

Seating arrangements that promote positive academic and behavioural outcomes: a review of empirical research

RACHEL WANNARKA *and* KATHY RUHL

Seating arrangements are important classroom setting events because they have the potential to help prevent problem behaviours that decrease student attention and diminish available instructional time. The purpose of this synthesis of empirical literature is to determine which arrangements of desks best facilitate positive academic and behavioural outcomes for primary through secondary high school students with a range of characteristics. Eight studies that investigated at least two of three common arrangements (i.e., rows, groups or semi-circles) were considered. Results indicate that teachers should let the nature of the task dictate seating arrangements. Evidence supports the idea that students display higher levels of appropriate behaviour during individual tasks when they are seated in rows, with disruptive students benefiting the most.

Key words: seating, achievement, behaviour, research.

Almost three decades ago, researchers began to call for systematic investigations of the influences of antecedent and structural events upon student performance (e.g., Weinstein, 1979). Often referred to as *setting events* or *stimulus conditions*, antecedent and structural events are of particular interest because manipulations of these may be considered naturalistic interventions that unobtrusively alter behaviours. Interventions involving setting events can be easily incorporated into the course of a school day and should aid in behavioural generalisation. Focusing on stimulus conditions rather than consequences may help teachers discretely to prevent problem behaviours before they occur and avoid utilising unnecessarily intrusive interventions. Also, interventions based on unnatural consequences are less likely to lead to behavioural generalisation than interventions that control naturally occurring reinforcers (Wheldall, Morris, Vaughan and Ng, 1981). Thus, teachers should be knowl-

edgeable about setting events so that they can apply this knowledge to everyday classroom situations.

A wide range of stimulus conditions fall into the category of classroom environmental variables and setting events. Some of these conditions are temperature, lighting (Granstrom, 1996), seating arrangement, noise level, and the presence or absence of peers or adults. Of particular interest is seating arrangement because variables related to seating arrangement, such as classroom position, have been shown to impact on educational interactions.

The physical arrangement of the classroom has the potential to encourage desirable behaviour or contribute to students' misbehaviour (Daniels, 1998). Additionally, unlike other factors that also impact on behaviour (e.g., individual student characteristics, social dynamics), seating arrangement is one factor that is typically under teacher control. Classroom arrangement significantly impacts on student behaviour, and there is evidence to suggest that it impacts on achievement as well (Pace and Price, 2005). Moore and Glynn (1984), for example, found that a student's location in the classroom is related to the number of questions received from the teacher; this may influence the student's opportunity to respond and thus to learn. Also, Granstrom (1996), perhaps not surprisingly, found that students at the back of the classroom tend to interact with each other more frequently than those seated at the front, potentially adversely impacting their attention to the task at hand.

Because proximity and orientation influence communication, it is possible that desk configuration impacts on the nature and extent of student interaction. Thus it is important for teachers to have the knowledge necessary to make informed decisions about whether rows, clusters, semi-circles or some other arrangement will best meet the instructional needs of their students. This may be especially critical in inclusive settings that serve students with

disabilities and those without disabilities concurrently, due to the wide range of behavioural and academic characteristics represented.

On examination of various texts (e.g., Paine, Radicchi, Rosellini, Deutchman and Darch, 1983; Walker, Shea and Bauer, 2007) for recommendations pertaining to seating arrangements, it seems that there is a lack of consensus to guide teachers as they seek to make good decisions about the best arrangement to use for their students. The purpose of this synthesis of the literature is to summarise empirical studies that investigate either academic or behavioural outcomes as a result of different seating arrangements. Student behavioural (e.g., 'disruptive') and academic (e.g., 'high-achieving') characteristics are considered within this context.

Method

Inclusion criteria

Articles had to meet the following criteria to be included in the synthesis: (a) the article described an empirical study in which desk arrangement served as an independent variable; (b) subjects had to be of school age (i.e., nursery through 12th grade); and (c) the articles had to be available in English and published in a peer reviewed journal between 1979 and 2007 (inclusive). Articles were not excluded based upon the country in which the study was conducted.

Search procedures

Searches of two educational databases (i.e., ERIC and Wilson) and one psychological database (i.e., PsychInfo) were conducted. All three databases were searched using *room arrangement*, *classroom arrangement*, *desk arrangement*, and *seating arrangement* as keywords. A large number of irrelevant articles were identified on PsychInfo so the procedure for that database was refined. Eliminating

room arrangement and *seating arrangement* resulted in a much higher proportion of relevant articles. Finally, an ancestral search was conducted using the references of the studies obtained using the above procedures and additional articles meeting the criteria were identified and included. Eight studies meeting the above criteria were identified through this process.

Results

The studies identified for inclusion in this review all used *seating arrangement* as an independent variable with rows as a condition. In most cases, rows were compared to aggregations of desks (i.e., clusters, tables or groups) that are collectively referred to here as 'groups.' Two studies also compared rows to a circular arrangement (Marx, Furher and Hartig, 2000; Rosenfeld, Lambert and Black, 1985). All but two studies (Bennett and Blundell, 1983; Marx, Furher and Hartig, 2000) were concerned with identifying changes in on-task behaviour as a result of the seating arrangements imposed, though definitions of 'on-task' varied considerably between the studies. Marx and colleagues studied student question-asking; Bennett and Blundell focused on the quantity and quality of work output.

Participants ranged in age from 7 to 15 years old, though 9-, 10- and 11-year-olds were the subjects of six of the eight studies. Effects of a rows seating arrangement on the various student behaviours are summarised in Table 1.

Seating arrangement impact on student on-task behaviour

The studies that concerned individual tasks were unequivocal in their support for a rows arrangement to increase on-task behaviour and/or decrease off-task behaviour when students were expected to work on their own. What consti-

Table 1. Effects of a rows seating arrangement on student behaviour in individual and interactional tasks

Article	Students		Type of task	Outcome of rows
	Age	Additional characteristics		
Axelrod, Hall and Tams, 1979	7-8	'academically behind'	Individual	Increased OTB
Bennett and Blundell, 1983	10-11	-	Individual	Work production increased, quality maintained
Hastings and Schweiso, 1995	7-8	-	Individual	Increased class OTB
Hastings and Schweiso, 1995	9-11	3 target boys were 'disruptive'	Individual	Increased class OTB; dramatic increase for target students
Marx, Furher and Hartig, 2000	9-10	-	Interactive	Decreased OTB
Rosenfeld, Lambert and Black, 1985	10-12	'high' and 'low' ability	Interactive	Decreased OTB
Wheldall and Lam, 1987	12-15	Emotional, behavioural, and/or learning difficulties	Individual	Increased OTB
Wheldall, Morris, Vaughan and Ng, 1981	10-11	Students initially rated as high, medium, or low NTB; one class considered 'boisterous'	Individual	Increased OTB
Yeomans, 1989	7-8	-	Individual	Increased OTB

Note: Dashes indicate that additional behavioural and academic characteristics were not provided.

OTB = on-task behaviour defined as following teacher's directions (speaking only with permission, keeping hands to self, etc.) and attending to academic tasks.

tuted on- and off-task behaviour was defined by teachers or researchers, so the particular behaviours of concern varied by activity across the studies. Examples of on-task behaviour were hand-raising and complying with requests, and examples of off-task behaviour were talking out of turn or being out of seat without permission. Four of the studies (Axelrod, Hall and Tams, 1979; Wheldall, Morris, Vaughan and Ng, 1981; Wheldall and Lam, 1987; Hastings and Schweiso, 1995) represent essentially the same line of research and will be considered as such here.

Axelrod, Hall and Tams (1979) compared rows to groups in two separate experiments. In the first experiment they used an ABAB design to find that 17 inner-city, second graders who were below grade level had significantly greater study behaviour (e.g., complying with requests, raising hand for assistance) when they were seated in rows than when they were seated in four-person groups. In the second, they used an ABA design to find that 32 upper-middle-class seventh graders who were on grade level engaged in significantly fewer instances of talking without permission when they were seated in rows rather than in face-to-face dyads.

In a replication and extension of Axelrod *et al.*'s (1979) study, Wheldall and colleagues (1981) found that a rows arrangement increased on-task behaviour (e.g., compliance with teacher instructions, eye contact with materials, etc.) in a mixed-ability classroom. In addition to recording class averages, these researchers separated data for students identified by their teacher and through their observation as being *high*, *medium*, or *low* in initial on-task behaviour. They found little difference between rows and clusters for the high group, a moderate difference for the medium group, and a 'substantial' (p. 178) difference for the low group. Wheldall and Lam (1987) replicated this study in a special school for children with behavioural difficulties, where they found substantial improvement in on-task behaviour when students moved from a groups to a rows arrangement.

As a replication of Wheldall and Lam's (1987) study, Hastings and Schweiso (1995) studied two parallel classes of suburban 9–11-year-olds in an ABA design. They found that the rows arrangement improved on-task behaviour in the whole class. They also found the largest improvement in students who had been initially rated as the most disruptive.

In seeming contradiction to this line of research, a fifth study comparing rows to groups utilising on-task behaviour as a dependent variable, Rosenfield, Lambert and Black (1985) found that rows decreased the target behaviours compared with groups, and in this case, circles as well. A notable difference of this study is that the task students were most engaged in was a brainstorming activity that required peer interaction, rather than the more individual activities represented by the other studies.

Seating arrangement impact on other behaviours

Taken together, results of the two studies in this area are somewhat more equivocal in their support for rows, even

when the task is individual. Marx, Furher and Hartig (2000) investigated the relationship between seating arrangements and the question-asking patterns of ten-year-olds. They found that students asked their teacher significantly more questions when they were seated in a semi-circle than in rows.

Finally, in the only study of its kind, Bennett and Blundell (1983) looked at both the quantity and the quality of work produced by 10- and 11-year-old students seated in rows and in groups. They found that students produced work of equal quality in both conditions, but significantly greater quantity in rows. Additionally, they found that when students sat in groups after having been seated in rows for two weeks that students' quantity of work was higher than during the first time they sat in groups (though not as high as in rows).

Discussion

Results of this synthesis suggest that the nature of the academic task and type of behaviour desired should dictate the seating arrangement. Generally, teachers who want to maximise the on-task behaviour of their students during independent work should consider utilising rows rather than groups as their primary seating arrangement and moving desks into other positions to facilitate interaction when it is desired. Researchers have pointed out the logical inconsistency of seating arrangements that seem to run counter to the nature of the academic task (e.g., Bennett and Blundell, 1983; Hastings and Schweiso, 1995). When teachers consider behaviours such as hand-raising and writing to be on-task and talking to peers and being out of seat without permission to be off-task, rows appear to be the superior arrangement.

If students are working on individual assignments, they should be seated in an arrangement that makes interacting with their peers inconvenient and apparent to teachers – for example, in rows students are not directly facing each other and they may not be close enough to touch each other inconspicuously. When the desired behaviour is interactive, however, like brainstorming (Rosenfield, Lambert and Black, 1985) or questioning the teacher (Marx, Furher and Hartig, 2000), seating arrangements that facilitate interactions by proximity and position, such as clustered desks or semi-circles, should be utilised.

Consideration of the nature of the academic task at hand highlights the fact that how one defines on-task behaviour is critical and indicates that the research of Rosenfield, Lambert and Black (1985) does not, in fact, contradict the findings of the other articles. These researchers found rows to be the *least* conducive to on-task behaviour because students performed better in both groups and circles, while all the other studies determined rows to be the most conducive. A critical difference of this study is that the task the students were most frequently engaged in during observations was a brainstorming activity that required talking and collaboration. Rosenfield and colleagues considered any type of comment to be

on-task, regardless of content, while most of the other studies interpreted comments to be off-task in the context of individual academic tasks (i.e., Axelrod, Hall and Tams, 1979; Hastings and Schweiso, 1995; Wheldall and Lam, 1987; Wheldall, Morris, Vaughan and Ng, 1981; Yeomans, 1989).

The only researchers in addition to Rosenfield, Lambert and Black (1985) to find a seating arrangement other than rows to be superior were Marx, Furher and Hartig (2000). Their study was the only one to address children's question-asking behaviour in rows and in a semi-circle and was so designed because '... questions serve many important educational functions, enabling individuals to seek information, obtain clarification, and receive information...' (p. 252). Students in this study asked more questions in a semi-circle than they did in rows in a pattern that was stable over time. This study did not consider off-task behaviour or any other type of behaviour apart from asking the teacher questions that might be considered on-task.

The majority of the studies sought to describe the use of seating arrangements to minimise disruptive behaviour or maximise on-task behaviour during individual activities. Rows were consistently superior for this purpose, and the studies that described individual student characteristics (i.e., Hastings and Schweiso, 1995; Wheldall and Lam, 1987; Wheldall, Morris, Vaughan and Ng, 1981) found the effects to be most substantial for students initially described as lowest in on-task behaviour.

One potential limitation of this synthesis is the lack of recent data represented. The most recent study to investigate the relationship between seating arrangements and on-task behaviour in individual assignments was conducted by Hastings and Schweiso in 1995, though it seems that there have not been substantive changes in education that could be expected to impact on the reasoning behind various seating arrangements. Thus we anticipate that the findings of this review could be reasonably generalised to current classroom dynamics, with at least one notable exception: inclusive classrooms. Previously, the educational community at large tended to be of the opinion that most students with special needs should have unique curricula. The current predominant view is that these students should have access to the same general education curricula as their peers without disabilities, and that the optimal setting is in the general education classroom with accommodations made as necessary (Friend, 2005) rather than in a segregated special education setting. It is possible that the more varied requirements of students with special educational needs may impact on optimal seating arrangements and this is an area that should be studied.

Results of this synthesis indicate that rows seating arrangements tend to have a proportionally large positive impact upon the behaviour of especially disruptive students. Because disruptive behaviour is characteristic of certain special education categories such as learning disabilities or behaviour disorders (Salend, 1998), there is justification for

hypothesising that a primary rows seating arrangement would be particularly helpful to general education teachers in inclusive classrooms serving students with either learning disabilities or behaviour disorders when tasks are individual. Students who have learning disabilities frequently also have behaviour problems including excessive out-of-seat behaviour and talk-outs (Friend, 2005), two examples of behaviour that was considered off-task by a majority of the studies in this review. Students with behaviour disorders by definition have behaviour differences from their peers without disabilities, and some researchers (e.g., Handwerk and Marshall, 1998) have suggested that the problematic externalising behaviours exhibited by students with learning disabilities and students with behaviour disorders are similar in nature, and vary mainly in severity.

General education teachers are often reluctant or untrained and unable to deal competently with disruptive behaviour (MacAuley and Johnson, 1993). Teachers have reported feeling significantly more stress than normal when teaching students who have Attention Deficit-Hyperactivity Disorder and thus often exhibit problematic and off-task behaviour (Green, Beszterczey, Katzenstein, Park and Goring, 2002). General education teachers report more negative feelings associated with students with behaviour disorders than student groups with any other type of disability (Friend, 2005). Altering seating arrangements may be a way to address teacher stress and other negative feelings that impact on the classroom environment; paying attention to behavioural antecedents as a way to reduce undesired behaviour could benefit students and help to alleviate teacher anxiety.

Much has changed in the last 20 years in terms of definitions and prevalence of special education students in the general education classroom (Salend, 1998), and the majority of included articles failed to provide information about the special education status of the represented students. Studies that identified behavioural characteristics of individual students (Axelrod, Hall and Tams, 1979; Hastings and Schweiso, 1995; Rosenfield, Lambert and Black, 1985; Wheldall and Lam, 1987; Wheldall, Morris, Vaughan and Ng, 1981) probably included students who would be either at risk or meeting the criteria for special education services for behaviour problems, learning disabilities, or both.

In addition to inclusive classrooms with heterogeneous populations, seating arrangements have the potential to be a useful tool for special educators in homogeneous classrooms, perhaps especially in classrooms for students with behaviour disorders. Only one study specifically targeted a similar population (Wheldall and Lam, 1987), but the results were dramatic. In order to replicate and extend previous research (Wheldall, Morris, Vaughan and Ng, 1981) that found rows to be most beneficial for children with low initial on-task behaviour in a heterogeneous classroom, Wheldall and Lam repeated the study in a special school for 'behaviourally troublesome children with moderate learning difficulties' (p. 304). They found that, overall, rows doubled on-task behaviour and decreased the disruption rate by two-thirds.

Though the results of this review should be largely generalisable to today's classrooms, important questions still remain. Some concern individual student characteristics: What are the effects of a rows arrangement upon children with difficulties that are not primarily behavioural? What are the effects of a rows seating arrangement on children older than 12? Only one study looked at teenagers (Wheldall and Lam, 1987), but none looked at students older than 15. Behaviour patterns of children tend to change as they grow older (Slavin, 2003), so student behavioural responses to seating arrangements may also differ with age.

Other questions concern the nature of the task: What are the effects of rows seating arrangements on the quality of work produced? One study (Bennett and Blundell, 1983) addressed this question and found no difference in quality, but the sole measure of quality was percentage of answers correct in reading and language comprehension. Effects of rows upon other measures of quality (e.g., ability to apply or generalise) and in other domains (e.g., maths or written expression) remain to be determined.

Filling in these gaps in our knowledge has the potential to be useful. As Axelrod, Hall, and Tams (1979) pointed out, arranging antecedent events to promote on-task behaviour is frequently less labour intensive for the teacher than managing a contingency arrangement; seating arrangements certainly deserve some attention from current educational researchers. From a behavioural analytic perspective, environment and behaviour are not separable and must be considered as one unit. The studies in this review clearly indicate that a factor as simple as desk arrangement can have a dramatic impact on student behaviour. It may be appropriate for teachers to begin by asking themselves what the instructional goals are for their students and then selecting a seating arrangement that has shown promise in the existing literature. Effective teachers will monitor student behaviour and, if warranted, reconfigure desks to encourage students to engage in desired behaviours.

There is no single classroom seating arrangement that promotes positive behavioural and academic outcomes for all tasks, because the available research clearly indicates that the nature (i.e., interactive versus independent) of the task should dictate the arrangement. Teachers, especially those who have students with special educational needs that impact on their behaviour in inclusive or homogeneous settings, should be able to eliminate many disruptions that are due to inappropriate student interactions by utilising a rows arrangement for individual tasks and moving desks together when interaction is desirable.

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Correspondence

Kathy Ruhl, PhD
 Professor of Special Education
 Head, Department of Educational Psychology, School
 Psychology and Special Education
 The Pennsylvania State University
 125E Cedar Building
 University Park, PA 16802
 USA
 Email: klr3@psu.edu