Computer-Supported Collaboration and Social Communication Disorder

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Computer-Supported Collaboration and Social Communication Disorder: Overview

- Peer collaboration: Benefits for young children
- Collaboration by children with SCD
- Supporting children with SCD in collaborative contexts: Advantages of technology
- Design and testing of a computer intervention

Focus: Children 4 - 7 years-old
Benefits of collaborative activity

Collaboration is a ‘coordinated activity that is the result of a continued attempt to construct and maintain a shared conception of a problem’ (Rochelle & Teasley 1995, p.70)

A large body of research has demonstrated that collaborative group work:

- Is an effective strategy to facilitate learning (e.g. Christie et al 2009)
- Also fosters more positive peer social relations (Tolmie et al., 2010)
Benefits of collaborative activity

Piagetian perspective
Socio-cognitive conflict - peer's alternative view - disagreement is disequilibrating
Child individually restructures understanding in light of the conflict
Essentially a private, individual process (Howie, Tolmie, & Rodgers, 1990; Howe, Tolmie, & Rodgers, 1992).

Social determinist perspective
Peer cooperation, not conflict, enhances cognitive development.
Children solve problems together by establishing a joint definition of the situation (Wertsch, 1984), partners co-construct knowledge by coordinating and integrating their perspectives (Vygotsky, 1978). Thus, this theoretical orientation predicts that dyadic interactions that are cooperative rather than conflictual are more likely to result in cognitive change (Damon & Killen, 1982; Damon & Phelps, 1987).
Benefits of collaborative activity

The positive effects of collaborative activities stem primarily from:

- **Engagement in productive discussion** expressing ideas, questioning each other, proposing alternatives, requesting explanations (Kruger, 1993; Howe 2010, Littleton & Howe 2010, Tolmie & Howe, 1993)

- **Especially – differences in opinion and perspective** (Howe & Tolmie, 1998; Mercer, 1995).

- A review (Sills et al., 2016, children ages 4-7) concluded that brief ‘one-off’ collaborative interactions were sufficient to have positive, significant impact on cognitive development
Children with SCD and peer collaboration

Brinton et al (2000) (n=6, ages 6-7)
Presented a challenge - aggressive or withdrawn behaviour
Were frequently ignored or dominated by TD children

Kimhi & Bauminger (2012) (n=58; ages 3-6) HF-ASD children:
I. More irrelevant behaviours
II. Slower to solve the problems
III. Fewer coordinative gestures, shared less information

Murphy et al (2014) Low pragmatic test scoring children (n=32, ages 5-6)
I. Used high-quality information-seeking questions less often (low-quality questions more often)
II. Ignored questions and requests
III. Poorer instructions
IV. More irrelevant statements and responses
V. Fewer positive statements

TD children were more negative about LS children
Children with SCD; interactions at school

Observation of teaching assistant role (EDTA project)
- Blatchford et al., (2009) - 49 mainstream schools, 686 pupils
- Support for children with special educational needs – esp low ability and/or difficult behaviour
- Most common activity: working with one-to-one with pupils – many advantages to TA support
- However, pupils with more classroom support have less interaction with teacher/other peers - rates of interaction reduced by about half
- Strong evidence; peer group approaches for children with SEN are effective academically and for social participation (Nind & Wearmouth, 2006)
Children with SCD; interactions at school

Radford, Blatchford et al. (2015) Model of Scaffolding for TAs: Moment-by-moment observation how TAs interact with pupils

1. Repair role: self-initiated, other initiated repair – hints and prompts preferable to outright corrections

2. Support role: Keep children on-task, motivated, reduce frustration: ‘Remember be sensible, ok’, ‘You've been really good all the morning’ ‘Come on then’ ‘See if you can do this next one’

3. Heuristic role: ‘using any method that encourages learners to discover solutions for themselves’ – e.g., modelling, questioning/probing, prompting rethinking ‘why did you do it like that?’ ‘could you do it another way?’
Children with SCD; interactions at school

Peer collaboration - children with SCD typically overwhelmed

Managing interaction with peers demands a high level of input from an adult:

• ensuring equitable participation
• resolving disputes
• enforcing rules
• giving rewards and feedback
• Sustain motivation .............whilst at the same time explaining aspects of communication
Supporting children with SCD in peer collaboration

- Could we design a collaborative task with ‘built-in’ support for children with SCD?

Task design:
- ‘in its infancy’ (Howe & Mercer, 2007);
- ‘one of the most challenging aspects of fostering constructive collaborative activity’ (Baines et al., 2012);
- current activities rely heavily on adult skill to support children; well-designed activities could reduce adult support (Alt, 2012)
Typically-used tasks in schools and studies of collaboration:

- Jigsaw puzzles, artistic collaborations (e.g., drawings, collages), games (e.g., shopping task) referential communication tasks (e.g., Map-task), science/maths problems, consensus exercises, construction (e.g., Lego®)

- Tasks that are stimulating, open-ended and high in ambiguity are best (Baines et al., 2009; Howe et al., 2007).
Advantages of technology

8 Games: report the use of technology to support children with ‘communication difficulties’ (learning disability, HF- and LF-ASD) to communicate and collaborate with peers (Ben-Sasson, 2013; Cress et al., 2011; Holt & Yuill, 2014; Parsons, 2015; Piper et al., 2006; van Veen et al., 2009; Weiss et al., 2011; Zancanaro et al., 2014)

FEATURES IN COMMON

- ‘Floor control’ turn-taking resolves issues of dominance and control
- Reward distribution and rule implementation by a computer program - seen as fairer and less arbitrary than if imposed by an adult
- Inclusion of multiple, discrete, achievable goals
- All children view, and act upon, same problem space
Advantages of technology

• Technical flexibility - games can be tailored for individual need to just the right skill level - scaffolding fades and falls away

• ‘Enforced’ structured collaboration between children so that they solve problems in partnership

• Computer games have a ‘script’ - elicit and guide particular types of activities, predictable sequence of events

• *Clear* consistent feedback

• Increases awareness - others’ actions, views, perspectives

• Repeatable, variable setting/environment

• Built-in virtual joint ‘rewards’

• Fun! Surprises, colourful animations unusual sounds
Advantages of technology

Act as a ‘scaffold’ for social interaction - free up an adult from handling behavioural issues to focus on developing and improving communication skills
Advantages of technology

Drawbacks

• Much of the technology used in these 8 initial studies is expensive (e.g., Diamond Touch® ~£5,000)

• Physical limitations – must remain in seat or on foot pad

• Small studies (n= 4 - 16), pre- post-testing, no control groups
Development of E-PLAYS

• **E-PLAYS** – ‘**E**nhancing **P**ragmatic **L**A**n**guage skills for **Y**oung children with **S**ocial communication disorder’

• Game design was based on findings from previous small-scale studies and on scaffolding research for peer collaboration
Development of E-PLAYS

- Prototype game development - with young gamers and a games developer

- Children and teachers at Bedford schools were consulted on the prototype, played the game and gave feedback. Speech and language therapists also gave input.

- Three more cycles of testing, consultation and revision over 6 months with children, teachers, speech and language therapists and gamers

- Testing cycles informed pacing, hand control and animation – established suitable levels for language and problem-solving
Pilot testing of E-PLAYS

Pilot testing:
- (1) What are differences between TD and children with SCD in their use of the game?
- (2) Testing of the intervention (E-PLAYS) based on the computer game
Pilot testing of E-PLAYS: participants

- 6 schools - all Year 1 children (5-6 years-old)
- Consent /response rate 61%, n = 215
- All were screened using the Test of Pragmatic Skills (TPS, Shulman, 1986) which gives a measure of a child’s skill level for his/her age (TPS standardised 650 children USA)
- All children falling 1 sd below the mean were selected (LPs), a total of 32 children
- They were gender-matched with children at or above the expected level for their age according to the TPS (HPs)
- 24 further pairs of HPs children were made up of other children
Pilot testing of E-PLAYS

32 HPs + LPs pairs
24 HPs + HPs pairs

Questions:
What are differences in communication between LPs individuals and HPs individuals in HPs pairs?

What are differences in communication between HPs individuals in HPs+LPs pairs and HPs individuals in HPs +HPs pairs?
Pilot testing of E-PLAYS

• All dyads played the game for 10 minutes

• Audio-recorded and professionally transcribed


Coded by blinded raters – inter-rater reliability = weighted Kappa = 0.82.
High-pragmatic vs Low-pragmatic scorers

High-P pairs scored more rewards on the game (p=.06)

Murphy, Faulkner & Farley, *Journal of Abnormal child Psychology*, 2014
High-pragmatic vs Low-pragmatic scorers

- Positive statement**
- Information question*
- Partner understanding**
- Specific clarification request*
- High-quality directive

Legend:
- Low-P
- High-P
High-pragmatic vs High-pragmatic with Low-pragmatic scores

- negative**: 0 for HPwLP, 1 for HPwHP
- inform*: 16 for HPwLP, 0 for HPwHP
- clarification*: 0 for HPwLP, 2 for HPwHP
- non-discussed disagreement*: 0 for HPwLP, 2 for HPwHP
- hard directive**: 1 for HPwLP, 1 for HPwHP
Design of E-PLAYS intervention

- Based on collaborative learning research
  - our study comparing HPs and LPs

Training manual for consistency – sessions delivered by research assistant

Three sessions (30 mins):
1. Asking information questions
2. Giving clear directions
3. Clarification requests
Design of E-PLAYS intervention

Training sessions:
Research assistant played game with the child, within context of the game:
Modelled good questions, directives etc.
‘sabotage’ – e.g., ludicrously poor directives
Practiced the game with the child pointing out where questions, clarifications could be used effectively
Timeline for E-PLAYS intervention testing

6 weeks between baseline, time 1, time 2

Group 1
16 children

Group 2
16 children

BASELINE (PRE-TEST)
TPS & computer game with partner
3 training sessions

POST-TEST 1
TPS & computer game with partner
No intervention

POST-TEST 2
TPS & computer game with partner
3 training sessions
E-PLAYS intervention outcome – reward scores

Difference at Time 1
\( p = .03, r = .32 \)
E-PLAYS intervention outcome – TPS scores

Difference at Time 1 $p = .009$, $r = .42$

## E-PLAYS intervention outcome – verbal communication - LPs

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<thead>
<tr>
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<th>$p$</th>
<th>$r$</th>
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<tr>
<td>Navigational directives</td>
<td>.40</td>
<td>.05</td>
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<tr>
<td>Information-seeking questions</td>
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<td>.60</td>
</tr>
<tr>
<td>High-quality clarification requests</td>
<td>.06</td>
<td>.26</td>
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<tr>
<td>Low-quality questions</td>
<td>.26</td>
<td>.12</td>
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<tr>
<td>Ignoring responses</td>
<td>.47</td>
<td>.02</td>
</tr>
<tr>
<td>Positive statements</td>
<td>.02*</td>
<td>.34</td>
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**E-PLAYS intervention outcome – verbal communication – HP partners**

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<thead>
<tr>
<th></th>
<th>( p )</th>
<th>( r )</th>
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<tbody>
<tr>
<td>Checking understanding</td>
<td>.01**</td>
<td>.38</td>
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Non-significant increase in positive statements and decrease in negative statements
Summary & Conclusions

• Collaborative activities are commonly used in schools
• Evidence indicates that children with SCD could benefit – they receive little opportunity
• TAs spend much time dealing with behaviour issues
• Facilitating collaborative activities for children with SCD takes considerable adult input
Summary & Conclusions

• Use of technology could provide ‘scaffolding’ within a collaborative activity, freeing up an adult to focus on teaching communication skills

• E-PLAYS could possibly address this need – three sessions showed improvements in collaborative skills such as asking questions, and TD peers were more positive

• Mechanisms?
  Motivation
  Practice (~2 rewards per minute)
  Impact of collaboration for 4-7 years-olds – (Sills et al. review, 2016)
  Reduced cognitive load during interaction
  Other viewpoints strikingly illustrated
What next for E-PLAYS?

• Further investigation on teaching directives
• Testing in schools with TAs delivering
• Greater range of outcome measures (impacts on classroom behaviour, learning, mental health and peer relations)
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references


