Calculating School Capacity
for next generation learners

originally presented 10.06.07
updated: 10.28.17
(finally!)

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Association for Learning Environments
workshop agenda

1. Introductions
   ▪ who & why
   ▪ learning objectives

2. The Basics
   ▪ terminology
   ▪ variables
   ▪ example calculations

3. New Ideas for a New Generation
   ▪ adjusted variables
   ▪ new approaches
   ▪ examples

4. Story Time (Q/A)
   ▪ sharing ideas, questions, lessons learned
Introductions

why we’re here, why you’re here

BrainSpaces
Architects & Educators
Brain-Based Learning & Environments
Collaborating with Clients around the world
Internationally Recognized for Holistic Design
Award-winning schools
Why Calculate Capacity?

- to enroll the right number of students in a school facility
  
  or conversely

- to plan a school facility that is the right size for its intended enrollment

• School construction funding
• Maximize educational resources
• Accommodate enrollments
• Overcrowding & underutilization
• Adjust Attendance Boundaries
• others?
Learning Objectives:

■ to understand conventions and terminology used by local and state guidelines

■ to see what it takes to plan a school facility that is the right size for its intended enrollment

■ to see what characteristics of next generation learning are transforming how school capacities should be calculated
The number of learners that can be reasonably accommodated by a school, building, and site.

- Physical variables
- Operational variables
- Programmatic variables
Capacity Variables

- physical variables can include:
  - building size/area
  - number/types of spaces for learning
  - support facilities (kitchen, lunchroom, restrooms, etc.)
  - infrastructure (power, systems, security, etc.)
  - net vs gross areas
  - building & life-safety codes
  - site amenities (parking, drop-offs, bus area, play areas, etc.)
Capacity Variables

- operational variables can include:
  - utilization rates & efficiency
  - operational policies
  - staffing
  - funding structures
  - teacher/union regulations
  - space management
  - staff & operational budgets
  - specialty program offerings
Capacity Variables

- Programmatic variables can include:
  - Class sizes & staff ratios
  - Educational program offerings
  - Operational models (teams, academies, etc.)
  - Specialty programs
  - Schedules
  - Partnerships, off-site learning, etc.
  - Extended use
A Spectrum of Definitions

- **Maximum Capacity**
  The total number of student “seats” in the school facility.

- **Building Capacity**
  Also considers the extent of support facilities.

- **Functional Capacity**
  Also considers the desired level of schedule flexibility.

- **Program Capacity**
  Also considers demographics, curriculum & program offerings.

- **Temporary Capacity**
  Also considers temporary and make-shift facilities.
Example: Maximum Capacity

- considers
  - total student "seats"
  - largely hypothetical - difficult/impossible to operate in a traditional school setting

In this example:
- 25 students each
- used 8 of 8 periods
- = 100% utilization
- = 400 students/day

25 students x 2 rooms = 50 students at a time

50 students x 8 periods = 400 students per day
Building Capacity

considers

- total student “seats”
- support facilities

Clark Middle School, Anchorage, McCool Carlson Green Architects + BrainSpaces

400

+/-350

such as:
- systems
- circulation
- toilets
- dining
- commons
- offices
- etc…

kitchen
dining
restrooms
commons
office & student services
circulation
Functional Capacity

considers:

- total student “seats”
- support facilities
- schedule flexibility

In this example:

25 students each used 6 of 8 periods = 75% utilization = 300 students/day

25 students x 2 rooms = 50 students at a time
50 students x 6 periods = 300 students per day

Bold Text = Variables to be determined for each project’s specific parameters
**Program Capacity**

- **Considers**
  - Total student “seats”
  - Support facilities
  - Schedule flexibility
  - Student needs / demographics
  - Curriculum & program offerings

**In this Example:**
- 25 students regular
- 15 students small
- Used 6 of 8 periods

= 75% utilization
= 240 students/day

**Bold Text** = Variables to be determined for each project’s specific parameters

- **25** students x 1 room = 25 students at a time
- **15** students x 1 room = 15 students at a time

**40** students x **6** periods = **240** students per day
Room Capacity

Classroom Size VS Class Size

- number of students
- size of classroom
- furniture & equipment
- classroom activities
- desired flexibility
Room Capacity

Classroom Size VS Class Size

- number of students
- size of classroom
- furniture & equipment
- classroom activities
- desired flexibility
Room Capacity

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- number of students
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- desired flexibility
Room Capacity

Classroom VS Class Size

- number of students
- size of classroom
- furniture & equipment
- classroom activities
- desired flexibility

\[
\frac{875 \text{ sf classroom}}{35 \text{ sf}} = 25 \text{ students}
\]
Room Capacity

Classroom VS Class Size

- number of students
- size of classroom
- furniture & equipment
- classroom activities
- desired flexibility

35 sf

700 sf classroom ÷ 35 sf = 20 students
Room Capacity

Classroom VS Class Size

- number of students
- size of classroom
- furniture & equipment
- classroom activities
- desired flexibility

700 sf classroom ÷ 25 students = 28 sf
Utilization

A) The educationally appropriate percentage of the school day that teaching stations can be used for instruction.

B) The ratio of unoccupied to occupied “seats” per teaching station per period.
Utilization: Seats

- class size & “seat” utilization

For example:

25:25 = 100%

Note: the number of “seats” and the actual class size don’t often match.
Utilization: Seats

- Class size & “seat” utilization

For example:

- 30:25 = 120%
- 18:25 = 75%

Note: the number of “seats” and the average class size don’t often match.

Calculations are rounded for clarity.
# Utilization: Time

## Rules of Thumb

<table>
<thead>
<tr>
<th>School Type</th>
<th>avg. utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>90-100%</td>
</tr>
<tr>
<td>Middle/Jr. High</td>
<td>65-85%</td>
</tr>
<tr>
<td>High</td>
<td>75-95%</td>
</tr>
</tbody>
</table>

- Higher utilization usually equals tighter scheduling.

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**SPACES**

Calculating School Capacity for a New Generation of Learners  |  A4LE  |  10.28.17
## Teaching Stations

what counts in utilization calcs?

<table>
<thead>
<tr>
<th>School Type</th>
<th>what counts?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elementary</strong></td>
<td>classrooms</td>
</tr>
<tr>
<td><strong>Middle</strong></td>
<td>classrooms, science rooms, gymnasium (x1)</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>classrooms, science rooms, art &amp; music, media center, auditorium/stage, computer labs</td>
</tr>
<tr>
<td></td>
<td>special education, media center, computer labs</td>
</tr>
<tr>
<td></td>
<td>gyms (x2)</td>
</tr>
<tr>
<td></td>
<td>vocational programs</td>
</tr>
<tr>
<td></td>
<td>etc…</td>
</tr>
<tr>
<td></td>
<td>pe fields (depending on climate)</td>
</tr>
<tr>
<td></td>
<td>etc…</td>
</tr>
</tbody>
</table>
### Utilization: Time

**Example: Middle vs Junior High Schools**

#### Variables in this example:
- Class size
- Schedule
- Utilization

<table>
<thead>
<tr>
<th></th>
<th>Middle School</th>
<th>Junior High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Stations</strong></td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Class Size</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Periods/day</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Teacher prep</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Team Planning</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Periods of Instruction</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Utilization Rate</td>
<td>71%</td>
<td>86%</td>
</tr>
<tr>
<td><strong>Student Capacity</strong></td>
<td><strong>712</strong></td>
<td><strong>860</strong></td>
</tr>
</tbody>
</table>

**difference = 148 students**
### Variable Utilization: Time

#### Example: Middle vs Junior High Schools

<table>
<thead>
<tr>
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<th>Junior High</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
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**Student Capacity**
Utilization

Example: Middle vs Junior High Schools

Variables in this example:
- Class size
- Schedule
- Utilization

<table>
<thead>
<tr>
<th></th>
<th>Middle School</th>
<th>Junior High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student Capacity</strong></td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td><strong>Class Size</strong></td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Periods/day</strong></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td><strong>Teacher prep</strong></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Team Planning</strong></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Periods of Instruction</strong></td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>Utilization Rate</strong></td>
<td>71%</td>
<td>86%</td>
</tr>
<tr>
<td><strong>Teaching Stations</strong></td>
<td>45</td>
<td>37</td>
</tr>
</tbody>
</table>

difference = 8 teaching stations
### Teaching Stations

#### Average Class Size (Number of Learners)

<table>
<thead>
<tr>
<th>School Type</th>
<th>Class Sizes</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>10-25</td>
<td>little variety</td>
</tr>
<tr>
<td>Middle</td>
<td>15-35</td>
<td>some variety</td>
</tr>
<tr>
<td>High</td>
<td>5-50</td>
<td>much variety</td>
</tr>
</tbody>
</table>
# Teaching Stations

### Average Classroom Size (Traditional)

<table>
<thead>
<tr>
<th>School Type</th>
<th>Class Sizes:</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>800-1,200</td>
<td>Little variety</td>
</tr>
<tr>
<td>Middle</td>
<td>400-900</td>
<td>Some variety</td>
</tr>
<tr>
<td>High</td>
<td>200-2,000</td>
<td>Much variety</td>
</tr>
</tbody>
</table>

**Space Size Basic Considerations:**

1. # learners, # adults
2. Intended activities
3. Equipment & furniture
### Example Calculations

**Comparison of Facilities for Science**

**Case “A”**
- 3,200sf (2 rooms + prep)
- for 50 students
- = 56 sf/student

**Case “B”**
- 2,600sf (2 rooms + prep)
- for 50 students
- = 52 sf/student

**Size Difference**

$$\text{size difference} = 800\text{sf or } 16\text{ sf/student}$$
Example Calculations

Comparison of facilities for science

Case “A”
say 25 students each
used 6 of 8 periods
= 75% utilization
= 300 students/day

main difference = area (SqFt)

Case “B”
say 25 students each
used 6 of 8 periods
= 75% utilization
= 300 students/day
Example Calculations

- Comparison of facilities for science

Case “C”

- Say 75 students total
- Used 8 of 8 periods
- 100% utilization
- 600 students/day

4,000 sf

Diagram:

- Small Group
- Prep Room
- Faculty Office
- Large Group (2 classes)
- Learning Studio
- Outdoor Classroom
- Tinkering Lab
Example Calculations

Comparison of facilities for science

Traditional Facilities for Science & Commonly Used Capacity Calcs.

Case A:
200 Students
25 per Classroom
80% Utilization
Need 10 Classrooms
16,000 sf total
(excluding teacher offices & small group / resource rooms)

Case B:
200 Students
25 per Classroom
80% Utilization
Need 10 Classrooms
13,000 sf total
(excluding teacher offices & small group / resource rooms)

Case C:
200 Students
75 per Suite
100% Utilization
Need 3 Suites
12,000 sf total
(all inclusive)
Example Calculations

- Comparison of square-footages

Need 10 Classrooms
about 16,000 sf total

Need 10 Classrooms
about 13,000 sf total

Need 3 Suites
about 12,000 sf total
Calculations: Traditional

Capacity, Teachers, & Utilization

200

200 ÷ 80% = 250 “seats” needed

250 ÷ 25 = 10 “classrooms” needed

200 ÷ 25 = 8 classrooms in use per period

8 ÷ .75 = 11 “teachers”
Calculations: New Capacity, Teachers, & Utilization

200 @ 100% = 200 “seats” needed
200 ÷ 5 to 50 = Variety of spaces needed
Variety of Uses = Variety spaces used
Space for = 10-15 “teachers” ★
### Analysis of Existing Use

Understanding current practices so you can “defrag” use of existing facilities

| RM# | Use               | Use P1 | Use P2 | Use P3 | Use P4 | Use P5 | Use P6 | Use P7 | Use P8 | Prepl | Comp |
|-----|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|------|------|
| 111 | English           | 25     | 23     |        | 26     | 30     | prep   | 19     | 25     | 0.97  | 0.83 | 0.77 |
| 177 | English           | 30     | 24     |        | 24     | 28     | 18     | prep   | 26     | 1.06  | 0.81 | 0.73 |
| 201 | English/Drama     | 28     | prep   |        | 21     | 28     | 30     | 28     | 28     | 0.83  | 0.81 | 0.77 |
| 211 | English           | prep   | 30     |        | 28     | 24     | 30     | 22     | 28     | 0.81  | 0.73 | 0.73 |
| 230 | English           | 24     | 22     |        | 20     | prep   | 23     | 24     | 30     | 0.81  | 0.81 | 0.81 |
| 241 | English           | prep   | 28     |        | 24     | 22     | 24     | 20     | 28     | 0.81  | 0.81 | 0.81 |
| 244 | English           | 30     | 30     |        | 23     | 30     | OPEN   | 25     | prep   | 0.81  | 0.81 | 0.81 |
| 246 | English/Resource  | 20     | 15     |        | 12     | 18     | 12     | 18     | 15     | 1.05  |      |      |
| 248 | English/AP        | 23     | 21     |        | prep   | 22     | 28     | 23     | 28     | 0.74  |      |      |
| 249 | English           | 22     | 30     |        | 26     | 30     | prep   | 27     | 30     | 0.81  |      |      |

Traditional 8-Period Day
### National Trends

for the median school district in the US

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>70</td>
<td>90</td>
<td>120</td>
<td>149</td>
<td>188</td>
<td>135</td>
</tr>
<tr>
<td>Middle</td>
<td>70</td>
<td>111</td>
<td>146</td>
<td>173</td>
<td>173</td>
<td>180</td>
</tr>
<tr>
<td>High</td>
<td>120</td>
<td>153</td>
<td>163</td>
<td>174</td>
<td>180</td>
<td>182</td>
</tr>
</tbody>
</table>

Source: School Planning & Management, Annual New School Construction Reports
Calculations

Gross Building Area - What Counts?

- lockers?
- dining/kitchen facilities?
- overhangs & canopies?
- vertical circulation?
- toilet facilities (specific to program)?
- exterior walls - to inside or outside face of wall?
Public High School Principals Report

Those schools that principals described as overcrowded used a variety of approaches to deal with the overcrowding:

- using portable classrooms (78%)
- converting non-classroom space into classrooms (53%)
- increasing class sizes (44%)
- building new buildings or additions (35%)
- using off-site instructional facilities (5%)
- or other approaches (12%).

Strategies for Increasing Capacity

- Scheduling (daily & annual)
- Space Utilization
- Multiple-Use Facilities
- Off-Site & Joint-Use Facilities
- Reassignment of spaces
- Blended, On-line & Virtual Learning
- others?
Calculating School Capacity for a New Generation of Learners

### Calendar & Schedule

<table>
<thead>
<tr>
<th>TRADITIONAL</th>
<th>600 students</th>
<th>Traditional BREAK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEP</strong></td>
<td><strong>OCT</strong></td>
<td><strong>NOV</strong></td>
</tr>
<tr>
<td><strong>DEC</strong></td>
<td><strong>JAN</strong></td>
<td><strong>FEB</strong></td>
</tr>
<tr>
<td><strong>MAR</strong></td>
<td><strong>APR</strong></td>
<td><strong>MAY</strong></td>
</tr>
<tr>
<td><strong>JUN</strong></td>
<td><strong>JUL</strong></td>
<td><strong>AUG</strong></td>
</tr>
</tbody>
</table>

**Does Not Add Capacity**

<table>
<thead>
<tr>
<th>SINGLE-TRACK</th>
<th>600 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINI BREAK</td>
<td>MINI BREAK</td>
</tr>
<tr>
<td>MINI BREAK</td>
<td>MINI BREAK</td>
</tr>
</tbody>
</table>

**Adds Capacity**

<table>
<thead>
<tr>
<th>MULTI-TRACK</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track A – 200 students</td>
<td></td>
</tr>
<tr>
<td>Track B – 200 students</td>
<td></td>
</tr>
<tr>
<td>Track C – 200 students</td>
<td></td>
</tr>
<tr>
<td>Track D – 200 students</td>
<td></td>
</tr>
</tbody>
</table>

---

Assumptions for this example:

1) school buildings can accommodate 600 students at one time, 2) school facilities can support full-capacity increases, 3) a 60/20 calendar is used, 4) multi-track schedules include common winter and summer mini-breaks.

Strategies for Increasing Capacity

- Multiple-Use Facilities

Example: a cafeteria space that can be transformed into a theater.

South Anchorage High School: Perkins+Will and ECI Hyer
Strategies for Increasing Capacity

- Multiple-Use Facilities

Example: a cafeteria space that can be transformed into a theater
Strategies for Increasing Capacity

- Multiple-Use Facilities

Example: a dining space that serves as classroom break-out spaces during the rest of the day.
Strategies for Increasing Capacity

- Joint Use or Off-Site Facilities

Example: using community facilities as learning environments

SAMI, iDEA and SOTA, Tacoma Public Schools
Strategies for Increasing Capacity

- Joint Use or Off-Site Facilities

SAMI, iDEA and SOTA, Tacoma Public Schools
Strategies for Increasing Capacity

- Off-Site & Blended Learning

Example: a school that has enough “seats” for roughly half of the students enrolled – the other half of its students learn off campus.

School for the Physical City, New York, NY, Rothzeid Kaiserman Thomson & Bee
Strategies for Increasing Capacity

- Multi-Use Spaces

Example: a school lobby area that can be used as a mini-theater or large group instruction.
Strategies for Increasing Capacity

- Reassignment of Spaces

Example: existing spaces used for a variety of activities and groupings – lead to design of new facilities that recognize needs for space other than “classrooms” (see next slide)

Existing Alternative School, Central Kitsap SD
Strategies for Increasing Capacity

Reassignment of Spaces

Barker Creek School, Central Kitsap SD
Strategies for Increasing Capacity

- Faculty/Staff Support

Example: a “think-tank” for teachers to use while planning and prep – might be modeled after a frequent flier lounge (without the bar!)

United Club concept
Strategies for Increasing Capacity

- Faculty
Strategies for Increasing Capacity

- Alternative Settings

Example:
A large stairway that also serves as a presentation / lecture hall and gathering space.
Strategies for Increasing Capacity

Alternative Settings: Roof Plaza

Example: a library that extends its reading room out onto the adjacent (green) roof.
Strategies for Increasing Capacity

Alternative Settings: Roof Plaza

Example: a library that extends its reading room out onto the adjacent (green) roof.
Strategies for Increasing Capacity

- Alternative Settings

Example: an outdoor space that can be used for school and community events, movies, and presentations.
Strategies for Increasing Capacity

- Technology / Virtual Reality Settings

Example: students experiencing virtual environments
Calculating School Capacity for a New Generation of Learners

**Recommendations**

For national, state & local guidelines

- **Use Net Building Area**
- **Consider State-wide specifics**
- **Include District-wide practices**
- **Account for Specific Programs**
Recommendations
For national, state & local guidelines

and always:

Plan for the Future

- “Flex” spaces that can support programs not yet defined
- Divide spaces in ways that may be easily changed
- Nurture community relationships where learning can extend beyond the school walls and bell schedule.
- Be prepared to use technology to not only enhance teaching and learning, but to also redefine “where” they take place.
Calculating School Capacity for next generation learners

how will you redefine learner capacity in your schools?

presented by:
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Association for Learning Environments