Imagining Science Communities

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Project Kaleidoscope is dedicated to teaching science, so it should be no surprise that PKAL advocates the application of current empirical findings about learning to both 1) Science Technology Engineering and Math (STEM) pedagogy, and 2) the spaces that support STEM fields. It seems that we have taken a reflective step back to ask "just what do we know about the nature of humans that can inform post secondary (and STEM) education?" One part of the answer properly leads us to characterize humans as *information processors*. Thus, we recognize the centrality of cognitive science as an archive for the neurological and cognitive processes that support learning and memory.

A second answer to the question about human character is that humans are also *social animals* who typically work, play, and learn in groups. The influence of social data on PKAL principles is apparent in discussions of community and informal learning.

Colleges are enduring a time of dwindling resources paired with a preoccupation with outcomes assessment. We should expect little institutional tolerance for expensive exercises in architectural fashion or whimsical experiments in the design of spaces. On the contrary, efficiency, not fashion, demands that we avoid a false prejudice that devalues the social/emotional/aesthetic contexts in which learning processes occur.

"Social" should not be confused with "superfluous socializing," and "aesthetics and emotion" are not synonymous with "trivial fashion." We must acknowledge that some of the most important kinds of learning occur in social situations and then examine some of the characteristics of spaces that are likely to support alternative learning opportunities.

Strange and Banning (2001) recognize the importance of the social context of learning in college environments, as articulated in their discussion of community (p.160).

> "The concept of community contains all of the essential features associated with effective educational environments, as unifying purposes and values, traditions and symbols of belonging and involvement, and mutuality of care. Support and responsibility create a synergy of participation and worth, checking and cross-checking, to create a positive human learning environment."

This description paints a comforting picture of engaged students and faculty working in a heady atmosphere of belonging. Not *just* belonging, of course, but membership in a deeply interconnected organization with a shared thirst for ideas and discovery. Before becoming totally seduced by this fond image, we should examine the term more formally. Kenney, Dumont, & Kenny (2005) remind us that "…community can mean many things." (p. 47). If we speak of the "student community" or even the "university community" we are usually referring just to role membership— those people who are recognized members of the group that consists of students, or, in the second case, students, faculty, staff, and administrators.

On the other hand, when we talk about "sense of community" or "fostering community" we also imagine a positive emotional or affective component. "Community," in this sense, connotes caring, interaction, respect, and shared identity, not mere classification.

Positive emotional tone is easy to support, but do positive emotions maximize science learning and discovery? Is it possible to imagine an environment in which the load of social encounters and their byproducts, like noise and distraction, undermine learning? Is it possible to have spaces that are too social? If so, there can be too much socializing, but can there also be *too much* community?

Communities are more than mere groups— a group is a necessary, but not sufficient precursor to community. Nevertheless, one function of community spaces is to encourage people to behave in groups. When individuals are physically close to each other, share similar roles, or share a cognitive or emotional bond, they are more likely to take collective action.

So, at a fairly mundane level, what are some of the advantages or disadvantages of people behaving in groups? These questions have long been central to behavioral scientists such as social psychologists, and to the applied fields of organizational behavior and organizational psychology. I'll oversimplify by only briefly examining three somewhat different concepts: *social facilitation*, *group processes*, and *social learning*.

Groups or Communities?

Social facilitation is one of the oldest concepts within empirically-oriented psychology (e.g. Triplett, 1898). Within limits, people perform better in the presence of others than alone.

Performance increments may result from a heightened level of arousal and sense of purpose in the presence of others. At an extreme we may ascribe some of these effects to "competition," but the phenomenon also occurs in much more cooperative situations. We want to be at our best amongst others, particularly those we like, respect, or (sadly) are intimidated by.

Facilitation may also occur because people choose positive social situations and are more alert and engaged. Yet, as in most things, the presence of others can be overdone, as exemplified by stage fright and performance anxiety.

Technically, social facilitation occurs when the net advantages of the presence of others are not outweighed by the potential disadvantages, but even moderate social anxiety may have benefits if it inoculates students against debilitating fear of the inevitable formal presentation or the tough questions we all encounter in "life as a group project."

Social facilitation requires others, but not necessarily a "community." Beyond the advantages of the mere presence of others, we are stimulated by the interchange of ideas. Standard examinations of creative problem solving emphasize the importance of generating both a variety of unique solutions, and imposing some evaluation that confirms that solutions are of good *quality*.

Yes, groups benefit from the additive advantages of the more complete survey of relevant information residing in the experience of individual members, but these *additive* effects don't actually require group membership, let alone a real community— the information could be gathered from a clerical exercise.

Dyads or groups really come into their own in those wonderfully generative situations when one person's thoughts prompt another person to identify a new idea that would have remained unknown to either in isolation. Exchanges are most promising when people take risks in an atmosphere of mutual trust and support.

Unfortunately, as any instructor who assigns group projects knows, groups create their own "load" of distractions, digressions, and potentially stifling social pressures.

Real communities are inclusive rather than exclusive; they encourage participation by dissimilar others as well as those we are most like. More than groups, more than friendship circles, communities can capitalize on the generative effects of groups while avoiding "groupthink" and other penalties of social censure.

Finally, *social learning* (modeling) occurs when we learn by watching someone else perform a task. Not all models are equal, however. We learn best by observing a model we respect— people seen as competent and knowledgeable. Learning is better still if that person is also roughly similar to us, a person we can hope to emulate.

Of course there are plenty of competent and knowledgeable instructors who perform demonstrations in front of a class— a situation for social learning. There may even be many instances when lectures are efficient, but a formal classroom has little to do with community.

On the other hand, mentoring and coaching are promoted when barriers are lowered, trust is fostered, and risks are taken. These conditions have always existed for some selected individuals, but they become more common when the expectation is that students, faculty, and interested others share productive, but unstructured time and space.

In sum community implies more than just group membership. In particular, a *sense of community* adds personal identification and a positive emotional tone to mere role or group membership. Usually a sense of community maximizes the benefits of groups, while minimizing their negative effects. One exception to this generalization might appear in the case of "groupthink," the familiar social pathology that occurs when cohesive groups stifle dissent in problem solving (e.g. Janis, 1972).

In the example of STEM facilities, there is no profit in creating an insular "club" that distrusts non scientists or cavalierly belittles non scientific disciplines or ideas because a real community is not so much cohesive as tolerant. Science needs to take its place as part of the political and social fabric of the campus community and, as PKAL clearly states among its goals, we need to make science visible.

To avoid insularity, and to embrace the community broadly defined, we need to deliberately extend the boundaries of the community to include more than science students, more than science faculty, even more than the university community.

Community Spaces

The distinction is artificial, but this discussion will assume that spaces that support important social behavior are not necessarily *community* spaces. For instance, an instructor's office may provide valuable space for tutorials and the almost magical atmosphere of a creative conversation. Similarly positive social interactions occur in classrooms, elevators, even restrooms. Yes, the social function of even these spaces may be accentuated by good planning, and they *are* important, but their primary design requirements—the uses that necessarily shape their programs— lie outside of this brief review.

Sadly, however, superficial efficiency has resulted in many STEM buildings with virtually *no* planned areas that we can properly label "community spaces." Blindly maximizing the funds available for "useful" laboratories, classrooms, and offices, leaves little room for community areas. Community behaviors are too important to be accidental treasures appropriated from passageways and "wasted" corners.

A custom built system as complex as a laboratory building is bound to have small mechanical or structural surprises, but a good designer and a careful process can enclose spaces that are large enough, warm enough, and durable enough to meet the owner's requirements. If only we could be as confident about our ability to control the activities of the humans inside!

The function of architecture in shaping behavior is barely probabilistic and certainly not deterministic. One need not be a designer to recognize "ugly" spaces that somehow support a vibrant social atmosphere or superficially impressive buildings that are unloved and empty.

For a time one of the most vital spaces in one science complex was officially a sedimentology laboratory, fit sloppily in a space that didn't try to hide its previous life as an auto shop. No designer would plan the "wasted" excess space or the industrial balcony pined across one wall, and no registrar would have approved leaving so much square footage unscheduled.

The bay was big enough for students to drag in an appropriated couch, and a microwave appeared on a countertop. The place was unkempt enough that the faculty didn't care. For a wonderful, accidental, and too brief time, the sedimentology lab became the "department hearth." Then, sadly, the space again became "useful."

Designers must be frustrated when carefully planned rooms fall short of their promise, and bemused when places succeed in spite of apparent design flaws. Surprises will occur when the patterns of behaviors that evolve in a space differ from those anticipated in design.

Decades ago Roger Barker (1968) coined the term "behavior setting" to describe the molar physical/spatial choreography of a space. Over time, Barker noted, the physical milieu and standing patterns of behavior interact to form relatively stable behavior settings. In a small town the corner café, a high school basketball game, or a chemistry classroom begin to show time-bound and repeating patterns of behavior that are largely independent of any individual person.

Many of the most successful behavior settings evolve through a dialog of mutual influence and change as spaces are modified and people learn effective ways to use them. In his aptly titled classic *How Buildings Learn: What Happens After They're Built* (1994), Stewart Brand reminds us that the most adaptable spaces are often the "low road" buildings that enclose space generously, but cheaply. Like the sedimentology lab, they will be durable, but not too fine and elegant to change.

Although design is fallible, and even bad buildings can evolve, the most effective academic communities will result when people are drawn together in spaces explicitly programmed to promote *positive affect*, foster *secondary territory*, and preserve opportunities for *adaptation*.

Restated, a sense of community is most likely to evolve when individuals experience positive emotions in the presence of others, when interactions are frequent and there is a shared identification with a space, and when the spaces can be easily adapted or modified.

A sensitive designer recognizes that too small spaces constrain community, but that opportunities are also lost to the indifference of cavernous space. An understanding of potential traffic patterns, intentional concentration of individuals in seating areas, or the inclusion of "activity generators" such as food services or information kiosks can help create the "critical mass" that *may* allow for meaningful interactions.

Propinquity (physical adjacency) can define group boundaries, but it says little about the emotional tone of the ensuing interactions. We do know important places to look for contexts that support positive affect. Factor analysis shows that the emotional tone of an environment is largely described by two dimensions: *pleasantness and arousal* (Russell, Ward & Pratt, 1981).

Pleasantness is not beyond empirical investigation, but the roots are complex and at least partially determined by idiosyncratic taste and instable fashion, so it may be more efficient to rely on the professional sensibilities of designers and decorators. Perhaps the arousal continuum is more easily documented and a more useful focus for lay collaborators. It is possible to explicitly plan the level of arousal and activity for each community space.

The task is not to seek one optimum, but to provide a spectrum of choice ranging from extremely active spaces to those conducive to conversation or study. The short form of the Russell et al. scale (1981) is easily scored and provides a convenient and efficient tool for characterizing almost any space, including projections of the character of spaces under design.

When spaces are familiar, and especially when they are pleasant, they may be adopted as territories. Americans have an uneasy understanding of the word "territory," an understanding that is at least slightly pejorative.

Irwin Altman noted that there are two components to territory: defense (the first dimension and the one usually acknowledged by laypersons), and personalization or presentation of self (or community). In the second sense, things that facilitate the establishment of territory provide for the physical manifestation of "*...unifying purposes and values, traditions and symbols of belonging and involvement, and mutuality of care...*" which are central components of community. (Strange and Banning, 2001).

Insensitive use of territory, rather than territory itself, is antithetical to the goal of a scientific community. We should discourage individuals from hoarding resources for exclusive fiefdoms. These are inefficient uses of resources in the short term, and shortsighted because they are expensive to renovate as curricula or personnel inevitably change.

On the other hand, a sense of community is conveyed and fostered by *mutual* psychological ownership, not the lack of it. Truly unowned spaces are cold, impersonal, and poorly cared for (refer to the concept of *defensible space*, a focus of the late Oscar Newman). The interdependence and community we seek will be manifest in observable, non-exclusive, territorial behavior.

Planned support for territory is revealed by hardware to present posters of student and faculty work, cases for display of old scientific instruments, and movable furniture that is allowed to settle in familiar, but slightly dynamic conversational formations.

Less formal, but persuasive illustrations include things like a small alcove adopted every Thursday by an informal seminar, a bright illustration of the solar system painted down a hallway by physics students, or a regular noontime Frisbee toss in a courtyard.

All of these artifacts manifest a vital community. Some reflect design insights; some reflect intentional or evolved program choices. Some may even be fortuitous accidents. We should like to take advantage of the latter, and allow our growing understanding of a behavior setting to inform its evolution.

Adaptability is the great safety net. Even the most careful design will result in oversights, and optimal space for this generation may work poorly for the next. Just as laboratories and classrooms need to be planned for the next generations of faculty and students, community spaces need to be able to respond to changing requirements with agility, so they should be planned for change.

Imagining Community

Spaces that foster a sense of community can only evolve when they are predicated on a program that demands them. If we give ourselves permission to imagine the warmth, support, and creativity that flourish in a functioning community, we settle on images— a palette of spaces that have been part of our own transforming social experiences. Design professionals and educators share these memories, and the spaces will appear when we give ourselves permission to imagine them.

In the end the most important choice is the first one— a choice to insist that community spaces deserve the same attention and priority as laboratories and lecture halls. So often overlooked, planned community spaces promise to elevate the instructional climate and dramatically accelerate educational dividends. ■

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