Goal Setting Interventions: Implications for Participants on the Autism Spectrum

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Abstract Single-case research design studies that included a goal setting component in interventions for a broad array of participants engaged in a learner role were reviewed. A systematic search of the empirical literature identified 38 studies that met the inclusion criteria. These studies were evaluated in terms of participant characteristics, who set the goals (self or other), how goals were incorporated into interventions, type of behavior change goal setting was applied to and whether maintenance and generalization of intervention effects was assessed. Results highlight the potential benefits of including a self-set goal component in interventions aimed at assisting participants across the autism spectrum to achieve independent functioning. An agenda is proposed for future research exploring goal setting for this population.

Keywords Autism spectrum disorder · Goal setting · Self-management · Systematic review

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Introduction

Goals have been defined as the object or aim of an action that an individual is trying to accomplish, and it is generally understood that goal attainment involves meeting a specific standard of task proficiency within an acceptable time frame (Locke et al. 1981). Several published reviews have reported that goal setting and goal attainment are important components of self-determination for students with various developmental or learning disabilities (Algozzine et al. 2001; Fowler et al. 2007; Konrad et al. 2007; Palmer and Wehmeyer 2003). Self-determination has been identified by the US Department of Education as an important educational outcome for students with disabilities (Algozzine et al. 2001). The Division of Career Development and Transition (DCDT) has suggested that by the age of 14 years, students should be encouraged to the full extent of their capabilities to assume a maximum amount of responsibility in planning their futures (Halpern 1994).

The skills required to develop self-determination are derived from the classic career development literature (Super 1983) and include developing an understanding of the relationship of time to goal attainment (Field et al. 1998). Research by Palmer and Wehmeyer (2003) conducted amongst children with learning disabilities, speech impairments, giftedness and mental retardation has shown that problem solving and goal setting skills develop over time. Their findings demonstrated that children with disabilities can, with the support of teachers, set goals and work through a self-determined skill development model at as young as 5 years of age.

Copeland and Hughes (2002) conducted a review on the effects of goal setting upon task performance for individuals with a diagnosis of mental retardation (MR). The authors reported an improvement in awareness and task performance upon the introduction of goal setting, with stronger effects

noted with more training. Self-management strategies were taught in addition to goal setting in 7 of the 17 studies reviewed and achieved positive outcomes. Similarly, Konrad et al. (2007) published a review of the effects of self-determination interventions on the academic skills of students with learning disabilities (LDs) and/or attention deficit/hyperactivity disorder (ADHD). Again, stronger increases in students' productivity were achieved when goal setting was added to self-management.

The literature has indicated that goal setting skills can direct attention and effort towards relevant activities and positively affect task performance (Copeland and Hughes 2002; Konrad et al. 2007; Locke and Latham 2002). While it is evident that these skills can be learned over time, it is possible that individuals with autism spectrum disorder (ASD) are not always given adequate opportunity to acquire the necessary skills to set and attain goals or opportunity to practice them. The ability to independently set challenging, attainable and appropriate goals is an important skill for students with ASD to develop and may contribute to improved awareness, task performance, fulfilment and independent functioning.

Recently, attention has been drawn to the significant number of individuals with high-functioning autism or Asperger's syndrome who were diagnosed during the early 1990s and, as a result of early intervention and supports throughout school, are both capable and motivated to enter higher education (Pinder-Amaker 2014; VanBergeijk et al. 2008). Elsewhere, it has been reported that children with ASD may face an elevated risk for developing obesity (Curtin et al. 2014). Curtin and colleagues (2014) postulated that contributing factors may include disordered sleep, atypical eating patterns and challenges associated with engaging in physical activity. It is plausible that goal setting skills may prove an important component in treatment programs aimed to overcome these barriers and develop a healthy and independent lifestyle.

However, a recent review of self-management interventions for students with ASD (Carr et al. 2014) identified a paucity of goal setting research for students on the autism spectrum. Yet, evidence of the success of goal setting techniques has been reported for individuals with mental retardation or cognitive disabilities. Therefore, to address this knowledge gap, we conducted a broader systematic literature search of goal setting research which included an array of participants not restricted by diagnostic category. The aim of this review was to map the current knowledge base regarding goal setting as an intervention, or part thereof, for students with varied additional learning needs and challenges. Given our focus on the use of goal setting as part of individualised self-management training for individuals with ASD, the search was restricted to research employing single-case research designs (SCDs). The ideographic nature of SCD research makes this methodology particularly appropriate when examining the effects of individualised interventions (Southall and

Gast 2011), such as often seen in special education research (Horner et al. 2005). These findings are then discussed with reference to their implications for students with ASD with a view to proposing an agenda for future research in this area. The following research questions were investigated:

1. What are the profiles of participants in goal setting research?
2. How have goal setting interventions been structured?
3. What target behavior was goal setting applied to?
4. Who is involved in setting participant goals (self or other)?
5. Are goal setting skills maintained over time and was generalization assessed?
6. What does the current literature suggest for applying goal setting to participants with ASD?

Method

Studies were located for this review by conducting a systematic search of peer-reviewed literature published prior to November, 2013. Keywords typically associated with goal setting were identified from existing literature reviews, and a PsycINFO database search was subsequently conducted. The following search terms were queried: "goal setting", "goal attainment" and "goal orientation". A hand search of the reference lists of existing goal setting reviews, published in peer-reviewed journals, was also conducted to identify any additional relevant articles that may have been omitted from the database search results.

The following inclusion criteria were adopted for this review:

1. The study utilised a SCD such as a multiple baseline, reversal or alternating treatment design.
2. The study presented data from each phase in graphical format for each participant.
3. The intervention included a goal setting component.
4. Participants were students engaged in a learning process.
5. Articles were published in English in peer-reviewed journals.

An independent review of both the title and the abstracts was conducted to ensure the reliability of the article selection process. A graduate student familiar with the broader self-management literature was provided a randomly selected sample of 30 % of all search results and examined both the titles and the abstracts to determine whether these articles met the inclusion criteria for further review. Inter-assessor agreement (IOA) for the article selection procedure was determined by dividing the number of agreements by the total number of

agreements plus disagreements and multiplying by 100. An IOA of 97 % was achieved for this process.

Results and Discussion

This search and selection process yielded 38 studies describing research conducted with 186 participants, who ranged in age from 6 to 54 years. Participants were attending school, higher education, elite athlete or sheltered workshop job skills training programs. The 38 studies were conducted by 29 separate research teams in various locations. A total of 30 studies were from within the USA, conducted in the following states: Alabama (2), California (1), Florida (3), Georgia (1), Hawaii (1), Illinois (2), Kansas (2), Louisiana (2), Missouri (1), Montana (1), Nebraska (2), New York (3), Ohio (3), Oklahoma (2), Oregon (1), Tennessee (2) and Washington (1). The remaining eight studies were conducted in the following locations: Canada (3), New Zealand (2) and the UK (3). Further, for one study by researchers from Oregon, data collection was conducted in South Korea.

Table 1 provides a descriptive overview of each study included in the review.

The descriptive statistics obtained from these data are further summarised in Table 2.

What Are the Profiles of Participants in Goal Setting Research?

Of the 186 participants, 128 were males (69 %) and 58 were females (31 %). For studies that reported an age range only, we have classified the participants using the uppermost age. Where studies reported an average age, we have classified the participants using the average age provided. The remaining studies provided an age for each participant. Accordingly, there were 82 elementary students aged 6 through 12 years (44 %), 73 high school students aged 13 through 17 years (39 %) and 31 adults aged 18 years or older (17 %).

Participant descriptions were classified using the primary diagnosis provided in the original study. Accordingly, there were 5 participants with autism (3 %), 4 with Asperger's syndrome (AS) (2 %), 14 with ADHD (8 %), 14 with emotional behavioral disorder or difficulties (8 %), 45 with learning disability or difficulties (24 %), 21 with mental retardation (11 %), 12 with non-compliance/conduct disorder (6 %), 1 participant who was manic/depressive (1 %), 2 gifted students (1 %), 15 participants described as typically developing (8 %), 49 athletes (26 %) and 4 participants with physical disabilities (2 %).

Mixed results were reported with young students. Figarola et al. (2008) used goal setting and self-graphing to improve the math fact fluency of three young participants that included a 7 year old with a LD and 7 and 8 year olds with ADHD. A

goal was established for the end of the year, and participants graphed their daily performance scores. Participants were given verbal praise for correctly entering their data, as well as for meeting or exceeding their aim line. Results showed that performance met or exceeded goals 83 % of the time for the 8-year-old participant and 90 % of the time for the 7 year old with LD. Modifications in the form of shorter problem sets, verbal prompts and reinforcement were required for the other 7 year-old participant before achieving consistent improvement.

By contrast, Grossi and Heward (1998) reported more consistent results in a study with older participants. Four adults aged 20–37 years old diagnosed with mild mental retardation were included in an intervention that was conducted in a community based restaurant training program. During training, each participant established a goal to increase production, goal setting being guided by the experimenter if the goal appeared unattainable. Participants were taught to self-monitor and record their performance. The authors reported that all participants increased their work productivity without compromising the quality of their work and without achieving complete accuracy in self-recording.

Similarly, Balcazar et al. (1991) reported consistent results and generalization effects among older physically disabled students. Three university students aged in their 20s and one aged 40 years were included in an intervention that used role-play to teach the skills necessary for individuals to recruit the help they may need to attain their own self-set personal goals. A goal attainment scale was used to identify either no change, realistic attainment or best anticipated attainment outcomes, and the authors reported that for the 20 goals that were set by the four participants, realistic attainment was reported eight times and best anticipated attainment was achieved for seven goals. No change was reported in only five instances. A generalization probe also reported that intervention effects were observed in natural situations in which participants asked for help.

To date, intervention research has been conducted across a broad age range of participants. While less consistency has been demonstrated with younger children, the literature we reviewed has indicated preliminary support for goal setting employed across all ages. Importantly, these findings indicate that adults have been able to learn and apply goal setting skills. While our search revealed little research conducted among participants diagnosed with ASD, goal setting has been employed in successful interventions with participants who experience learning difficulties or cognitive challenges. These preliminary findings may present significant implications for future research with this population as the behavioral issues often exhibited by individuals with ASD that may serve to mask a self-determination skill deficit amenable to goal setting intervention.

Table 1 Description of studies

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Goals set by others									
Barry and Messer (2003)	ADHD	12	5 M	Classroom of elementary school	On-task behavior, disruptive behavior, academic performance	Multiple baseline across five students with embedded withdrawal	Goals based on classroom behavior of other students, self-recording, teacher verbal/written prompting, reinforcement, fading	Self-management intervention was effective, gradual fading required; also influenced academic performance as well as classroom behavior	Yes
Brobst and Ward (2002)	Soccer players	15–17	3 F	General education high school	(i) Movement with the ball. (ii) Movement during restarts. (iii) Movements after ball passed	Multiple baseline across behaviors for each participant	Public posting of daily practice results placed near playing field; Coach established goal setting; Oral feedback; praise for meeting goals or encouragement if not met	Intervention was effective in improving practice performance for all three behaviors; generalization to games evident for movement with the ball for all three participants but unclear for other behaviors	Yes
Coddling, Lewandowski and Eckert (2005) *	ADHD	9–12	1 M, 1 F	Elementary school	Increase mathematics fluency	Alternating treatments	Comparison: performance feedback and experimenter goal setting and Performance feedback and student selected goal setting or instruction; performance feedback; experimenter set goals (percentile shaping) student selected prize for exceeding goal	Both participants performed better during the self-set goals condition; both participants indicated that PFSG was their favourite intervention	No
Duhon et al. (2004)	Failing grades in written language, spelling math	8–10	4 M	General education	Math: work completed correctly per minute; reading/writing: words correct per minute	Alternating treatments	Practice, guided organisation, or instruction; performance feedback; experimenter set goals (percentile shaping) student selected prize for exceeding goal	Two student rewards were effective in the brief assessment suggesting a performance deficit hypothesis; for two a skill deficit hypothesis; extended analysis conducted to compare skills-based treatment with performance-based treatment	No
Farrell and McDougall (2008)	SED/ADHD/BI/Polar (1) ADHD (2) SLD—Math (4) ADHD/Tourettes (1)	14–15	4 M, 2 F	Special education math at high school	Correct digits, incorrect digits, accuracy	Combined multiple baseline across participant, changing criterion	Self-monitoring pace using: MotivAider tactile cuing, visual cuing on worksheets, daily self-graphing, teacher-set goals	One participant omitted given unstable baseline; five participants met or exceeded lower performance limit in nearly every session; increase in pace not associated with a decrease in accuracy, most participants also increased overall percentage of digits completed accurately	Yes
Figarola et al. (2008)	Learning disability (1) ADHD (2)	7–8	3 F	Special education resource room in public elementary school	Performance of 40 one-digit by one-digit sums from 0 to 18	ABAB withdrawal (2) AB with reduction in sets (1)	Goal setting based upon baseline, self-graphing of daily results, verbal praise	Goal setting met or exceeded aim line on 83 and 90 % of occasions; multiple modifications to reduce sets, with verbal prompting for third participant, described as less successful	No
Gross and Duhon (2013)	Math skill deficits	8–9	3 F	Elementary school	Math problem accuracy	Non-concurrent multiple baseline across subjects	Computer-aided instruction with prizes; accuracy goal set at 90 %; teacher training in instruction, modelling and rehearsal with performance; feedback	Findings demonstrated an increase in math fact accuracy. All three students met accuracy goal at some point using CAI	No
Hanel and Martin (1980)	Mental retardation	19–54	8 M	Residential sheltered workshop	Coffee pack assembly rate per hour; percentage correct	Combined multiple baseline, reversal; delayed treatment control group	Self-monitoring, self-administration of token reinforcement, goal setting determined by other	Increased productivity of all clients, some considerably, some minimally	No
Lambert et al. (1999)	Gymnasts	12–13	4 F	Gym		Within subjects alternating treatment	Self-set goals, coach-set goals	Gymnasts with an internal locus of control spent more time on-task	No

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Ward et al. (1998)	PE: volleyball	Grade 4	14 M 10 F	General education—PE volleyball skills	On-task behavior when working on beam during competition training Opportunity to respond: number of trials performed, number correct per minute	Multi-treatment A-B-A-C reversal	Group instruction, peer dyads, peer mediated accountability, teacher determined goal setting, peer recording and public posting, reinforcement	during self-set goal condition; gymnasts with an external locus of control spent more time on-task during coach-set goal condition Little difference between group instruction and peer dyad condition; highest number of or's and correct trials during peer-mediated accountability phase; using peers as data collectors created an instructional environment where teacher could hold students accountable for performance, recording created a product of performance All students increased journal writing quantity; goals set to be attainable but challenging; all teachers reported intervention easy to implement and required few resources, student like the intervention, one student appeared to improve performance in other academic areas	No
Winn et al. (2004)	N/A; referred for behavioral consultation	7–9	2 M, 1 F	General education in three inner-city schools	Number of words written in daily journal	Non-concurrent multiple baseline using three AB designs	Goal setting; self-recording: counting words and recording on goal charts, reinforcers	Increased number of story elements used when writing fictional stories, quality of the story and the average number of words. Generalised across task, from fictional to narrative writing, and maintained at four week follow-up Increase in work productivity for all four trainees, trainees increased their rates of work without sacrificing work quality, results suggest complete accuracy is not necessary for improved work performance All students increased on-task levels upon implementation of SR and GS; all students levels in SR and GS higher than baseline for math productivity; because of ceiling effects and results suggest effects of SR and GS not consistently different Demonstrated statistically significant increase in positive affect for all participants; no statistically significant decrease in negative	Anecdotal, no data
Asaro-Saddler and Saddler (2010)	Asperger's syndrome (1) Autism (2)	6–9	3 M	Public elementary, various empty classrooms	Improve story writing length, number of story elements, quality	Multiple probes across multiple baseline design	Goal setting (participant and instructor), self-monitoring, self-recording, self-reinforcement	Increased number of story elements used when writing fictional stories, quality of the story and the average number of words. Generalised across task, from fictional to narrative writing, and maintained at four week follow-up Increase in work productivity for all four trainees, trainees increased their rates of work without sacrificing work quality, results suggest complete accuracy is not necessary for improved work performance All students increased on-task levels upon implementation of SR and GS; all students levels in SR and GS higher than baseline for math productivity; because of ceiling effects and results suggest effects of SR and GS not consistently different Demonstrated statistically significant increase in positive affect for all participants; no statistically significant decrease in negative	Yes
Grossi and Heward (1998)	Mild mental retardation	20–37	4 M	Community-based restaurant training program	(a) Work productivity, (b) Work quality/accuracy, (c) Accuracy of self-monitoring work performance	Multiple baseline across tasks	Self-evaluation training, self-set goals with guidance, self-monitoring, verbal direction, modelling, rehearsal, corrective feedback, social praise, self-adjustment of goal	Increased number of story elements used when writing fictional stories, quality of the story and the average number of words. Generalised across task, from fictional to narrative writing, and maintained at four week follow-up Increase in work productivity for all four trainees, trainees increased their rates of work without sacrificing work quality, results suggest complete accuracy is not necessary for improved work performance All students increased on-task levels upon implementation of SR and GS; all students levels in SR and GS higher than baseline for math productivity; because of ceiling effects and results suggest effects of SR and GS not consistently different Demonstrated statistically significant increase in positive affect for all participants; no statistically significant decrease in negative	No
Lee and Tindal (1994)	Typically developing students	10–12	3 M, 2 F	Regular education classroom in Korea	(i) Percentage of time on-task, (ii) Mathematics productivity rate completed accurately per minute	Alternating treatments	Self-recording; self-set goals with guidance; combined goal setting and reward for achieving daily goal (teacher provided snack); feedback	Increased number of story elements used when writing fictional stories, quality of the story and the average number of words. Generalised across task, from fictional to narrative writing, and maintained at four week follow-up Increase in work productivity for all four trainees, trainees increased their rates of work without sacrificing work quality, results suggest complete accuracy is not necessary for improved work performance All students increased on-task levels upon implementation of SR and GS; all students levels in SR and GS higher than baseline for math productivity; because of ceiling effects and results suggest effects of SR and GS not consistently different Demonstrated statistically significant increase in positive affect for all participants; no statistically significant decrease in negative	Yes
McCarthy et al. (2010)	Junior multi event athletes	12 (2), 13 (1)	3 F	Athletes club track	(i) Positive affect, (ii) Negative affect	Multiple baseline across participants	Coach assisted goal setting; diary to detail process goals and goal setting; feedback and reinforcement	Increased number of story elements used when writing fictional stories, quality of the story and the average number of words. Generalised across task, from fictional to narrative writing, and maintained at four week follow-up Increase in work productivity for all four trainees, trainees increased their rates of work without sacrificing work quality, results suggest complete accuracy is not necessary for improved work performance All students increased on-task levels upon implementation of SR and GS; all students levels in SR and GS higher than baseline for math productivity; because of ceiling effects and results suggest effects of SR and GS not consistently different Demonstrated statistically significant increase in positive affect for all participants; no statistically significant decrease in negative	No

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Merriman and Coddig (2008)	ADHD	HS	2 M, 1 F	General high school, special ed teacher support	(i) Homework completion. (ii) Homework accuracy	Multiple baseline across participants	Coaching with guided goal setting, self-monitoring of homework completion, accuracy and progress, graphing of completion and accuracy, fading	affect; participants set appropriate process and performance goals with guidance and mastered goals All students increased percentages for homework completion and accuracy, maintained during fading and follow-up for two participants (not implemented for third participant as did not meet accuracy, fading long-term goal, however increase considered adequate)	Yes
Miller and Kelley (1994)	Conduct and learning problems, hyperactivity, inattention/passivity	9–11	2 M, 2 F	General education	(i) Accuracy of completed homework. (ii) On-task behavior	Reversal ABAB multiple baseline	Child, parent goal suggestions then determined a compromised goal, parent monitoring, contingency contracting, daily and weekly rewards or sanctions	Increased work accuracy for all participants and increased stability of responding across phases for three of four participants, two participants demonstrated increases in percentage of on-task behavior	No
Moore et al. (2001)	Typically developing students	8	3 M	General education	On-task behavior	Multiple baseline across subjects	Self-monitoring with self-recording using intervals of on-task at the time, tallied at end and graphed; goal setting with assistance and on-going performance feedback; fading	Substantial increase in on-task behavior for all three students during self-monitoring/self-recording; performance levels maintained during goal setting; maintained during fading for two participants	Yes
Srikameswaran and Martin (1984)*	Mentally handicapped	25–36	2 M, 2 F	Sheltered workshop training centre	(i) Production of bags of ceiling tile clips. (ii) Percentage of correct production	Modified multiple baseline with reversal-replication	Self-monitoring plus goal setting (guided during training); token exchange quarters; edibles/activities; general/ specific prompts verbal interactions; feedback; pay system	SRP(SMGS+reinforcer) was effective at increasing production rate above baseline, two participants did not respond to quarters but demonstrated small increases for edible/activity reinforcers; SRP more effective than SM or SMGS for three of four participants	No
Tollefson et al. (1986)	Learning disabled	Grade 7 (6) Grade 8 (2)	7 M, 1 F	Middle school resource room	Classroom assignment completion, homework assignment completion	Multiple baseline across eight students classroom assignment comparison group for homework assignment	Contract: goal statement, plan to meet goal, and evaluation of appropriateness of goal and plan. Student selected achievement goal; student developed a specific goal statement/plan, student chart, feedback	Students can learn to set realistic achievement goal, develop plans to reach these goals and monitor progress towards goals. Students increased rates of assignment completion and were more confident of their ability to plan	No
Goals set by participants * also included Coddig et al. (2005); Srikameswaran and Martin (1984); Lambert et al. (1999)									
Albertson and Billingsley (2001)	Gifted students	13	1 M 1 F	Enrolled in school honours program,	Creative writing planning, text production, rates of writing, reviewing and writing quality	Multiple baseline across participant	Student-set goal setting: planning and time recording; story writing and time recording; reviewing,	Strategy instruction plus self-regulation (goal setting and graphing) enhanced story length, fluency (words/minute) and story	Yes

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Balcazar et al. (1991)	Physical disabilities	20–40	2 M, 2 F	conducted in home office of researcher	Independently recruit help to attain personal goals	Interrupted time series multiple replication across participants	changes and time recording; self-recording and graphing; feedback with verbal praise	element scores for both participants; participants met or exceed goals 88 % of time; written quality of stories written quickly during intervention was judged as equal to or better than prior sessions	Yes
Balcazar et al. (1995)	behavioral disorder (4), mental retardation (1), manic-depressive (1)	17–19	6 M	Residential treatment school	(i) Transition goals, (ii) Action towards reaching goals, (iii) Help-recruiting skills	Multiple baseline design across behaviors (as a group)	Role-play assessment; written training manual of help-recruiting skills with list of 25 verbal responses; feedback and praise	Comparison of scores before and after training indicated significant improvement in participants help-recruiting skills; participants set 20 goals with total of five reported as no change, eight met realistic attainment and seven best anticipated attainment outcomes	Yes
Benitez et al. (2005)	Emotional behavioral disorder	15–17	5 M	Special education	Conflict resolution (1), assertiveness (2), career exploration (2)	Five AB designs, identical goals and outcome measures	Self-goal setting, self-recording in student diary, role-play of help-recruiting skills	Consistent improvements in help-recruiting skills of group; all students demonstrated substantial efforts and reported in goal attainment (11/17 goals for group attained, 2/2 goals dropped and 4/17 goals in progress)	Yes
Caldwell and Joseph (2012)	Conduct disorder and substance abuse (2); emotional disturbance (1)	14, 17, 18	3 F	Maximum-security juvenile facility	Time on-task, academic productivity, academic accuracy during independent math practice	Single-case reversal design across participants	Goal setting with goal training, goal attainment measures, self-monitoring	Increased correct responses by condition for all participants, all participants achieved their target goals	No
Delano (2007)	Asperger's syndrome	13–17	3 M	General education classes, instruction in conference room	Words written, functional essay elements	Multiple baseline design across responses and participants	Set and record productivity and accuracy goals, self-monitoring, fading	Students were taught to graph performance data and set performance and accuracy goals answering question to maintain or increase previous result. Corrective feedback was provided. Accuracy did not increase during intervention, direction instruction on math problems was not provided. Sample size small, incentive rewards not immediate. Baselines long, possible that intervention should have occurred sooner	Yes
Graham et al. (1992)	Learning disability	11 (2), 12 (1), 13 (1)	3 M, 1 F	Resource room in elementary school	Improve writing composition	Multiple probe design across subjects	Self-monitoring, self-recording, self-goal setting, verbal/written story starter/video prompts	Used video self-modelling to teach SRSD and self-monitoring. Increased number of words, functional essay elements in persuasive essay writing. Two participants maintained increase in number of words at 3-month follow-up, functional essay elements were not maintained	Yes

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Holt et al. (2012)	Professional soccer club academy players	10–12	5 M	Indoor coaching	Technical drill “passing square”: awareness, passing and first touch	Single-subject, multiple baseline with reversal	Peer-assessed feedback with carting, goal setting and group contingency; players self-set personal goals and following agreement with coach charted goal line	convincing. Post-treatment two times as many elements and four times more basic parts. Essays were two to three times longer, more convincing. Maintained gains over time, student and teacher reported strategy improved writing performance noticeably during intervention, passing and first touch data also improved and were more consistent during intervention; findings support research that accountability drives the instruction task system	Yes
Kelley and Stokes (1984)	High school dropouts with academic and social deficits	16–21	7 M 1 F	Vocational training program	Number and percentage of academic items answered correct	Contracting; reversal; multiple baseline	Baseline payment based on attendance; contingency contracting payment for number of correct workbook items plus \$13.50 for completing weekly goal (or % thereof); student-set goal setting daily/weekly payment	Student-teacher contracting with pay was effective in increasing student productivity; student goal setting effective for maintaining student productivity substantially higher than baseline, although generally lower than during contracting conditions	No
Lenz et al. (1991)	Learning disability	13	5 M 1 F	6-week summer program	Improve completion of project-type assignments	Multiple baseline across subjects	Goal setting: task evaluation, options, specification; Actualisation: plan identification, plan expansion, self-monitoring, feedback	Effective in increasing the number of projects successfully completed and the quality of goal setting and goal actualisation responses; all students demonstrated an increase of at least 20 % over their baseline averages in both goal setting and goal actualisation	No
Lyman (1984)	Conduct disorder	12	6 M	Residential treatment facility	On-task behavior	Multiple baseline across six subjects	Private student-set goal; public student-set goal, goal card on bulletin board at front of class	Percentage of time on-task slightly higher in private goal setting than baseline; percentage of time on-task substantially higher in public goal setting than either baseline or private goal setting; public goal setting may be more effective than private goal setting	No
Moore et al. (1989)	Severe mental retardation	19–21	2 M, 2 F	Sheltered workshop	Rate for sorting washers; self-instructions	Multiple baseline across subjects	Self-talk training, self-goal setting, self-reinforcement, verbal praise, corrective feedback, modelling	All workers increased production to criterion levels, increases maintained up to 3 months, productivity consistent throughout work periods, work production increase under self-reinforcement was modest and perhaps money was not reinforcing	No
O'Brien et al. (2009)	Elite (3) and non-elite (3) boxers	15–17	6 M	Amateur boxing association		Multiple baseline across individuals	Participant goal determination, participant goal setting, goal	All elite participants immediately improved performance, sustained	No

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Todd et al. (2010)	Autism	15–17	2 M 1 F	Cycling course at special education school	(i) Performance (number of punches), (ii) Competition outcomes	Multiple baseline changing criterion	reviewing, reinforcement for goal attainment, feedback Self-monitoring, goal setting: intensity phase and distance phase	during retention phase; all non-elite participants immediately improved performance, not sustained during retention phase. Non-elite mean percentage of wins increased during intervention and retention for two participants and showed no increase during intervention and a decrease at retention for one participant Developed attitude and skills to effectively engage in self-regulation; two students increased distance cycled, all participants developed accuracy at different intensity levels, all participants developed accuracy in distance goal setting, direct instruction in self-efficacy appeared beneficial for teaching goal setting	Yes
Trammel et al. (1994)	Learning disability	13–16	6 M 2 F	General education resource room support	Homework assignment completion	Multiple baseline across subjects	Self-monitoring, self-evaluation, goal setting, self-graphing	Immediate increase of homework assignment completion under both self-monitoring and self-graphing conditions; results maintained at high levels during maintenance phase and at 20- and 40-day follow-up probes	Yes
Wanlin et al. (1997)	Speed skating performance	12–17	4 F	Provincial team preparing for National Winter Games	(i) Lap frequency, (ii) Number of drills completed, (iii) 500-m race times, (iv) Off-task behavior	Multiple baseline across individuals (1 control)	Mission development, long-term self-setting, sub-goal and practice goal setting, self-talk, goal visualisation; self-monitoring and recording; prompt, self-evaluation and set new practice goals; public goal sharing	Immediate increase in laps for all three participants, control initially increased then dropped below mean levels of both baseline and intervention; all participants improved number of drills, control participant maintained stable level of completion; all participants improved mean racing times, control participant chose not to race; off-task behaviors immediately dropped for two participants, one participant reported an almost complete absence of off-task behavior; control participant had high frequency of off-task behavior throughout study; goal achievement at 72, 76 and 71 %	No
Goals introduced in latter phase Maag et al. (1992)	Learning disability	7–11	4 M 2 F	Regular classroom	(i) On-task behavior, (ii) Academic productivity	Multiple treatment design across participant	(i) Self-observation, (ii) Self-observation and self-recording, (iii) Self-observation, self-recording	Substantial changes in on-task behavior and academic productivity for each student in each experimental condition	Yes

Table 1 (continued)

Author (year)	Diagnosis	Age	M/F	Setting	Target behavior	Research design	Intervention elements	Findings	generalization/ maintenance data
Skinner et al. (1993)	behavioral disorders	9	1 M	Private special education	(i) Percentage of division problems correct. (ii) Number of digits and/or problems correct per minute	Multiple baseline across-problems within subjects	and contingent reinforcement phase 1. (iv) Self-observation, self-recording, contingent reinforcement phase 2 Guided goal setting Cognitive cover, copy, and compare (CCC); one participant required assessment feedback and teacher-set goal setting to reach mastery level	except self-observation alone in which effects were negligible. Increased performance of on-task behavior and academic productivity most substantial during contingent-reinforcement phases CCC effective at increasing students' rate of accurate responding to division problems; assessment feedback and goal setting suggest that these procedures alone may result in increases in rates of accurate responding	Yes

How Have Goal-Setting Interventions Been Structured?

Interventions that included goal setting as part of treatment packages and alongside other intervention components were frequently described. These included contracting (3), self-monitoring (25), reinforcement (15) and feedback (17). The use of technology was also described and included computer instruction (1) and video modelling (1). An approach to teach goal setting was described in six studies (16 %), and the use of self-regulated strategy development (SRSD) techniques was reported in two studies (5 %). Public goal sharing was included as an intervention element in four studies (11 %).

Lyman (1984) explored the effects of private student-set goals and public sharing of student-set goals with six students schooled in a residential treatment facility as a result of conduct disorder. During the public condition, a goal card was placed on the bulletin board at the front of the class. Participants reportedly spent a slightly higher percentage of time attending to task during the private goal setting condition and substantially more time on task upon introduction of public goal sharing.

Goal setting was introduced during the latter stage of intervention in two studies (5 %). One study examined the effects of self-monitoring with contingent reinforcement under two conditions: comparison to prior performance and contingent to meeting a goal (Maag et al. 1992). Another study introduced goals in the latter phase in order for one participant to achieve mastery of math division (Skinner et al. 1993).

Maag et al. (1992) introduced goal setting in the final phase of an intervention that included the following phases: a self-observation condition; self-observation and self-recording; self-observation (reversal), self-recording and contingent verbal reinforcement for performance improvement; and self-observation, self-recording and contingent reinforcement using teacher- and student-set goals for successive increases in mathematics problem task performance. The largest gain in academic productivity occurred during the phase of contingent reinforcement plus goal setting, during which the teacher not only provided verbal reinforcement for an increase over prior performance but also provided verbal encouragement in the event a goal was not met. The authors concluded that treatment effects can be increased by the simultaneous use of goal setting. However, the effect of goal setting alone was not explored.

While the original authors of these 38 studies have consistently reported positive treatment effects, the majority of the studies have confounded goal setting with other dependant variables. Three studies were identified which enable the effectiveness of goal setting alone to be examined. Lambert et al. (1999) compared self-set goals with coach-set goals, and

Table 2 Summary of descriptive statistics

	Descriptor	Participant numbers
Sex	Male	128
	Female	58
Age	School aged (6–12 years)	82
	Adolescence (13–17 years)	73
	Adulthood (18 years and older)	31
Diagnosis	Autism	5
	Asperger's syndrome	4
	ADHD	14
	Emotional behavioral disorder	14
	Learning disability	45
	Mental retardation	21
	Non-compliance/conduct	12
	Manic depressive	1
	Giftedness	2
	Typically developing	15
	Athletics	49
	Physical disability	4
Method	Taught prerequisite skills	1
	Taught goal setting	6
	Taught self-regulated strategy development (SRSD)	2
	Goals set by other	11
	Guided goal setting	9
	Guided goal setting, set by participant	20
	Public goal sharing	4
	Goals introduced in latter phase	2
Other components	Contracting	3
	Self-monitoring	25
	Reinforcement	15
	Feedback	17
	Used computer instruction	1
Target behavior	Used video modelling	1
	Transition planning	2
	Problem behavior	8
	Mathematics	9
	Writing	6
	Reading	1
	Academics—all subjects	3
	Homework	4
	Projects	1
	Social skills	1
	Athletics	7
	Development of physical activity skills	1
	Vocational tasks	4

both Maag et al. (1992) and Skinner et al. (1993) introduced a goal condition additively to achieve an effective treatment thereby enabling intervention effects to be measured before and after the introduction of goal setting. In each case, goal setting was associated with clear behavioral gains.

What Types of Target Behavior Was Goal Setting Applied To?

These interventions addressed a variety of target behaviors including transition planning (2), decreasing problem

behavior (8), mathematics (9), writing (6), reading (1), all academic subjects (3), homework (4), projects (1), social skills (1), athletic performance (7), development of physical activity skills (1) and vocational tasks (4). Target behavior was plotted by number of participants, as illustrated in (Fig. 1).

Barry and Messer (2003) incorporated goal setting with self-management to increase on-task behavior and academic performance and decrease disruptive behavior in an intervention conducted with five boys with ADHD. The teacher set participant goals using the approximate average for the class in an intervention that included self-recording, teacher prompting and reinforcement. Goals for academic achievement and on-task behaviors were gradually increased during fading. While results again showed this to be an effective intervention procedure, researchers noted that gradual fading of supports was necessary to ensure maintenance.

Tollefson et al. (1986) targeted an increase in completion of classroom assignments and an increase in homework assignment completion for eight middle school students described as learning disabled. During training with the research assistant, each student selected an achievement goal: daily or weekly in-class assignments, or homework assignments for the week, and developed a goal statement of what was required and by when. A study plan was specified, and each student self-monitored work completion. Subsequently, students met with the research assistant to evaluate the goal and the plan, addressing reasons for success or failure in goal attainment. A homework contract phase was introduced for four students, intended to promote generalization of goal implementation skills. Three students demonstrated a marked increase in homework assignment completion. The authors reported that

time spent teaching goal setting and goal implementation strategies not only increased the rate of assignment completion but also made students more confident in their ability to plan.

A goal setting model that included goal determination, goal setting and goal reviewing was used to examine the cumulative effects on skill performance among six high school boxers (O'Brien et al. 2009). During goal determination, participants met with the researcher to determine a self-generated performance behavior. All participants rated the number of punches landed as most important, thus determining this as the target behavior. During goal setting, a numeric system to measure changes in the participants' target expectations over time as well as a means to measure progress during intervention was developed. Three elite level participants immediately improved performance, and improvement was sustained during a follow-up phase. However, while the three non-elite participants also immediately improved performance, their increase was not sustained during follow-up.

Individuals with ASD are often described as having an uneven profile of executive functioning skills, an area of importance for achieving academic or vocational success (Geller and Greenberg 2010). While high-functioning students on the spectrum may be academically capable, problems with organisation and planning may negatively impact success in higher education or vocational settings and present a challenge for independent functioning. The application of goal setting to behavior management, attention to task and time management described in the existing literature raises the possibility that effective goal setting instruction may be beneficial to students with ASD in learning skills necessary to

Fig. 1 Target behavior by participants

overcome these challenges and to perform tasks independently.

Who Is Involved in Setting Participant Goals?

The studies in this data set described a variety of stakeholders involved in the goal setting process. Twenty studies (53 %) described goal setting by the participants, 9 studies (24 %) described the participant setting goals under guidance, and in 11 studies (29 %), goals were set by someone other than the participant.

Two studies employed an alternating treatment design to compare the effects of goal setting by either the experimenter/coach with goals that were set by the participant (Coddington et al. 2005; Lambert et al. 1999). While Coddington and colleagues (2005) reported that participants not only performed better during the student selected goals condition but also favoured this condition over the experimenter-selected goal condition, Lambert and colleagues (1999) reported that self-set and coach-set goals functioned differently depending on the participants' locus of control. In particular, an internal locus of control was associated with greater gains under a self-set goal condition, and an external locus of control was associated with greater gains under a coach-set goal condition.

Participant descriptions were plotted against the differences in the identity and role of the goal setter (self vs other vs guidance provided) for the studies reviewed, as illustrated in Fig. 2. The graph illustrates a potpourri of self, other and guided approaches to goal setting. The exclusive use of independently set goals was noted amongst participants described

either as gifted or physically disabled, while goals were either set independently by the participants or under guidance for participants with ASD, AS, conduct disorder and students with manic depression. Typically developing students in this data set did not set goals independently and received guidance with setting goals only marginally more frequently than having goals set by an adult. A few athletes received guidance with goal setting, and athletes set goals independently in just over one third of the data. The majority of participants with learning disabilities self-set goals, although both guidance and goals set by another adult were observed. Few students with ADHD set goals independently, and occasional provision of guidance was observed in these studies though the majority of these participants had goals set by an adult. This diversity in approaches may reflect different purposes on the part of the researchers when adopting goal setting in interventions. For studies targeting increased performance, such as in the case of athletes, it may arguably be less relevant for the participants to independently set their own performance goals. By contrast, where the aim of the intervention is to enhance independent functioning, developing social skills, transition planning or reducing problem behavior for example, teaching participants to set their own goals either independently or with guidance may be of greater relevance.

By way of example, three non-verbal high school students diagnosed with ASD were included in an intervention that aimed to increase participation in sustained physical activity (Todd et al. 2010). The students possessed the physical skills required to cycle and were able to discriminate correctly between more or less necessary to set distance goals. Prior to

Goal setting method used by participants

Fig. 2 Goal setting method used by participants

independently setting cycling distance goals, participants were given guidance to understand their cycling capabilities and were taught to self-monitor. All three students developed accuracy in setting both distance and intensity goals, and two of the students increased the distance they cycled.

However, for interventions in which successful completion of task is less related to attaining independence, the identity of the goal setter may be less significant. For example, guided goal setting, combined with self-monitoring and performance feedback, formed the basis of a coaching intervention in an intervention conducted with three high school students with ADHD (Merriman and Coddling 2008). An initial goal setting meeting was conducted between each student and the coach. Students used their baseline data to set goals for mathematics homework completion and accuracy, and the coach gave guidance in the event of unrealistic goal suggestions. Coaching was conducted daily with feedback and goal reformulation, and praise for progress was provided until the students achieved their long-term goals. During systematic fading, coaching sessions went to alternate days then weekly until eventual termination. Results showed that coaching improved the completion and accuracy of homework for all three participants, with improvements maintained during fading and follow-up for the two participants that met their long-term goals.

In contrast, interventions that do not impact the participants' ability to achieve independent functioning may not require the participants themselves to set goals in order to achieve positive outcomes. For example, Brobst and Ward (2002) reported a study with three teenaged female soccer players to increase performance of existing ball skills in both practice sessions and games. The head coach and the researcher established a performance level for the targeted skills, and an intervention package that included public posting, goal setting and oral feedback was implemented. Both the goal and the rationale behind it were explained to the participants, and practice results were reported on a performance chart displayed near the playing field. Players were praised for meeting goals and given encouragement if they did not. Results demonstrated improvement during practice. Generalization results were less consistent, and improvement during games was apparent for only one of the three ball skills.

Are Goal Setting Effects Maintained Over Time and Was Generalization Assessed?

While frequent informal reports of generalization and maintenance over time were included by the original authors of studies in this set, data confirming such effects was reported in 18 of the 38 studies (47 %). Three of the 38 studies included participants with ASD (Asaro-Saddler and Saddler 2010; Delano 2007; Todd et al. 2010), and notably, all three of these

articles included data for either generalization or maintenance of treatment effects over time.

Inspection of generalization and maintenance data for the participants with ASD revealed variable findings. Asaro-Saddler and Saddler (2010) included a generalization task in an intervention conducted with two elementary students with AS, and one with autism, in which the writing requirement altered from fiction to personal recount. While two participants appeared to successfully generalize writing skills to the new task, one participant included a fictional name rather than "I". The authors reported that participants may not have clearly distinguished the required difference. Similarly, data gathered to explore maintenance of treatment effects over time also resulted in variable findings. Todd et al. (2010) examined cycling distance goals in the maintenance phase of an intervention with three non-verbal teens. Gains in excess of baseline were maintained for two of the three participants during the phase. Delano (2007) collected follow-up data at both 1-week and 3-month time frames for three teens with AS. Although a gain in the number of words written was maintained by all three participants at 3 months, the number of functional essay elements was not maintained. Delano (2007) suggested that a longer intervention period may be required. Asaro-Saddler and Saddler (2010) also collected maintenance probes after 4 weeks and acknowledged the limitation of their data as continued gains beyond this time frame remain unknown.

Stokes and Baer (1977) described generalization across subjects, settings, people, behaviors and/or time as the occurrence of relevant behavior under different untrained conditions in the absence of conditions that had been scheduled during training. At that time, attention was drawn to the importance of actively programming to achieve generalization, rather than to passively expect it as an outcome of training procedures. In addition, the use of stimuli found in the generalization settings, which included the role of peers as tutors, was highlighted as significant to future research when structuring training sessions.

Authors of the original studies from our broader data set generally concur that graduated fading is necessary in order to maintain intervention effects over time or to observe generalization of effects to new settings or behaviors. Several studies reported successful maintenance of treatment effects over time among all participants in research that included systematic stimulus fading (Moore et al. 2001; Merriman and Coddling 2008).

Conclusions

Our aim in this study was to map the existing single-subject research evidence for interventions that have included a goal

setting component with a view to informing a research agenda for participants with ASD. This data set as a whole provides preliminary support for the effectiveness of goal setting techniques in a wide variety of interventions. However, to date, little research on goal setting has been performed with individuals who have a diagnosis of ASD.

Second, in the research identified, goal setting effects have almost always been confounded with interventions typically involving a combination of components additional to goal setting. The most common of these, self-monitoring, was included in two thirds of the interventions. Several of these studies noted that participants value both establishing their goal independently and self-monitoring their behavior. Feedback was also included in almost half of the interventions, and again, original author reports suggest that information derived from feedback played a significant role in positive intervention outcomes.

Southall and Gast (2011), in their qualitative review of self-management interventions for students with ASD, emphasised the need for researchers to examine the effects of specific components of current self-management intervention packages to identify the relative contribution of each. Our findings support this conclusion, highlighting in particular the need to explore the contribution goal setting has, either in isolation or in combination with other intervention components, on intervention outcomes and on the development of self-determination more generally.

Another important observation arising from this data set concerns the generalization and maintenance of observed changes. Goal setting skill training may be an important component of treatment packages that aim to develop independent functioning for participants with ASD, and effective goal setting may be a vital skill for high-functioning students who pursue higher education. Given that goal setting skills are developed over time, it appears particularly important to gather generalization and maintenance data. While limited in volume, the preliminary maintenance data for participants with ASD is variable, including accounts of maintenance failure post-intervention. Accordingly, we reiterate the importance that future research includes longer intervention phases, in addition to programming for generalization and maintenance over longer time frames and/or including peers.

With respect to how participants have been involved in the goal setting process within an intervention, no clear pattern is evident in our data set. The basis on which researchers have decided either to set goals themselves or how and to what extent to involve the participants in this process is unclear, and importantly, the implications of these decisions are largely unexplored. This review has identified goal setting research that has been conducted successfully with a wide variety of individuals engaged in the process of learning. Although the authors of this work have consistently reported successful outcomes in interventions that have included goal setting

and these accounts suggest that goal setting skills are teachable, further research that explores the relative merit of engaging participants in the goal setting process and that identifies effective strategies for teaching goal setting appears warranted.

Finally, although the literature has included successful accounts of individuals improving sports performance through the use of goal setting skills, there is a paucity of research with participants with ASD regarding the development and/or improvement of skills required to promote a physically active lifestyle. This finding is of significance to this population given the recent reports of elevated chance of developing obesity, in addition to the loss of opportunity to engage in social interactions with typically developing peers. Research that explores treatments aimed to overcome challenges that may result from a sedentary lifestyle, food selectivity or disrupted sleep appears justified.

Proposed Research Agenda for Participants with ASD

While limited in quantity, the SCD research with participants on the autism spectrum included in this review suggests that goal setting instruction may be successful with this population. We propose the following foci as elements of future research to aid in developing treatment packages that foster independent living:

1. Research that explores the role of goal setting in isolation or in combination with other intervention components
2. Research that explores the generalization and maintenance effects of goal setting interventions, particularly including peers as tutors to assist in programming generalization
3. Research that explores how to best teach goal setting skills to participants with a view to attaining the ability to perform this skill independently
4. Research that explores the relative effects of goal setting by the participants themselves compared to goals set by other stakeholders

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