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ABSTRACT

This review of the literature of the effects of the physical setting on instructional goals posits that the physical setting in which instruction occurs will affect learners' behavior, whether or not it is intended to. These effects occur in two ways--directly, by the behavior the setting allows, and indirectly or symbolically, by the messages the setting communicates about what behaviors are permitted, how important learning is, and what the roles of the learner and the teacher should be. Teachers, trainers, and instructional designers should consider the direct and indirect effects of various spatial arrangements and determine which formations will maximize the effectiveness of the designed instruction. Environmentally competent teachers and designers consider what learners will be doing, i.e., whether they will be reading or writing independently or engaged in cooperative learning activities, watching a videotape, or collaborating in pairs at a microcomputer. Then they design a physical arrangement that supports these activities, making environmental design an integral part of their instructional design. (19 references) (BBM)

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Not too long ago, I visited a fifth-grade class to observe a student teacher. I had heard a great deal about how the children in this class made extensive use of the computer for writing. According to the student teacher, all the children had their own disks, and using Appleworks, they wrote, edited, and revised their stories. Eventually, the stories were "published" and became part of the class' personal library. The computers remained on all day, and students moved to the computer area at assigned times or whenever they had a free moment.

As I entered the classroom, I could see three computers against the back wall, each in its own narrow carrel. The dividers were clearly intended to ensure that the individual working independently at each computer wouldn't be distracted by neighbors. However, two students sat at each computer, crowded together, working on collaborative writing activities. As I watched, I saw some interesting "giraffe-like" behavior: the students at each computer would stretch their necks up and around the carrel dividers, trying to see what was going on next door. Furthermore, other students walking by (on their way to the pencil sharpener or the waste basket) would stop and peer over the shoulders of the students at the computer. They'd comment on what appeared on the screen, offer suggestions, correct spelling, and ask questions. At times, quite a cluster would form in the computer area.

Observing all this interaction, I recalled—with a smile—the early fears educators had voiced about microcomputers leading to individual isolation—fears that have certainly not been borne out. As Celia Genishi (1988) has observed, computer use is often "a social event" (p. 197). Clearly, computers can generate increased collaboration among children (Borgh & Dickson, 1986; Dickinson 1986, Hawkins et al., 1982; Wright & Samaras, 1986). One reason for this increased collaboration is the public nature of the computer screen. Another reason is the fact that in most classrooms, as in the one I was visiting, computers are a scarce resource, so teachers often assign children to work in pairs or in small groups.

I've begun with this anecdote to point out the mismatch that sometimes occurs between instructional goals and physical settings. The teacher in this classroom actively encouraged collaborative writing; she often assigned students to work on stories together; she encouraged group problem-solving around the computer; and she didn't mind when students passing by stopped to see what was on the monitor. Yet the physical setting was not designed for this interaction and collaboration; in fact, it was intended to promote individual, independent task activity. The narrow carrels prevented two students from sitting comfortably in front of each computer; the computer area was immediately adjacent to students' desks, so

students working on the computer needed to be quiet in order to prevent others from becoming distracted; and the aisle in front of the computer area was narrow and not suitable for group activities around a monitor.

When this kind of mismatch occurs, it underscores the need for those who design and carry out instruction--teachers, curriculum developers, instructional designers, trainers--to attend to the physical setting in which instruction will occur and to think seriously about the way design features can support or hinder instructional goals (Weinstein, 1981). Too often, discussions of physical settings focus solely on lighting, acoustics, the size and shape of the room, and the location of electrical outlets--the fixed features--and ignore environmental variables that can be manipulated by users, like furniture arrangement, clarity of pathways through the space, amenities, and provisions for privacy.

As my student teacher's story suggests, one physical variable that needs to be examined is seating arrangement and its impact on interaction among students. We must ask ourselves, "Given this physical setting, how much interaction is likely to occur?" "How much interaction do I wish to foster?" "What kind of interaction do I want to foster: conversation, group problem solving, tutoring?" "How do I want the interaction to flow?" The answers to these questions should influence the way we design the space and, in particular, the seating arrangement we choose. We know that different seating arrangements--horseshoes, rows, clusters of desks, tables--can affect interaction and task attention (Weinstein, 1984). Let's consider briefly about what is known about some of these common seating arrangements.

A number of studies have compared students' behavior when they're seated in the traditional row-and-column arrangement with their behavior when they're seated in clusters or around tables. For example, a 1983 study (Bennett and Blundell, 1983) placed 10- and 11-year-old students in a small group seating arrangement, then in rows, then once again in groups. The results indicated that the quantity of work completed increased when students were in rows, although the quality of work remained the same. The teachers also reported that there was a noticeable improvement in classroom behavior when the students were in rows.

These findings are consistent with earlier work (Wheldall, Morris, Vaughan, & Ng, 1981; Axelrod, Hall, & Tams, 1979), which found that elementary students seated in rows exhibited greater on-task behavior than students clustered around tables. It seems clear that when the instructional goal is to have students complete individual tasks, it is unwise to place them in clusters. In fact, I tell my students that it is inhumane to place students in clusters and then tell them that they may not interact. Whenever I see this situation, I am reminded of Phil Jackson's (1968) very astute comments about life in elementary classrooms:

> ....students must try to behave as if they were in solitude, when in point of fact they are not....in the early grades it is not uncommon to find students facing each other around a table while at the same time being required not to communicate with each other. These young people, if they are to become successful students, must learn how to be alone in a crowd. (p. 16)

On the other hand, when the instructional goal requires students to interact--for example, in cooperative learning situations and large group discussions--tables, clusters, squares, and circles are definitely preferable to rows. Peter Rosenfield, Nadine Lambert, and Allen Black (1985) compared fifth- and sixth-graders' discussion behavior in three arrangements--rows, clusters, and circles. They found circles were better for discussion than clusters, and clusters were better than rows, which produced more withdrawal and off-task behavior. One interesting observation was that the cluster arrangement encouraged students to raise their hands when they had a comment, whereas students seated in circles more often made spontaneous "out-of-order" comments.

It's not difficult to see why arrangements like circles and clusters would be superior to rows for discussion. Having individuals sit face-to-face promotes social interaction by providing opportunities for eye contact and non-verbal communication (e.g., gestures and facial expressions). Row formations, on the other hand, minimize social contact and thus help to focus individuals on the tasks at hand.

In addition to examining differences in interaction among seating arrangements, researchers have also looked at patterns of interaction within arrangements. For example, when individuals are seated in a circle, they are most likely to make a comment immediately after an individual seated directly across the circle, and they rarely speak to persons beside them (Steinzor, 1950). Similarly, when students are seated in a square, there is more participation from people directly opposite the instructor than from those at the sides, and students sitting adjacent to the instructor generally remain silent (Sommer, 1967). Again, greater opportunity for eye contact and non-verbal communication appear to be responsible for this pattern of interaction.

A comparable phenomenon occurs in row-and-column arrangements. The classic study in this area was done by Adams and Biddle in 1970. These investigators found that students who sat in the front and center of the room interacted most frequently with the teacher (assuming the teacher was in the front and center of the room). The effects were so dramatic that Adams and Biddle called this area the "action zone." Apparently, the action zone phenomenon is not just a matter of the more interested, more eager students choosing seats in the front. Although the research is not completely consistent, there is evidence that even when seats are randomly assigned, those in the front tend to participate more. Furthermore, research (Schwebel & Cherlin, 1972) has indicated that when elementary students are moved up to the front, they become more attentive. Whether it is increased eye contact with the teacher or the feeling that one is under closer surveillance, a seat in the front-center of the classroom does appear to facilitate participation (see Montello, 1988, for an excellent review of these studies).

In addition to influencing the flow of communication, seating position may affect an individual's perceived leadership ability. Howells and Becker (1962), for example, seated five-person groups at a rectangular table, with two people on one side and three people on the other. Since the two individuals on one side could influence three individuals, and those on the three-seat side could influence

only two, the investigators hypothesized that members of the two person side would emerge more frequently as leaders. The data confirmed this prediction--14 people emerged as leaders from the two-seat side, compared with six from the three-seat side.

What does all this mean for instructional design? The first lesson is that the physical setting in which instruction occurs is not simply a neutral backdrop, without influence or importance. Indeed, the physical setting will affect learners' behavior, whether we intend it to or not in the instructional design. These effects occur in two ways--directly, by the behaviors the setting allows, and indirectly or symbolically, by the messages the setting communicates about what behaviors are permitted, how important learning is, and what the roles of the learner and teacher should be (Proshansky & Wolfe, 1974). Let me give an example. We know that if individuals are seated facing each other in clusters, they are able to carry on a discussion more easily than if they are seated apart from one another in rows. Thus, discussion is directly affected by the arrangement of the setting. In addition, the arrangement may indirectly affect behavior by conveying the message that the teacher values discussion and collaboration, that students are supposed to talk. If this is indeed the message that the teacher wishes to communicate, all is well and good. If the message is actually contrary to the teacher's wishes, we have a situation where the design of the space contradicts the teacher's instructional goals. In other words, we have a mismatch between environment and intention.

A second lesson is that teachers, trainers, and instructional designers must consider the direct and indirect effects of various spatial arrangements and determine which formations will maximize the effectiveness of the designed instruction. If we do not systematically analyze these effects and design a setting to support our goals, we can easily become "victims" of the environment, for it will affect behavior in ways that we did not intend. This process of environmental analysis is somewhat different for those who are preparing instructional materials and those who are providing live instruction. As Tessmer and Harris (1992) have observed, designers are not present to arrange seating when materials are used, so they must anticipate the environment in which the activity will take place and provide some guidance on seating arrangements in instructor or student manuals.

Fred Steele (1973) has coined the term "environmental competence" to refer to an awareness of the physical environment and its impact and the ability to use or change that environment to suit one's needs. Environmentally competent teachers and designers do not assume that programs, materials, and activities will be equally effective in any instructional environment. They do not leave the design of instructional settings to custodians--who far too often are responsible for the way our instructional settings are arranged. Instead, they ask: What will the learners be doing? Will they be reading or writing independently, will they be engaged in cooperative learning activities, will they be watching a videotape, will they be collaborating in pairs at a microcomputer? And then they design a physical arrangement that supports these activities, making environmental design an integral part of their instructional design.

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