PROMOTING ROAD SAFETY FOR PREADOLESCENT BOYS WITH MILD INTELLECTUAL DISABILITIES: THE EFFECT OF COGNITIVE STYLE AND THE ROLE OF ATTENTION IN THE IDENTIFICATION OF SAFE AND DANGEROUS ROAD-CROSSING SITES

Alevriadou Anastasia
University of Western Macedonia

An important pedestrian skill that young people with intellectual disabilities (ID) (mental retardation) find difficult is the ability to find a safe place to cross the road. Safe pedestrian behaviour relies on cognitive skills, including the ability to focus attention on the traffic environment and ignore irrelevant stimuli. Individuals with ID consistently demonstrate selective attention deficiencies. Other factors such as individual differences in cognitive style might play a role in road safety. The aims of the present study were to test any possible significant relationship between attention, cognitive style and identification of safe and dangerous road-crossing sites in preadolescents with ID. Participants were 40 boys with mild ID. Attention and field dependence-independence were assessed using the visual attention subtest of the Developmental Neuropsychological Assessment and the Children's Embedded Figures Test (CEFT), respectively. The participants were subdivided into two groups, matched on IQ. The two groups differed significantly in mean score on the visual attention subtest and on the CEFT. Analysis of variance showed that preadolescents with higher scores on both tests performed better than those who were more filed dependent and less attentive. Attention and cognitive style should be considered in the planning of road safety training for individuals with ID.

Introduction

Attention is a multifaceted construct that is manifested in a variety of ways. Studies of visual selective attention (Broadbent, 1982; Parasuraman & Davies, 1984) have provided considerable information concerning the manner in which stimuli are selected for processing. The assumption that underlies much of the research in this area is that the environment provides individuals with a complex array of stimuli from which a subset of stimuli may be selected for processing. Selective attention implies that attention is directed toward some stimuli and away from other stimuli. The ability to narrow attention to those stimuli that are relevant to the performance of a given task and direct attention away from nonrelevant stimuli is considered to be a characteristic of optimal selective attention processing.

Since individuals with subnormal intellectual development consistently demonstrate attention deficiencies (Bergen & Mosley, 1994; Merrill, 1990; Nugent & Mosley, 1987), selective attention processes represent a coherent focus on the search for important deficiencies in cognition associated with intellectual disabilities (ID). In particular, a significant number of theorists and researchers comparing the selective attention abilities of individuals with and without ID have consistently shown that those with ID are more distracted by the presence of irrelevant information in a stimulus array than are individuals without ID (Crosby, 1972; Hagen & Huntsman, 1971). Neil and his colleagues (Neil, 1977; Neil & Westberry, 1987) and Tipper (1985) have proposed that selective attention may involve not only facilitating processes directed toward the selected target but also inhibitory processes operating on the unselected distractor stimuli.

Experimental evidence for inhibitory deficits in individuals with ID has been found across many experimental tasks. In an early study, Terdal (1967) reported evidence that individuals with moderate to mild ID were less able to inhibit attention to background stimuli during a simple looking task involving checkerboard stimuli. Additionally, in the presence of distractors, children with ID had more difficulty in inhibiting responses caused by distracting dimensions of task stimuli (Ellis, Woodley-Zanthos, Dulaney, & Palmer, 1989). A few years later, Merrill and O' Dekirk (1994), using a flanker task, found that individuals with ID were affected negatively by flanking stimuli at much greater eccentricities than were individuals without ID. These authors asserted that the differences observed might have resulted from the differential use of top-down processing resources across groups. Similar findings of susceptibility to distraction or interference have been reported on Stroop tasks (Ellis & Dulaney, 1991) and identity-based negative-priming tasks (e.g., Cha & Merrill, 1994). In one study, Cha (1992) measured the ability of persons with and without ID to focus attention during a visual selective attention task in which a central target stimulus letter was presented between two flanker stimuli. The results revealed that the performance of individuals with ID was more influenced by the distracting effects flankers than was the performance of individuals without ID. In another study, Cha (1992) evaluated the degree to which individuals with ID are able to overcome the effects of the onset of distractors. The magnitude of the distractor effect differed between IQ groups. The researcher concluded that irrelevant stimuli are more powerful attractors of attention for individuals with ID than they are for individuals without ID. Recently, Merrill (2006) found that the failure to engage in inhibitory processes by the participants with ID in tasks of selective attention was related to increased distractor interference. Taken collectively, these studies suggest that individuals with ID have more difficulty than their peers without ID in controlling the focus of their attention and that, at least part, this difficulty can be traced to deficits in selectively attending to relevant cues.

On the contrary, Merrill, Cha, and Moore (1994) demonstrated that individuals with and without ID show similar negative-priming effects on a location-based task. Thus, individuals with ID may be able to utilize top-down processing to inhibit attention to irrelevant information but did not do so in all experimental contexts (see also Crosby, 1972). Furthermore, it has been shown that the susceptibility of individuals with ID to distraction is related to the level of task difficulty. For example, Sen and Clarke (1968) found that although adults with ID were distracted by extraneous stimulation during a difficult task, they were unaffected by the same distractors when the task was easy. Similarly, Belmont and Ellis (1968) found that adults with ID were not more distractible than adults without ID. They suggested that some forms of distraction might have no effect or even a facilitative effect upon performance in a learning situation because they act as general arousers, resulting in greater alertness and concomitant improvements in attention. Recently, Oka and Miura (2008) suggested that when persons with ID perform a dual-task that has no interference in the sub-storage of working memory, their function of attention allocation could work without impairment.

Although there appears to be some inconsistency between studies, a particular pattern emerges that may help to explain these differences. Specifically, it may be that in tasks in which distractors are similar to the central task stimuli (i.e., the task requires more effortful processing) individuals with ID show decrements in performance, whereas in tasks in which the distractors are easily distinguished from the central task stimuli, no such performance decrements are produced. Altogether, these data suggest that in some instances, individuals with ID have enhanced difficulty in comparison with their peers without ID in attending selectively to relevant cues (Pearson, Norton & Farwell, 1997). The challenges facing researchers, therefore, are to identify the circumstances in which individuals with ID do and do not demonstrate the ability to limit attention to task-irrelevant distractions and to develop methods and/or presentation formats that facilitate adaptive attending behavior. Additionally, the extent to which the results of laboratory-based studies of attention predict retarded individuals' behaviour in educational and training settings remains to be elucidated. It is valuable, then, to determine whether it is possible to facilitate the use of mechanisms of selective attention by persons with mild ID across a range of cognitive tasks.

A characteristic activity that is heavily relied on selective attention is the safe pedestrian behaviour, since one has to focus attention on the traffic environment and ignore irrelevant stimuli. Pedestrian accidents are among the most common causes of death and serious injury to young children in the developed world (Ampofo-Boateng & Thomson, 1991; Thomson, 1991). Particularly puzzling is the fact that 32% of road accident deaths in Europe involve pedestrians, while 34% involve private car occupants and 34% motorcycle occupants (Gaskell, Harrison, & Goodwyn, 1989).

Tabibi and Pfeffer (2003) indicated that attention is required for identifying road-crossing sites quickly and accurately, especially for young children. Dunbar, Lewis, and Hill (1999) found that four to ten-year-old typically developing children who were better at attention switching were more likely to show awareness of traffic when crossing a road, and children who maintained concentration when challenged by a distracting event, crossed the road in a *less reckless* manner. Furthermore, Hill, Lewis, and Dunbar (2000) found that four to nine-year-old typically developing children have difficulty paying attention to the features that make a road-crossing situation dangerous; namely, they have difficulty paying attention to relevant information and ignoring irrelevant.

Personal safety skill instruction is considered by many as being as important as teaching communication, motor, and social skills to persons with disabilities (Collins, Wolery, & Gast, 1991; Mechling, 2008). Unfortunately, little attention has been paid to the relationship between pedestrian skills and attention for children and adults with ID. A limited number of studies have demonstrated that individuals with mild ID show difficulties to find a safe place to cross the street and supported the need for pedestrian skill instruction (Alevriadou & Grouios, 2007; Matson, 1980; Page, Iwata, & Neef, 1976; Phillips & Todman, 1999). Specifically, Alevriadou and Grouios (2007) found that children with ID enhanced difficulty in comparison to typically developing mental age controls in attending selectively via the visual mode to road-crossing sites, especially when irrelevant information stimuli are involved. Additionally, there has been only one study, which shows that there is a significant relationship between attention and identification of safe and dangerous road-crossing sites in adults with mild ID (Alevriadou, Angelou & Tsakiridou, 2006).

Cognitive skills such as selective attention may play a role in road safety, but we also need more information about the influence of other factors such as individual differences in cognitive style (Zeedyk, Wallace, Carcaty, Jones, & Larter, 2001). This might provide a key variable in the explanation of pedestrian accidents by individuals who are particularly at risk.

Green (1985) defines cognitive style as consistencies in the ways in which people perceive, think, respond to others, and react to their environment. He contends that cognitive styles are bi-polar, value neutral, consistent across domains and stable over time. With nearly 5,000 references in the literature, field dependence/independence has received the most attention by researchers of all the cognitive styles (Chinien & Boutin, 1993; Davis, 1991; Kent-Davis & Cochran, 1989).

The Field Dependent-Independent cognitive style was hypothesized by Herman Witkin (e.g., Witkin, 1950; Witkin & Goodenough, 1981) and refers to the extent to which a person is dependent versus independent in organization of the surrounding perceptual field. Measures of cognitive style provide a more extensive and more functional characterization of the child than could be derived from IQ tests alone (Messick, 1984). Field-dependent individuals tend to operate in a global, holistic manner and be distracted by background elements. They generally attend to the field as a whole, thus having a global perception (Jonassen & Grabowski, 1993; Witkin, Moore, Goodenough, & Cox, 1977). They also tend to attend to external cues, and tend to accept percepts or symbolic representations at face value. This tendency hinders their ability either to concentrate on particular elements of the task or to reconstruct the whole task (Witkin, et al., 1977). They are also likely to be influenced by authority figures or by peer groups. Seeking approval and guidance, they seem to obtain their needed cues from others (Ruble & Nakamura, 1972). Konstadt and Forman (1965) noted that field dependent individuals looked at the examiner's face almost twice as often as those scoring field independent. Field-independent individuals, on the other hand, tend to abstract an item from the surrounding field, following a more analytical approach (Clark & Roof, 1988). They are more independent from authority, socially detached, and dependent on their own values and standards (Witkin, et al., 1977). They attend to internal cues, and this is associated with a greater aptitude for restructuring, i.e., for imposing organization on received information. This implies that individuals, in some way, move through a process of *sifting out* relevant from irrelevant information. Field-dependent and field-independent individuals are frequently shown to demonstrate qualitative and quantitative differences in their preferences for choosing certain cues and ignoring others (Richardson & Turner, 2000).

As for the matter of intelligence, children with ID have particular difficulty in overcoming a preference for wholes, showing a field dependent mode of perceiving (Witkin & Goodenough, 1981; Shah & Frith, 1993). They do not readily separate an item from its context. Young typically developing children are also holistic processors, having difficulty distinguishing between the whole and its parts (Garner, 1974). The difference is that children with ID remain field-dependent, while typically developing children start as field dependent and become more field-independent as they get older. Some researchers (Alevriadou et al, 2006; Bice, Halpin, & Halpin, 1986) investigated cognitive style differences between children with and without ID. The results showed that children with ID scored as more field-independent than those without ID. The difference, though, between the younger children with and without ID (8-9 years old) was less than the difference between the older children with and without ID (12-13 years old).

A principal measure of field dependence-independence is the Children's Embedded Figures Test (Karp & Konstadt, 1971), in which children locate a previously seen figure within a larger, complex figure. Bowd (1976) states that this test of cognitive style is one of the most widely used measures designed to assess field dependence- independence in children aged 5 to 12 years.

The aims of this study were to test: (1) if there is a significant relationship between attention and identification of safe and dangerous road-crossing sites in preadolescents with ID and (2) the effect of field dependence-independence on their ability to identify safe road-crossing sites. The task was presented by means of a table-top simulation displaying a selection of road-crossing sites varying in complexity in order to investigate the variables (attention and cognitive style) influencing preadolescent's ability with ID to select safe road-crossing sites.

Method

Participants

The participants consisted of 40 young boys with mild ID. They were all males due to well-documented gender differences in cognitive style (e.g., Johnson & Mead, 1987; Kerns & Berenbaum, 1991). To test their ability to select safe road-crossing sites, the 40 participants were further subdivided into two groups, matched on IQ, using the Test of Non-Verbal Intelligence (TONI-2) (Brown, Sherbenou, Johnsen, 1990): Group A (Mean IQ=66, SD=1.85) and Group B (Mean IQ=66, SD=1.99).

All preadolescents with mild ID were receiving special education in the nearest school in their community (inclusive education) and none were living in institutional settings. They were living in the broader area in the city of Kozani, Greece and were referred for diagnosis to the Counseling Centre for children with special needs. None of the children received any specific pedestrian skills instruction.

Group A composed of 20 boys with organic mild ID ranging in chronological age from 10.5 to 12.3 yrs (M=11.3 yrs, SD=0.85). Ten of the participants were premature and had anoxia at birth, two had postnatal head trauma, five had encephalitis, two were infected by the rubella in the mother, while the other seven had epilepsy. Group B consisted of 20 boys with organic mild ID (13 boys and 13 girls) ranging in chronological age from 10.6 to 12.1 years (M=11.2 yrs, SD=0.79). Ten of the participants were premature and had anoxia at birth, four had postnatal head trauma, five had encephalitis, while the other seven had epilepsy.

Attention and field dependence-independence were assessed using the visual attention subtest of the Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1998) and the Children's Embedded Figures Test (CEFT) (Karp & Konstandt, 1971), respectively. The two groups differed significantly in mean score on the visual attention subtest [Group A, Mean raw score=12.70, SD=2.05 (age equivalent=7:5 years), and Group B, Mean raw score=4.30, SD=1.83 (age equivalent=3:5 years)], [$t(38)=11{,}92$, $p<0.0001$]. The performance of Group A (M=16.9) on the Children's Embedded Figures Test was higher than that of Group B (M=10.5) [$t(38)=9{,}36$, $p<0.005$].

Tests and Instruments

The Children's Embedded Figures Test is a validated instrument for the measurement of field dependence-independence (Karp & Konstadt, 1971). The Children's Embedded Figures Test consists of 25 complex colored figures. Each complex figure contains one of two simple figures: a triangle or a house. In administering the test, the simple figure is shown to the child and then removed. The child is then asked to find the simple figure within the complex colored figure. A maximum of 3 minutes per card is allowed, after which, if no response is given, a 0 (zero) is recorded and the next card presented. For each incorrect response, a 0 is given; for each correct response, 1 point is given. A maximum score of 25 can be obtained with the higher score being indicative of field independence and a lower score of field dependence.

Internal consistency reliability coefficients for the Children's Embedded Figures Test were .88 and .86 for the groups A and B, respectively. A coefficient alpha reliability estimate of.88 was found overall for the participants of this study.

The visual attention subtest of the Developmental Neuropsychological Assessment (Korkman et al., 1998) is designed to assess the accuracy with which a child (3-12 years old) is able to focus selectively on and maintain attention to visual targets within an array. The maximum score is 40.

The method involved the use of a large traffic mat measuring approximately 120X100 cm. It comprised a street layout on which a range of trees, buses, and toy cars were placed to create situations similar to those individuals might encounter in the real traffic environment. The task was based on previous research on pedestrian skills (Ampofo-Boateng & Thomson, 1991; Tabibi & Pfeffer, 2003).

The recognition task featured the toy pedestrian standing at the edge of a road facing towards the road. Twenty-five road-crossing sites were represented separately, including one practice trial. Two tasks were designed using the 24 road-crossing sites: a) recognition task without irrelevant information constituted of 12 road-crossing sites (*Task A relevant*) and b) recognition task with irrelevant information constituted of 12 road-crossing sites (*Task B irrelevant*), respectively. For the recognition task without irrelevant information, distracting visual information was removed from the scene (such as cats, dogs, children playing) allowing the participant to focus on the road site.

The situations were all matched as far as possible for complexity and surrounding layout. The sites included junctions, bends, parked cars or other obstructions. In constructing the sites, care was taken that each was rendered dangerous by the presence of only one of these features. Selection of the sites in both tasks was done with the aid of the Hellenic Ministry of Education (Road Safety Educational Programs). A range of possible situations was presented to independent judges who evaluated them. Only situations that showed 100 per cent agreement as to their manifest safety or danger were selected for use.

Road-crossing sites were presented in random order with a 1-min interval between trials. Trials were not time limited. The experimenter, a certified psychologist, tested every individual individually. Road-crossing sites information was recorded on a standard data collection form. Correct identification of a safe road-crossing site was given 1 point. No point was given for identification of a dangerous road-crossing site.

Procedure

Informed consent was obtained before the investigation from the parents of all included children. All children with mild ID were examined in the Counseling Center. The pedestrian task conditions were presented randomly to the participants. The examination was performed on individual basis. The pedestrian toy was positioned near to each of the road-crossing locations and each child was asked to judge whether should (*safe*) or should not (*dangerous*) cross the road. Depending on the participant's speed of performance, the task took 15 minutes to complete for group A and around 25 minutes for group B. The Children's Embedded Figures Test and the visual attention subtest of the Developmental Neuropsychological Assessment were individually administered to each preadolescent in a quiet room by the experimenter.

Results

In order to compare the performance of each group in the two tasks, a one-way analysis of variance was performed. Analysis indicated that there was a significant main effect of group in both tasks, with Group B to mark lower score than Group A in *Task A relevant* (M= 8.00 and M=4.90 for groups A and B respectively) and in *Task B irrelevant* (M=5.15 and M=2.30 for groups A and B respectively) (Table1).

Table 1
Means and Standard Deviations of Tasks in each Group

Group / Variables	Group A		Group B		
	M	SD	M	SD	F
TASK A relevant	8.00	0.86	4.90	0.79	135.141*
TASK B irrelevant	5.15	0.75	2.30	0.86	122.332*

*p <0.001

In order to test the performance of each group separately in *task A relevant* vs *task B irrelevant*, the technique of paired samples t – test was performed. It was found that the performance on *task A relevant* was significantly higher than the performance on *task B irrelevant*, for both groups (group A: $t = 12.255$, $df = 19$, $p < 0.001$, group B: $t = 10.177$, $df = 19$, $p < 0.001$). Thus, both groups showed a higher performance on the easier task (*task A relevant*).

Finally, in order to test which variables could predict the scores in the two tasks; linear regression analysis was performed for each group separately. The independent variables that used for the regression models were: IQ, visual attention score, and cognitive style. For the group A, regression analysis indicated that no one of the independent variables was significant in prediction of the *task A relevant*. However, cognitive style and visual attention score were significant in prediction of the *task B irrelevant* (Table 2).

Table 2
Predicting, *task B irrelevant* (group A)

Model	Unstandardized Coefficients		T
	B	Std. Error	
(Constant)	5.13	1.44	3.56**
Cognitive style	0.26	0.14	2.71*
Visual attention score	0.19	0.10	2.36*

p < 0.05, ** : p < 0.005

For the group B, regression analysis indicated that the visual attention score and cognitive style are both significant in prediction of the *task A relevant* and the *task B irrelevant* (Table 3 & Table 4).

Table 3
Predicting, *task A relevant* (group B)

Model	Unstandardized Coefficients		T
	B	Std. Error	
(Constant)	3.10	0.88	3.53**
Visual attention score	0.21	0.11	2.54*
Cognitive style	0.17	0.09	2.28*

p <0.05, **: p < 0.005

Table 4
Predicting, *task B irrelevant* (group B)

Model	Unstandardized Coefficients		T
	B	Std. Error	
(Constant)	3.10	0.88	3.53**
Visual attention score	0.25	0.13	2.67*
Cognitive style	0.19	0.10	2.36*

* : p <0.05, **: p < 0.005

Discussion

Preadolescents of group B, who showed low scores at the attention subtest and on the CEFT, were less accurate at the road-crossing sites tasks. Our results indicate that attention and cognitive style are required for identifying road-crossing sites accurately. When the preadolescents with ID asked to choose a safe route across the road, group B tended to select the shortest, most direct route as the safest. They tend to behave like five and seven -year old children who go directly to their destination, walk between parked cars and other obstacles blocking their vision (Ampofo-Boateng, Thomson, Grieve, Pitcairn, Lee, & Demetre, 1993).

Irrelevant information affected the ability of all preadolescents with ID. This is consistent with published results on attention (Tabibi & Pfeffer, 2003), which suggest that the animated distractions (adding more visual information) may have been sufficiently demanding for all the participants. An increase in irrelevant information may highlight the vulnerability of all participants to interference more. This explains the fact that the performance of both groups in *task B irrelevant* is the lowest compared with the *task A relevant*. On the other hand, group B individuals experience enhanced difficulty inhibiting the influence of distractors (irrelevant information) than group A individuals.

It seems that group B who exhibited poorer selection skills and smaller suppression effects seem to show some kind of cognitive inertia (Ellis & Dulaney, 1991; Dulaney & Ellis, 1997). Zacks and Hasher (1994) suggested that these suppression processes might be important components of attention. If irrelevant stimuli are not effectively suppressed, they continue to demand processing resources associated with limited capacity working memory. This would reduce the functional capacity of working memory for the processing of relevant stimuli, and, as a consequence, the efficiency of processing relevant information would be reduced. Hence, inefficient stimulus suppression processes may result in performance decrements for individuals with ID across a variety of tasks, such as road-crossing identification (Tomporowski & Tinsley, 1997).

According to the matter of field dependence/independence, group B, who was more field dependent, found very difficult to separate an item from its context. They were more likely to go along with the field *as is*, without using processes like analyzing and structuring. Field dependence reflects a high sensitivity to interference, with subjects being less able to inhibit attention to irrelevant aspects of the distracting whole. The characteristics, shown by field dependent and independent preadolescents in road crossing tasks, lead us to expect a greater disposition by the latter group to use learning strategies (Tinajero & Paramo, 1998). Feuerstein (1980) noted that many persons with ID do not attend differentially to the stimuli, which is characteristic of the field dependent person. His intervention program aims at transforming the passive and dependent cognitive style of the individuals with ID into the characteristic of autonomous and independent thinkers, using mediated learning strategies.

In summary, our results indicate that selective attention and cognitive style are, at least, partially required for identifying road-crossing sites accurately. Regression analysis indicated that cognitive style and visual attention score were significant in prediction most of the tasks in both groups. On the other hand, no one of the independent variables was significant in prediction of *task A relevant* in group A. This group seems to be unaffected (the score was 8 out of 12); they were able to control their focus probably because the task was relatively easy. Their function of attention probably works without severe impairment (see also Belmont & Ellis, 1968; Sen & Clarke, 1968).

In general, although there are statistical significant differences between group A and group B, the differences are quantitative in nature. The results showed that there are some qualitative similar patterns between the two groups. Presenting participants with a mat-based task under controlled conditions facilitates the focusing of attention to the task in hand. The real pedestrian environment does not facilitate the focusing of attention; on the contrary it is more likely to provide interfering and distracting stimuli. It is expected that the role of the visual attention should be even higher in the natural environment. Further research is needed to determine which aspects of attention are most important for safe pedestrian behavior and the type of distractions that are the most deleterious for pedestrians with ID. Attention and cognitive style should be considered in the planning of road safety training for individuals with ID. Future research employing virtual reality technology in road safety education is advocated (Simpson, Johnston, & Richardson, 2003).

References

Alevriadou, A., Angelou, I., & Tsakiridou, E. (2006). The relationship between attention and identification of safe and dangerous road crossing sites in adults with mild intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*, *19*(3), 239.

Alevriadou, A., & Grouios, G. (2007). Distractor interference effects and identification of safe and dangerous road-crossing sites by children with and without mental retardation. In E.B. Heinz (Ed.), *Mental Retardation Research Advances* (pp. 75-87). New York: Nova Press.

Ampofo-Boateng, K., & Thomson, J. A. (1991). Children’s perception of safety and danger on the road. *British Journal of Psychology*, *82,* 487-505.

Ampofo-Boateng, K., Thomson, J. A., Grieve, R., Pitcairn, T., Lee, D. M., & Demetre, J. (1993). A developmental and training study of children's ability to find safe routes to cross the road. *British Journal of Developmental Psychology*, *11,* 31−45.

Belmont, J.M., & Ellis, N.R. (1968). Effects of extraneous stimulation upon discrimination learning in normals and retardates. *American Journal of Mental Deficiency*, *72,* 525-532.

Bergen, A-M. E., & Mosley, J.L. (1994). Attention and attentional shift efficiency in individuals with and without mental retardation. *American Journal on Mental Retardation*, *98,* 688-743.

Bice, T., Halpin, G., & Halpin, G. (1986). A comparison of the cognitive styles of typical and mildly retarded children with educational recommendations. *Education and Training of the Mentally Retarded*, *33,* 93-97.

Bowd, A. (1976). Item difficulty on the Children’s Embedded Figures Test. *Perceptual and Motor Skills*, *43,* 134.

Broadbent, D.E. (1982). Task combination and selective intake of information. *Acta Psychologica*, *50,* 253-290.

Brown L., Sherbenou R. J., & Johnsen, S.K. (1990). *Test of non-verbal intelligence.* (2nd ed.). Austin, TX: PRO-ED.

Cha, K-H. (1992). The effect of flanking context and its time course in focused attention processes of mentally retarded and nonretarded persons. (Doctoral dissertation, The University of Alabama, Tuscaloosa, 1992). *Dissertation Abstracts International*, *53,* 2087.

Cha, K-H., & Merrill, E.C. (1994). Facilitation and inhibition effects in visual selective attention processes of persons with and without mental retardation. *American Journal on Mental Retardation, 98,* 594-600.

Chinien, C. A., & Boutin, F. (1993). Cognitive style FD/I : An important learner characteristic for educational technologists. *Journal of Educational Technology Systems*, *21,* 303-311.

Clark, H., & Roof, K. (1988). Field dependence and strategy use. *Perceptual and Motor Skills*, *66,* 303-307.

Collins, B. C., Wolery, M., & Gast, D. L. (1991). A survey of safety concerns for students with special needs. *Education and Training in Mental Retardation*, *26,* 305-318.

Crosby, K.G. (1972). Attention and distractibility in mentally retarded children. *American Journal of Mental Deficiency*, *77,* 46-53.

Davis, J. K. (1991). Educational implications of field dependence-independence. In S.

Wapener & J. Demick (Eds.). Field dependence-independence: bio-psycho-social factors across the life span (pp. 149-175). Hillsdale, NJ: Lawrence Erlbaum.

Dulaney, C., & Ellis, N. (1997). Rigidity in the behavior of mentally retarded persons. In W. E. MacLean (Ed.), *Ellis' Handbook of mental deficiency, psychological theory and research* (pp. 175-195). Mahwah, NJ: Erlbaum.

Dunbar, G., Lewis, V., & Hill, R. (1999). Control processes and road-crossing skills. *Psychologist, 12,* 398-399.

Ellis, N.R., & Dulaney, C.L. (1991). Further evidence for cognitive inertia of persons with mental retardation. *American Journal on Mental Retardation*, *95,* 613-621.

Ellis, N.R., Woodley-Zanthos, P., Dulaney, C.L., & Palmer, R.L. (1989). Automatic-effortful processing and cognitive inertia in persons with mental retardation. *American Journal on Mental Retardation*, *93,* 412-423.

Feuerstein, R. (1980). *The Instrumental Enrichment Method: An intervention program for cognitive modifiability*. Baltimore, MD: University Park Press.

Garner, W.R. (1974). *The processing of information and structure*. Potomac, MD: Erlbaum.

Gaskell, G., Harrison, L., & Goodwyn, E. (1989). Vulnerability and behavioral factors in child pedestrian accidents. *European Transport and Planning*, *323*, 139−152.

Green, K. (1985). *Cognitive style: A review of the literature*. Chicago: IL: Johnson O'Connor Research Foundation.

Hagen, J.W., & Huntsman, N. (1971). Selective attention and mental retardation. *Developmental Psychology*, *5,* 151-160.

Hill, R., Lewis, V., & Dunbar, G. (2000). Young children's concepts of danger. *British Journal of Developmental Psychology*, *18,* 103-120.

Johnson, E.S., & Mead, A. C. (1987). Developmental patterns of spatial ability: An early sex difference. *Child Development, 58,* 725-740.

Jonassen, D., & Grabowski, B. (1993). Field dependence and field independence (global vs. articulated style). In D. Jonassen & B. Grabowski (Eds.), *Handbook of individual differences: Learning and instruction* (pp. 87-103). Hillsdale, NJ: Erlbaum.

Karp, S.A., & Konstadt, N. (1971). The Children's Embedded Figures Test (CEFT). In H. A. Witkin, P. K. Oltman, E. Raskin, & S. A. Karp (Eds.), *Manual for the Embedded Figures Test* (pp. 21-26). Palo Alto, CA: Consulting Psychologists Press.

Kent-Davis, J., & Cochran, K. F. (1989). An information processing view of field dependence-independence. *Early Child Development and Care, 51,* 31-47.

Kerns, K., & Berenbaum, S. (1991). Sex differences in spatial ability in children. *Behavior Genetics, 21,* 383-396.

Konstadt, N., & Forman, E. (1965). Field dependence and external directedness. *Journal of Personality and Social Psychology*, *1,* 490-493.

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A developmental neuropsychological assessment.* San Antonio, TX: The Psychological Corporation.

Matson, J.L. (1980). A controlled group study of pedestrian-skill training for the mentally retarded. *Behavior Research and Therapy*, *18*, 99-106.

Mechling, L. C. (2008). Thirty year review of safety skill instruction for persons with intellectual disabilities. *Education and Training in Developmental Disabilities*, *43*(3), 311-323.

Merrill, E.C. (1990). Resources allocation and mental retardation. In N.W. Bray (Ed.), *International Review of Research in Mental Retardation* (Vol. 16, pp. 51-88). Hillsdale, NJ: Erlbaum.

Merrill, E.C. (2006). Interference and inhibition in tasks of selective attention by persons with and without mental retardation. *American Journal on Mental Retardation*, *111,* 216-226.

Merrill, E.C., Cha, K-H., & Moore, A.L. (1994). The inhibition of location information by persons with and without mental retardation. *American Journal on Mental Retardation*, *99*, 207-214.

Merrill, E.C., & O' Dekirk, J.M. (1994). Selective attention and mental retardation. *Cognitive Neuropsychology*, *10*, 117-132.

Messick, S. (1984). The nature of cognitive styles: Problems and promise in educational practice. *Educational Psychologist*, *19,* 59-74.

Neil, W.T. (1977). Inhibitory and facilitory processes in selective attention. *Journal of Experimental Psychology*: *Human Perception and Performance*, *3*, 444-450.

Neil, W.T., & Westberry, R.L. (1987). Selective attention and the suppression of cognitive noise. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*, 327-334.

Nugent, P.M., & Mosley, J.L. (1987). Mentally retarded and nonretarded individuals' attention allocation and capacity. *American Journal of Mental Deficiency*, *91*, 598-605.

Oka, K., & Miura, T. (2008). Allocation of attention and effect of practice on persons with and without mental retardation. *Research in Developmental Disabilities, 29*(2), 165-175.

Page, T.J., Iwata, B.A., & Neef, N.A. (1976). Teaching pedestrian skills to retarded persons: Generalization from the classroom to the natural environment. *Journal of Applied Behavior Analysis*, *9*, 433-444.

Parasuraman, R., & Davies, D.R. (1984). *Varieties of attention*. New York: Academic Press.

Pearson, D.A., Norton, A.N., & Farwell, E.C. (1997). Attention-deficit/hyperactivity in mental retardation: Nature of attention deficits. In J.A. Burack and J.T. Enns (Eds.), *Attention, development, and psychopathology* (pp. 205-231). New York: Guilford Press.

Phillips, S., & Todman, J. (1999). Pedestrian skills training for children with learning difficulties. *International Journal of Rehabilitation Research*, *22*, 23-238.

Richardson, J. A., & Turner T. E. (2000). Field Dependence Revisited I: intelligence. *Educational Psychology*, *20*(3), 255-270.

Ruble, D., & Nakamura, C. (1972). Task orientation versus social orientation in young children and their attention to relevant social cues. *Child Development*, *43*, 471-480.

Sen, A., & Clarke, A.M. (1968). Some factors affecting distractibility in the mental retardate. *American Journal of Mental Deficiency*, *73*, 50-60.

Shah, A., & Frith, U. (1993). Why do autistics individuals show superior performance on the block design task? *Journal of Child Psychology and Psychiatry*, *34*, 1351-1364.

Simpson G., Johnston L., & Richardson, M. (2003). An investigation of road crossing in a virtual environment. *Accident Analysis and Prevention*, *35*, 787–796.

Tabibi, Z., & Pfeffer, K. (2003). Choosing a safe place to cross the road: The relationship between attention and identification of safe and dangerous road-crossing sites. *Child: Care, Health and Development*, *29*, 237-244.

Terdal, L.G. (1967). Stimulus satiation and mental retardation. *American Journal of Mental Deficiency*, *71*, 881-885.

Thomson, J.A. (1991). *The Facts About Child Pedestrian Accidents*. Cassell: London.

Tinajero, C., & Paramo, M.F. (1998). Field dependence-independence and strategic learning. *International Journal of Educational Research, 29,* 251-262.

Tipper, S.P. (1985). The negative priming effect: Inhibitory effect of ignored primes. *Quarterly Journal of Experimental Psychology*, *37*A, 571-590.

Tomporowski, P.D., & Tinsley, V. (1997). Attention in mentally retarded persons. In W.E. MacLean (Ed.), *Ellis' handbook of mental deficiency, psychological theory and research* (3rd ed., pp. 219-241). Hillsdale, NJ: Erlbaum.

Witkin, H. (1950). Individual differences in ease of perception of embedded figures. *Journal of Personality*, *19*, 1-15.

Witkin, H., & Goodenough, D. R. (1981). *Cognitive styles: Essence and origins*. New York: International Universities Press.

Witkin, H., Moore, C., Goodenough, D., & Cox, P. (1977). Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, *47*, 1-64.

Zacks, R.T. & Hasher, L. (1994). Directed ignoring: Inhibitory regulation of working memory. In D. Dagenbach & T.H. Carr (Eds.), *Inhibitory mechanisms in attention, memory and language* (pp. 241-264). New York: Academic Press.

Zeedyk, M. S., Wallace, L., Carcaty, B., Jones, K., & Larter, K. (2001). Children and road safety: Increasing knowledge does not improve behavior. *British Journal of Educational Psychology*, *71*, 573–594.