
<th>Focus</th>
<th>IF^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Journal of Autism and Developmental Disorders</td>
<td>28</td>
<td>ASD/SN</td>
<td>3.493</td>
</tr>
<tr>
<td>2 Research in Autism Spectrum Disorders</td>
<td>16</td>
<td>ASD/SN</td>
<td>1.317</td>
</tr>
<tr>
<td>3 Focus on Autism and Other Developmental Disabilities</td>
<td>10</td>
<td>ASD/SN</td>
<td>1.273</td>
</tr>
<tr>
<td>4 Autism: The International Journal of Research and Practice</td>
<td>9</td>
<td>ASD/SN</td>
<td>3.170</td>
</tr>
<tr>
<td>5 Education and Training in Autism and Developmental Disabilities</td>
<td>9</td>
<td>ASD/SN</td>
<td></td>
</tr>
<tr>
<td>6 Journal of Development and Physical Disabilities</td>
<td>7</td>
<td>ASD/SN</td>
<td>0.880</td>
</tr>
<tr>
<td>72 The Journal of Special Education</td>
<td>1</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>73 The Journal of Speech and Language Pathology – Applied Behavior Analysis</td>
<td>1</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>74 The Scientific World Journal</td>
<td>1</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>75 Topics in Language Disorders</td>
<td>1</td>
<td>1%</td>
<td></td>
</tr>
</tbody>
</table>

Total 178 100%

Note: SN = special needs; Tech = technology; Psy = psychology; Edu = education; Med = medicine; Neurosci = neuroscience; N/A = not applicable.

^It includes the two conference proceedings where the papers of Bhattacharya et al. (2015), Costa et al. (2010), and Saiano et al. (2015) were published. b2015 Impact Factor according to the JCR (Thomson Reuters, 2016).
Findings

- ASD population: females and adults are underrepresented

- Methodological weaknesses:
  - Lack of information (e.g., gender, diagnosis, setting)
  - Inappropriate research designs:
    - Group designs with small number of participants
    - Group designs without control or comparison group

- Social communication and social interaction skills
To systematically review TMI studies which focused on the improvement of JA skills in individuals with ASD

&

To determine the research quality and the level of evidence achieved by the studies reviewed
Search procedure

Electronic databases

Keywords

Autis* - Autism Spectrum Disorder / ASD - Autism Spectrum Condition / ASC - Asperger Syndrome - Pervasive Developmental Disorder / Pervasive Developmental Disorder Not-Otherwise Specified / PDD*

&

Technolog* - Technology Enhanced Learning / TEL - Computer* - Computer Assisted Technology / CAT - Virtual* - Robot*

Title & abstract of papers published in:

🌟 English
🌟 Peer-reviewed journals
🌟 January 2000 - December 2015
Selection of the studies

Inclusion criteria:

◆ IV: an intervention programme (≥ 2 sessions) with a piece of technology

◆ DV: a JA skill

◆ At least one participant with:
  ▸ PDD
     - Autism
     - Asperger’s Syndrome
     - PDD-NOS
  ▸ ASD

DSM-IV-TR
ICD-10

DSM-5
Selection of the studies

2000-2014

- PsycINFO N= 775
- ERIC N= 298
- PubMed N= 775
- WoS N= 2,681

Identified studies N= 4,529

- Duplicates N= 1,588

Screening of titles and abstracts N= 2,941

- Excluded: clearly not relevant N= 2,428

Assessment of full-text papers N= 513

- Excluded: do not match criteria N= 374

Studies included N= 139

2015

- PsycINFO N= 130
- ERIC N= 20
- PubMed N= 59
- WoS N= 393

Identified studies N= 602

- Duplicates N= 182

Screening of titles and abstracts N= 420

- Excluded: clearly not relevant N= 290

Assessment of full-text papers N= 136

- Excluded: do not match criteria N= 92

Studies included N= 38

Hand-searched studies N= 7

Total studies included N= 178

5 studies
Extraction of information

- Participant characteristics
  - Number
  - Gender
  - Age
  - Diagnosis

- IV: technology

- DV: JA skill

- Research design
  - Setting
  - Country
  - Year
  - Journal

Enhancing JA Skills in Individuals with ASD through TMIIs: A Systematic Review and EBP Evaluation
EBP Evaluation

Development of the Evaluative Method for Evaluating and Determining Evidence-Based Practices in Autism

Brian Reichow · Fred R. Volkmar · Domenic V. Cicchetti

[Reichow, Volkmar, Domenic, & Cicchetti, 2008]
# Research report rigour

## Group research

- **Primary quality indicators**
  - Participant characteristics
  - IV/DV
  - Comparison condition
  - Research question - data analysis
  - Statistical tests

- **Secondary quality indicators**
  - Random assignment
  - IOA
  - Blind raters
  - Fidelity
  - Attrition
  - Generalisation / maintenance
  - Effect size
  - Social validity

## Single-subject research

- **Primary quality indicators**
  - Participant characteristics
  - IV/DV
  - Baseline condition
  - Visual analysis
  - Experimental control

- **Secondary quality indicators**
  - IOA
  - Kappa
  - Blind raters
  - Fidelity
  - Generalisation / maintenance
  - Social validity

---

[Reichow, Volkmar, Domenic, & Cicchetti, 2008]
Research report strength

Group research

- Primary quality indicators
  - Participant characteristics
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  - Research question - data analysis
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- Secondary quality indicators
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Single-subject research

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[Reichow, Volkmar, Domenic, & Cicchetti, 2008]
Research report strength

**Group research**

- Primary quality indicators
  - Participant characteristics
  - IV/DV
  - Comparison condition
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  - Statistical tests

- Secondary quality indicators
  - Random assignment
  - IOA
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  - Fidelity
  - Attrition
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  - Effect size
  - Social validity

**Single-subject research**

- Primary quality indicators
  - Participant characteristics
  - IV/DV
  - Baseline condition
  - Visual analysis
  - Experimental control

- Secondary quality indicators
  - IOA
  - Kappa
  - Blind raters
  - Fidelity
  - Generalisation / maintenance
  - Social validity

[Reichow, Volkmar, Domenic, & Cicchetti, 2008]
Enhancing JA Skills in Individuals with ASD through TMIs: a Systematic Review and EBP Evaluation

Objective | Method | Results | Discussion

Study 1

Research question - data analysis

Primary quality indicators
- Participant characteristics
- IV/DV
- Comparison condition

Secondary quality indicators
- Random assignment
- IOA
- Blind raters
- Fidelity
- Attrition
- Generalisation / maintenance
- Effect size
- Social validity

Study 2

Baseline condition

Primary quality indicators
- Participant characteristics
- IV/DV

Secondary quality indicators
- IOA
- Kappa
- Blind raters
- Fidelity
- Generalisation / maintenance
- Social validity

Study 3

Visual analysis

Primary quality indicators
- Participant characteristics
- IV/DV

Secondary quality indicators
- IOA
- Kappa
- Blind raters
- Fidelity
- Generalisation / maintenance
- Social validity

Discussion

Evidence
- High
- Acceptable
- Unacceptable

No evidence
Level of EBP

- N single-subject and group studies
- Research report strength
- Conducted:
  - by N research teams
  - in N different locations
  - with N different participants

[Reichow, Volkmar, Domenic, & Cicchetti, 2008]
Studies included

[Cheng & Huang, 2012]  [Costa et al., 2015]  [Goodrich et al., 2012]  [Tapus et al., 2012]  [Warren et al., 2015]
Participant characteristics

<table>
<thead>
<tr>
<th>Study</th>
<th>Participant Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheng &amp; Huang, 2012</td>
<td>3 males, 9-12 PDD</td>
</tr>
<tr>
<td>Costa et al., 2015</td>
<td>8 males, 6-9 Autism</td>
</tr>
<tr>
<td>Goodrich et al., 2012</td>
<td>2 males, 3-8 ASD</td>
</tr>
<tr>
<td>Tapus et al., 2012</td>
<td>4 males, 2-6 Autism</td>
</tr>
<tr>
<td>Warren et al., 2015</td>
<td>6 males, 2-4 ASD</td>
</tr>
<tr>
<td></td>
<td>23 males, 2-12 years old</td>
</tr>
</tbody>
</table>
Technology

- Virtual Reality
  - JASL
  - Data glove

- Robot
  - Kaspar
  - Keyboard

- Robot
  - Troy
  - Wii controller

- Robot
  - Nao
  - Kinect

- Robot
  - Nao
  - Tobii120

[Cheng & Huang, 2012] [Costa et al., 2015] [Goodrich et al., 2012] [Tapus et al., 2012] [Warren et al., 2015]
JA skills

[Cheng & Huang, 2012]  [Costa et al., 2015]  [Goodrich et al., 2012]  [Tapus et al., 2012]  [Warren et al., 2015]

• Pointing
• Showing
• Sharing
• Interaction

• Following
• Looking
• Eye gaze
• Pointing
• Head movement
• Touching

Using/following:
• Eye gaze
• Pointing
• Head turn

• Initiating motor actions while gazing
• Eye gaze
• Gaze shifting

• Turning to look at a pointed target

IJA & RJA
Enhancing JA Skills in Individuals with ASD through TMIs: A Systematic Review and EBP Evaluation

**Objective**

**Method**

**Results**

**Discussion**

---

**Introduction**

**Study 1**

**Study 2**

**Study 3**

**Discussion**

Enhancing JA Skills in Individuals with ASD through TMIs: A Systematic Review and EBP Evaluation

**Objective**

**Method**

**Results**

**Discussion**

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**Research design**

[Cheng & Huang, 2012]  
[Costa et al., 2015]  
[Goodrich et al., 2012]  
[Tapus et al., 2012]  
[Warren et al., 2015]

- 3 participants  
- 8 participants  
- 2 participants  
- 4 participants  
- 6 participants

- Single-subject design  
  - Multiple probe  
- Group design  
  - Without control group  
- Single-subject design  
  - AB  
- Single-subject design  
  - Alternating treatment  
- Group design  
  - Without control group
Setting

[Cheng & Huang, 2012] Laboratory
[Costa et al., 2015] School
[Goodrich et al., 2012] Clinic
[Tapus et al., 2012] Laboratory
[Warren et al., 2015] Laboratory
<table>
<thead>
<tr>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Cheng &amp; Huang, 2012]</td>
</tr>
<tr>
<td>[Costa et al., 2015]</td>
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Enhancing JA Skills in Individuals with ASD through TMIs: a Systematic Review and EBP Evaluation

**Objective**

**Method**

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**Introduction**

Study 1

Study 2

Study 3

Discussion

Year

[Cheng & Huang, 2012]

[Costa et al., 2015]

[Goodrich et al., 2012]

[Tapus et al., 2012]

[Warren et al., 2015]
Enhancing JA Skills in Individuals with ASD through TMIs: A Systematic Review and EBP Evaluation

Objective  Method  Results  Discussion

Study 1
Enhancing JA Skills in Individuals with ASD through TMIs: A Systematic Review and EBP Evaluation

Objective  Method  Results  Discussion

Study 2
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Objective  Method  Results  Discussion

Study 3
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Objective  Method  Results  Discussion

Discussion
Enhancing JA Skills in Individuals with ASD through TMIs: A Systematic Review and EBP Evaluation

Objective  Method  Results  Discussion

[Cheng & Huang, 2012]  [Costa et al., 2015]  [Goodrich et al., 2012]  [Tapus et al., 2012]  [Warren et al., 2015]
# Enhancing JA Skills in Individuals with ASD through TMIs: a Systematic Review and EBP Evaluation

<table>
<thead>
<tr>
<th>Study</th>
<th>Primary quality indicators</th>
<th>Secondary quality indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PART</td>
<td>IV</td>
</tr>
</tbody>
</table>

Research report strength & level of EBP

<table>
<thead>
<tr>
<th>Study</th>
<th>Research method</th>
<th>Strength rating</th>
<th>Successful N/ Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheng &amp; Huang (2012)</td>
<td>SSD</td>
<td>W</td>
<td>3/3</td>
</tr>
<tr>
<td>Costa et al. (2015)</td>
<td>GD</td>
<td>W</td>
<td>8/8</td>
</tr>
<tr>
<td>Goodrich et al. (2012)</td>
<td>SSD</td>
<td>W</td>
<td>2/2</td>
</tr>
<tr>
<td>Tapus et al. (2012)</td>
<td>SSD</td>
<td>W</td>
<td>2/4</td>
</tr>
<tr>
<td>Warren et al. (2015)</td>
<td>GD</td>
<td>W</td>
<td>6/6</td>
</tr>
</tbody>
</table>

Number of group studies with strong rigour rating: 0 = Groups
Number of group studies with adequate rigour rating: 0 = Group_A
Number of participants from single-subject studies with strong rigour rating: 0 = SSD_s
Number of participants from single-subject studies with adequate rigour rating: 0 = SSD_A

Formula for determining EBP status:

\[
\text{EBP status} = \frac{(\text{Groups} \times 30) + (\text{Group}_A \times 15) - (\text{SSD}_s \times 4) + (\text{SSD}_A \times 2)}{0} = \frac{(0 \times 30) + (0 \times 15) + (0 \times 4) + (0 \times 2)}{0} = \text{Z}
\]

Points (Z) | 0 | 10 | 20 | 30 | 31 | 40 | 50 | 59 | 60+ |
---|---|---|---|---|---|---|---|---|---|
EBP status | Not an EBP | Promising EBP | Established EBP

Findings

- Small number of TMI studies focusing on JA skills
- Technology developed for research:
  - Sophisticated
  - Not available
- Lack of methodological rigour and strength
ENHANCING JA SKILLS IN CHILDREN WITH ASD THROUGH AN AUGMENTED REALITY-TMI

· To explore the impact of an Augmented Reality-TMI (AR-TMI) on the RJA skills of gaze following and pointing in children with ASD

· To use Reichow et al.’s (2008) quality guidelines for ensuring the rigour and strength of the research report
Participants

- 5 males, 1 female
- 3-8 years old
- 1 teacher of speech and hearing
- 1 teacher of special education
- ASD
- Intellectual disability
- Language difficulties
Setting and technology

Audio-visual classroom

Pictogram Room

Touch

Gaze following
Materials

RJA item of Module 1
Autism Diagnostic Observation Schedule-2 (ADOS-2)

[Lord et al., 2012]

Early Social Communication Scales (ESCS)

[Mundy et al., 2003]
Materials

Dummy

Turtles

Posters
Materials

Which poster is she looking at?

Which turtle is she looking at?

Which poster is the dummy looking at?

Which turtle is the dummy looking at?
Design

A multiple baseline single-subject design

[PhD Thesis - Patricia Pérez-Fuster]
Procedure

**Study 1**
Enhancing JA Skills in Children with ASD through an Augmented Reality-TMI

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-assessments</td>
<td>Pre-assessments</td>
<td>Pre-assessments</td>
</tr>
<tr>
<td>Baseline Phase</td>
<td>Baseline Phase</td>
<td>Baseline Phase</td>
</tr>
<tr>
<td>Learning Phase</td>
<td>Learning Phase</td>
<td>Learning Phase</td>
</tr>
<tr>
<td>Intervention Phase</td>
<td>Intervention Phase</td>
<td>Intervention Phase</td>
</tr>
<tr>
<td>Post-assessments</td>
<td>Post-assessments</td>
<td>Post-assessments</td>
</tr>
<tr>
<td>1 session</td>
<td>3 sessions</td>
<td>3 sessions</td>
</tr>
<tr>
<td>Week 1</td>
<td>Week 2</td>
<td>Week 3</td>
</tr>
</tbody>
</table>

**Study 2**

**Study 3**

**Discussion**

- Introduction
- Study 1: Enhancing JA Skills in Children with ASD through an Augmented Reality-TMI
  - Objective
  - Method
  - Results
  - Discussion
- Study 2
- Study 3
- Discussion

- PhD Thesis - Patricia Pérez-Fuster
Effectiveness of Pictogram Room

Percentage of All Non-Overlapping Data

- Highly effective

Pearson $\phi > 0.70$ [$p < 0.01$]

- Strong positive association
Effectiveness of Pictogram Room

Participant 5

Baseline | Learning | Intervention | Follow-up

Percent of opportunities with correct response

Sessions

- V2: Poster
- V3: Turtle
# Generalisation of JA skills

<table>
<thead>
<tr>
<th>Participant</th>
<th>V4</th>
<th>V5</th>
<th>V6: ESCS</th>
<th>V7: ADOS-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Poster</td>
<td>Turtle</td>
<td>L/R RJA</td>
<td>Behind RJA</td>
</tr>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| IOA | 1 | 1 | .97 | .92 |
| Kappa | 1 | 1 | .94 | .88 |
Enhancing JA Skills in Children with ASD through an Augmented Reality-TMI

Objective  Method  Results  Discussion
Research report rigour and strength

<table>
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- High
- Acceptable
- Unacceptable

Evidence
No evidence
Findings

- JA skills can be enhanced in children with ASD through an AR-TMI:
  - Short period of time: 6 intervention sessions
  - Easy-to-use and available technology

- Small number of participants:
  - Single-subject designs (MBD)
  - Statistical techniques (PAND) → Evidence-based conclusions

- Good levels of research report rigour and strength can be achieved by using quality indicators throughout the study
Findings

Success of a TMI study:

Identifying the needs/interests/preferences of the person with ASD

Real-world setting

Individuals who better know the person with ASD
Principal contributions

* Overview of TMI studies for individuals with ASD

* Report on the rigour and strength of previous TMI studies for the enhancement of JA skills in individuals with ASD

* Effectiveness of a novel AR-TMI for enhancing JA skills in children with ASD
Limitations

- 15-year period
- Languages other than English were not included
- Computer science databases were not considered
- Consensus was not evaluated at all stages
- No comparison group (traditional / other technology)
Future research

- TMI studies providing relevant information and using quality indicators
- Promoting EBP in the field of TMIs for individuals with ASD
- Systematic reviews including meta-analyses
- Implementing the novel AR-TMI to other and bigger samples of children
- Comparing the effect of Pictogram Room with traditional methods / other technologies
- Validating the tools developed for the assessment of JA skills
Enhancing Skills in Individuals with Autism Spectrum Disorder through Technology-mediated Interventions

Thank you
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www.uv.es/pefuspa

Kannerlezing - Cultural Center Rozet. Arnhem, 11th of September 2017