Minimum Classroom Size and Number of Students Per Classroom:

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Overview of the Problem

One of the most frequently asked questions that I get from individuals interested in the schools' physical environment is: What size should the classroom be? This is is a difficult question because there are many social, educational, and cultural variables that come into the equation. Instead of answering this question directly, lets look at the main problem.

Size and specifications are adequately addressed in the classic works of Hawkins and Lilly (1998) and Castaldi (1994). However, as I review schools and achievement of students from a research standpoint, my conclusion is that the major problem may not be size, but density. How many students should we place within a given space? That is the research question.

We assume that an important factor in achievement is the number of square feet per student. So we should plan for large media centers, dining halls, and courtyards that can serve as important meeting places for students and teachers and help establish identities for schools. Special areas such as science rooms, art rooms, and shops also require more space than the equation we are going to explore in this article. Most importantly of all, the curriculum (activities for learning) should be the dictator of space needs for a classroom. Because the issue of space is complex, the findings presented here should be applied only as minimum guidelines for traditional classroom activities such as lecture and small group activities, with computer terminals arranged along the walls of the classroom. In addition, evidence is pointing to natural light and outdoor learning areas adjacent to classrooms (especially in elementary schools) as factors in learning. For example, the basic classroom should have at least 72 Square feet (6.70 Square Meters) of windows for natural light, These classrooms should have views overlooking life and an exit door to the outside learning environments (Tanner, 2000). Recent research on daylighting is provided by the Heschong Mahone Group (2000). Ample egress makes sense in light of the trends in school violence (the students and teachers need to be able to get out of harms way quickly).

Research Based on the Concept of Social Distance

What do researchers say about space needs? Abramson (1991) found higher achievement in schools with adequate space and further noted that if those larger spaces were used for instructional purposes the achievement was even greater. The lesson is clear. Students need ample space because crowding causes problems. For example, a high-density school influences achievement negatively. The effects of high density were summarized by Wohlwill and van Vliet (1985). "It appears as though the consequences of high density conditions that involve either too many children or too little space are: excess levels of stimulation; stress and arousal; a drain on resources available; considerable interference; reductions in desired privacy levels; and loss of control (pp. 108-109).

If we conclude that students need space and crowding is bad, it is our job as school planners and designers to provide an equation for architects and decision makers. This issue may be viewed through the psychological

implications from the study of territoriality of place according to Banghart and Trull (1973). We know that the student is always dependent on the environment for psychological and sociological clues. The student is always interacting with the physical environment. Since the school is a social system within the cultural environment, we may consider social distance as a means for calculating minimum size of the classroom. The lower middle range for social distance in man and woman is 7 feet (Banghart & Trull, 1973, p. 233). With this guideline of social distance we can develop a chart that provides a guide for design and planning. The square footage shown in Tables 1 is not measured in terms of architectural or gross square feet, but the actual number of square feet or meters needed by the student within the bounds of the indoor classroom. The calculations for elementary school students were determined according to social distance research findings by using the factor of 49 square feet per person (The lower middle range). Larger students, according to the social distance concept require 64 square feet (The upper limit of the middle range for social distance). Table 1 also reveals the minimum standard according to social distance research for upper school students.

Table 1
A Minimum Standard for Classroom Size

Number of Students plus 1 Teacher	**Elementary School [Square Feet (Meters)]**	**Secondary School [Square Feet (Meters)]**
10	539 (50.13)	704 (65.47)
11	564 (52.45)	768 (71.42)
12	637 (59.24)	832 (77.38)
13	686 (63.80)	896 (83.33)
14	735 (68.36)	960 (89.28)
15	784 (72.91)	1024 (95.23)
16	833 (77.47)	1088 (101.18)
17	882 (82.03)	1152 (107.14)
18	931 (86.58)	1216 (113.09)
19	980 (91.14)	1280 (119.04)
20	1029 (95.70)	1344 (124.99)

With the trend toward smaller classes we should consider social distance as a major factor and adjust the size of classes accordingly. For example, the recommended size of the elementary school classroom in the United States is approximately 900 Square feet. If state policy allows 20 students per teacher, then with social distance as a guide, we expect to find a 1029 square feet per classroom (a deficit of 129 square feet by current standards). Unfortunately these findings regarding social distance (from the field of psychology) come in conflict with educational policy of 20 plus students per classroom in most schools (The classrooms are too small and the result is high density). From the above chart, I can conclude that no more than 17 students per average classroom is the correct number for elementary schools. This straightforward research-based calculation is also supported by the well publicized work of Achilles, Finn, and Bain (1998). The average class size for secondary schools is 1024 square feet and should house approximately 14 - 15 students.

These findings have strong implications for government policy. If smaller is better, then fewer students per existing classroom is the answer. We cannot simply put smaller classes in smaller spaces by dividing the spaces we already have. Such action will compound the density problem by having more students in less space. This is not educationally or psychologically sound.

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Revised Findings and Conclusions:

It is one of the great advantages of the Internet that I am able to review my previous work and adjust the findings and conclusions based on reflective thinking and perhaps some common sense. To this end, I suggest that the reader examine the social distance issue with the formula Area = (pi) x (r squared). [The ratio of a circle's circumference to its diameter is pi or 3.14159 units].

Here we are concerned with "how much space does it take for people to be comfortable;" notwithstanding, there are many cultural differences to be considered in these rough calculations.

If the extent of social distance for interactions among acquaintances is an average of seven (7) feet, with a range of from 4 to 12 feet, then consider developing a chart with the minimum, average and maximum distances as a guide to planning space for interactions in classrooms.
For one person the calculations are:

Four feet: A = 3.14159 times 4 (squared) = 50.265 square feet.
Seven Feet: A = 3.14159 times 7 (squared) = 153. 938 square feet.
12 feet: A = 3.14159 times 12 (squared) = 452.389 square feet.

Now weigh these calculations with the reality of building a facility for social interaction. The issue is not as straightforward as I indicated in 2000.

Further, let's examine the issue with other definitions for "distance" as a guideline. Personal distance in Caucasian culture is 1.5 feet to 2.5 feet to 4 feet. You can do the calculations. What we have here to quote "Cool Hand Luke, 1977" is "failure to communicate" how much learning is accomplished within boundaries defined as intimate distance, personal distance, social distance, or public distance.

What we may comfortably conclude is that ***no one has completed definitive research on the relationship of distance among students and the amount of learning that takes place in defined spaces.*** One thing is for certain, crowding is a negative factor for student outcomes.

I have added two references by Sommer *, and Tanner and Lackney **(see Chapter 4).

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