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Designing for competence: spaces that enhance collaboration readiness in healthcare

Gerri Lamb[1,2] and James Shraiky[2]

[1]College of Nursing and Health Innovation, Arizona State University, Phoenix, USA and [2]The Design School, Arizona State University, Tempe, USA

Abstract

Many universities in the United States are investing in classrooms and campuses designed to increase collaboration and teamwork among the health professions. To date, we know little about whether these learning spaces are having the intended impact on student performance. Recent advances in the identification of interprofessional teamwork competencies provide a much-needed step toward a defined outcome metric. Rigorous study of the relationship between design and student competence in collaboration also requires clear specification of design concepts and development of testable frameworks. Such theory-based evaluation is crucial for design to become an integral part of interprofessional education strategies and initiatives. Current classroom and campus designs were analyzed for common themes and features in collaborative spaces as a starting place for specification of design concepts and model development. Four major themes were identified: flexibility, visual transparency/proximity, technology and environmental infrastructure. Potential models linking this preliminary set of design concepts to student competencies are proposed and used to generate hypotheses for future study of the impact of collaborative design spaces on student outcomes.

Keywords

Collaboration, competence, design, healthcare

History

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Introduction

After a long hiatus, the United States has rediscovered and embraced interprofessional education (IPE) to drive its quality and safety agenda and to accelerate innovation in healthcare. The focus on interprofessional education in healthcare is part of a larger movement in the United States and internationally to harness the power of cross-disciplinary thinking and collaboration to solve complex social problems and to improve the health and economic well-being of communities and nations (Brown, Harris, & Russell, 2010; Johansson, 2004). Research findings increasingly show that interprofessional communication and collaboration positively impact healthcare outcomes and costs (Lemieux-Charles & McGuire, 2006; Meads & Ashcroft, 2005; Zwarenstein, Goldman, & Reeves, 2009). As a result, academic programs in medicine, nursing and other health professions are expected to educate their students together to prepare them for effective teamwork and collaborative decision making in clinical practice.

As faculty develop and implement IPE, there is considerable interest in learning how to build a strong and sustainable infrastructure to support these programs. There is active discussion of common issues such as university leadership and governance, faculty development, curriculum design and establishing connections between classroom and clinical learning. New guides to IPE, such as the recently disseminated competency statements for teamwork and collaboration, are eagerly embraced and quickly integrated into IPE grant requirements and curriculum design.

Correspondence: Gerri Lamb, PhD, College of Nursing and Health Innovation, Arizona State University, Phoenix, USA. E-mail: gerri.lamb@asu.edu

More recently, faculty and university administrators have begun to explore the role that physical design of classrooms and academic health centers play in enhancing interprofessional exchange and collaboration. A number of universities in the United States have invested in extensive redesign of their classrooms and campuses to encourage interaction and problem-solving among students of medicine, nursing and other health professions. To date, however, physical design has not been a central feature of IPE dialogue, nor do we know much about how it delivers on expectations or cost.

In this article, we propose steps that we believe are needed for design to become an active and meaningful part of the national IPE agenda. In the first part of the article, we provide a brief overview of the national context for IPE and make the case for using national competency statements in teamwork and collaboration as a promising benchmark for design outcomes. Next, we demonstrate how systematic analysis of current classroom and campus designs may be used to identify important collaborative design features that may be measured and evaluated. Finally, we pose some beginning theoretical frameworks that link design concepts to competence in collaboration in teamwork.

Collaboration and teamwork in healthcare

Support for interprofessional education (IPE) is not new in healthcare. As noted by Baldwin (2007) in his reflections on the history of IPE, interest in and funding for IPE in healthcare has waxed and waned over the past 40 years. The cycles of interest and commitment to IPE, until recently, were largely driven by educational institutions and faculty who believed in the importance of preparing students to work effectively together in hospitals and primary care settings. More successful models of IPE have needed to conquer issues of faculty time, coordination

of multiple student schedules as well as associated costs. Loss of faculty champions coupled with reductions in grants for IPE often meant that innovative teaching models would disappear until the next wave of interest in IPE.

The current rise in IPE in healthcare has followed the momentum initiated by intense examination of the quality of healthcare in the United States. The Institute of Medicine's now landmark reports, ''To Err Is Human'' (2000) and ''Crossing the Quality Chasm'' (2001), called attention to the magnitude of medical errors and preventable deaths in US hospitals. The Chasm Report set forth a new vision for healthcare delivery, one that relied on a foundation of effective communication, coordination and collaboration among healthcare professionals. Subsequent changes in policy and funding have encouraged and incentivized healthcare organizations and the many stakeholders in the US healthcare system to institute new practices that depend on effective collaboration across providers and settings. The ability of healthcare organizations to achieve expected outcomes like reduced hospital readmissions or reduced infection rates, for example, require exquisite coordination and teamwork. Thus, unlike many of the previous cycles of IPE that were initiated and driven by academics, the cycle we are in now is fueled by those in service delivery.

The shift from academic to clinical drivers of IPE is significant in a number of ways. First and perhaps most importantly, the value of IPE is more firmly recognized and grounded in clinical practice. Increasingly, the clinical world demands graduates who are prepared to work together to achieve quality and safety outcomes. As the body of evidence linking collaboration and quality and cost grows, the pressure to demonstrate that health professions students are ''collaboration ready'' will increase. A corollary to this trend is the increased expectation that academic faculty preparing students for practice will partner with clinical agencies to assure their students have expected competencies. To many, this is a positive development necessary to bridge the wide education-practice gap (Thibault, 2011). Finally, the new visibility and vocal participation of clinical organizations in IPE may well provide a critical ingredient to assure its sustainability through a longer cycle than in the past. Engagement of the healthcare delivery system in IPE provides a clear raison d'etre for IPE and demands clear accountability for assuring that students have the knowledge, skills and attitudes required for practice.

Developing a collaboration ready healthcare workforce

The movement to improve preparation of students for collaborative practice received a significant boost in the United States in 2011 with the publication of the ''Competencies for Collaborative Practice'' (Interprofessional Education Collaborative Expert Panel, 2011). Developed by the Interprofessional Education Collaborative (IPEC) comprised of leaders of six major healthcare accreditation organizations, the document identified competency statements for four major domains, including values and ethics, roles and responsibilities, communication, and teams and teamwork. As noted in the introductory materials, the development of the competencies was guided and influenced by extant work in IPE and the groundbreaking IPE competency initiatives in the United Kingdom and Canada.

The US competency model like many of the international models is grounded in the World Health Organization's (WHO) definitions of interprofessional education and collaborative practice (2010). The WHO definition of Interprofessional education is ''when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes''. Interprofessional collaborative practice is defined as ''multiple health workers from different professional backgrounds work together with patients, families, carers, and communities to deliver the highest quality of care'' (WHO, 2010). Integral to these definitions are the understandings that students must interact and learn from each other for IPE to occur and that interprofessional education and practice are not ends in themselves. Collaboration is an important strategy to achieve quality of care for patients, families and communities.

The IPEC competency statements identify core knowledge, skills and attitudes required for effective collaborative practice. Some of the competencies are foundational, such as the ability to explain the role of and responsibilities of team members or the ability to describe how teams develop. Many of the competencies focus on teamwork performance in patient and clinical situations. Students are expected to engage others in shared decision making and use process improvement strategies to improve team performance. Together, the definitions and competency statements provide a blueprint for IPE teaching/learning activities and evaluation of student performance. With reliable and valid measurement, the competency statements serve as the outcomes or goals for collaborative education and may be used to ground evaluation of the impact of collaborative design.

Factors that influence collaborative learning

We are just beginning to explore and understand the range of factors that enable the development of competence in collaboration. Figure 1 identifies several key areas including curriculum design, teaching-learning strategies, and student and faculty characteristics. There is growing interest in the link between the physical design of the learning environment and student interaction and collaboration as a greater number of universities in the United States invest in new or repurposed classrooms and campuses aimed at increasing interaction and collaborative problem-solving among students.

Many current initiatives focus on curriculum design and new or enhanced teaching/learning strategies for IPE, including problem-based learning, clinical scenarios and simulation. There seems to be general agreement, for instance, that IPE curricula need to be phased in over time and provide integrated classroom and clinical learning (IPEC, 2011). There also is considerable emphasis on the development and evaluation of strategies that are student-centered, practical and realistic as part of the effort to bridge the academic-practice gap. A number of universities are studying technology-enhanced IPE, incorporating tools like computer tablets and phones, already used by students and integrated into their student and personal lives (Palloff & Pratt, 2005; Pulman, Scammell, & Martin, 2009).

In addition to curriculum and instructional design, there is growing attention to selection and readiness of students for IPE. Faculty are moving from convenience-based IPE experiences (i.e. in which students are selected according to their availability in a particular academic time slot) to experiences that are leveled according to student preparation and readiness to engage in basic to advanced competencies. Faculty readiness for teaching and modeling IPE also has been questioned. Increasingly, faculty recognize that teaching across professions requires different knowledge and skills than teaching within one profession and have led calls for more faculty development.

The study of the relationship between physical design and student learning outcomes is not new. Previous research has examined various outcomes including student retention and performance on standardized tests, and there have been a few

noteworthy efforts to develop more comprehensive evaluation models (Lee & Tan, 2011; Walker, Brooks, & Baepler, 2011). To date, however, there has been minimal study of the relationship between emerging classroom and campus designs and student competence in collaboration. Post-occupancy evaluations traditionally are limited to examination of whether faculty and students use the collaborative spaces and their level of satisfaction (Lee & Tan, 2011). Proponents of new interprofessional teaching-learning models are just beginning to examine the synergy between classroom design and teaching strategies (Beichner, 2006). While some indicators of collaborative processes and outcomes such as student interaction rates are now included in the evaluation of learning spaces (Wilson & Randall, 2012), we did not find any systematic reviews of collaborative design features or research linking design features to outcomes relevant to the IPEC competencies, such as a change in student attitudes toward collaboration or their team performance. Lack of evidence linking design features to competency-based outcomes presents a significant problem for justifying current collaborative designs or their expense.

Selection of design features for collaborative learning environments appears to be based on a combination of stakeholder interviews, best practices, focus groups and hunches about factors that encourage interaction. Much of the literature in this area is anecdotal based on a compilation of personal experiences and opinions (Villano, 2010). All of this work, interviews, arm-chair hypothesizing and the like are foundational in the development of theoretical perspectives around collaborative learning spaces. However, greater specification of collaborative design features is required to guide measurement and subsequent testing of the impact of these features on learning outcomes.

In the next section, we begin to lay out what we believe are the needed components of a theoretical model to allow rigorous study of the relationship between design and student competence in collaboration. Beginning with the core concepts outlined in Figure 1, we suggest that detailed analysis of emerging classroom and clinical designs intended to enhance interprofessional collaboration may be used to specify design themes and features *at a conceptual level.* Conceptual work is core to promoting scholarship in this area and ultimately, understanding how design influences collaboration as well as the factors that may influence this relationship. Our goal of concept identification to guide theoretical model development distinguishes this effort from earlier work seeking to create a comprehensive catalogue or listing of collaborative design features (Wolf, 2003).

Translating ''designed for collaboration'' into conceptual terms

It is increasingly common to see announcements in university newsletters about the opening of new classrooms and campuses specifically designed to enhance interaction and collaboration among students. Along with delivering a powerful message that ''collaboration is valued and expected here'', these announcements provide a useful source of data about design characteristics believed to be associated with collaboration. We started with our own experience in student-designed collaborative spaces and then used literature searches and personal contacts with architectural firms to identify examples of classrooms and campuses designed as collaborative environments.

Our intent was to illustrate the potential range of collaborative learning spaces from small to large classrooms and single buildings to multi-building campuses. This is keeping with Dugdale's (2009) exhortation to consider the whole academic campus as a learning space. We also wanted to consider spaces that were intended for informal collaboration, that is, lounges as well as formal learning spaces. Our goal is to create a beginning typology of collaborative design features to illustrate the potential for theory development and hypothesis testing. As such, we did not aim for our examples to be exhaustive, but rather to demonstrate the potential to translate available narratives and illustrations into concepts for subsequent model development and testing. For this initial work, we selected examples of learning spaces that were designed specifically to enhance student interaction. We also selected examples with written and/or interview support that academic stakeholders, including administrators, faculty and/or students were involved in the design process.

Written narratives, pictures and renderings of various collaborative learning spaces were examined for common design themes and features. Both of the authors studied the examples and identified major themes individually. We used both visual and

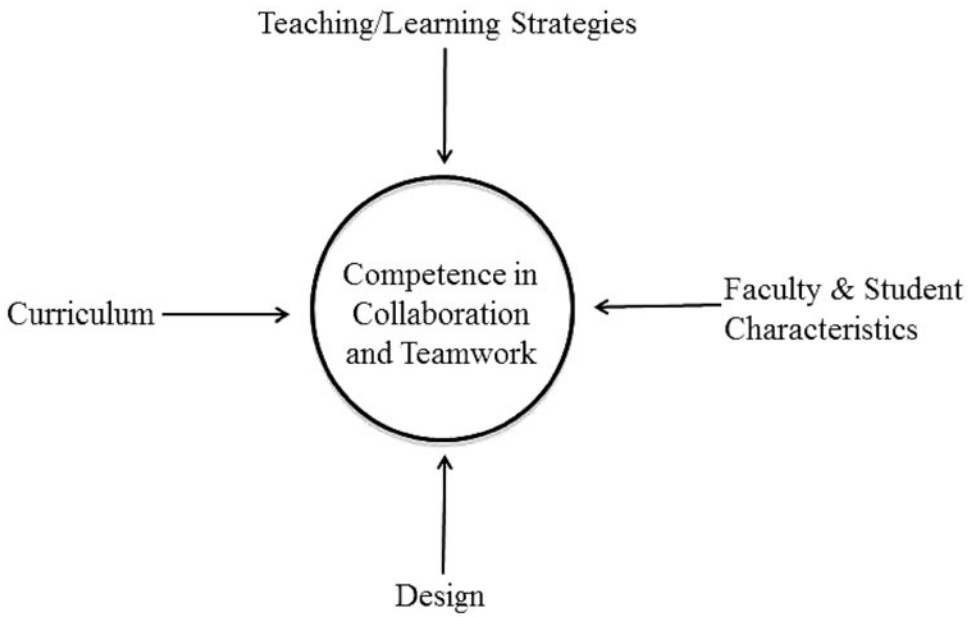

Figure 1. Factors that influence competency development.

content analysis methods to code illustrations and narratives (Krippendorff, 2013; Neuendorf, 2002; Rose, 2012). The common themes and associated features were refined through discussion and further examination of the examples. Three examples used for this article are described.

Example 1: The Healing Design Studio at Arizona State University

The Healing Design Studio is a graduate-level course at Arizona State University's Herberger Institute of Design and the Arts. Students from multiple healthcare and design professions enroll. In the studio example used for this article, students worked in teams in classroom and field settings to design a new facility for wellness services for women and children in Rwanda, Africa. Students traveled to Rwanda for two weeks at the beginning of the course to learn about the culture, interview and observe stakeholders and begin project design. They returned to the studio to complete their designs. We thought observing the ways our students spontaneously changed their classroom and field environments would provide us with helpful insights about design features associated with collaboration and teamwork.

Students started the course using individual work stations to work on their own and a larger conference table for group work, a fairly traditional studio format. Once in teams, the students spontaneously reconfigured classroom and hotel spaces to present and discuss their findings in smaller groups. When we returned from Rwanda, we were fascinated to watch the students create and decorate team spaces that allowed for close proximity among team members and permeable boundaries with other teams (see Image 1).

Example 2: University of South Carolina School of Medicine, Greenville, South Carolina

Classrooms in the new facilities at the University of South Carolina (USC) School of Medicine include a traditional lecture hall that can be modified for small group discussion and interaction (Image 2). The front set of chairs in each tier of the classroom rotate to allow groups of 6–8 students to face each other. The wall behind the second set of chairs in each tier has dry erase boards for group exercises.

The USC Learning Studio is designed specifically for group work. The studio contains multiple workstations with projection screens around the room (Image 3). Each workstation is wired to support the use of laptops and other electronic devices. The infrastructure for the technology is housed in the raised floor allowing for unobstructed views of people and screens from anywhere in the room. Lighting may be adjusted according to the needs of each workgroup and the activities going on in various areas of the room.

Example 3: The University of Arizona Health Sciences Education Building, Phoenix, Arizona

The University of Arizona's Health Sciences Education Building (HSEB) is part of the University's new College of Medicine complex located on the Biomedical Campus in downtown Phoenix, Arizona. This building, scheduled to open this fall, will house a number of interprofessional programs and is designed to encourage faculty and student interaction in both informal spaces and structured classroom spaces. The HSEB Building footprint (Image 4) has informal meeting places adjacent to structured classroom and studio environments.

Classrooms in the HSEB (Image 5) are designed primarily for small group work. Each student table has a dedicated plasma screen. The wide aisle down the center of the room facilitates faculty and student circulation among the tables.

Design themes and features

Four major design themes emerged from these examples. The four themes, flexibility, visual transparency/proximity, technology and environmental infrastructure, were found in each level of collaborative environments, including small and large classrooms, buildings and campuses. In the following section, each of the design themes and associated features is described. We found that some of the features fit with more than one design theme. For instance, having multiple projection screens around the room permits ease of viewing group displays (visual transparency/proximity) and at the same time is a good example of the use of technology to support group interaction and problem-solving.

Flexibility

This offers faculty and students the ability to modify or change the design features of a defined space, such as a classroom or informal social interaction area, to accommodate diverse needs for teaching, interaction and problem-solving. These may include changes in teaching strategies, class or working group size and the like. The

Image 1. The healing experience studio space. This figure illustrates the reconfigured team space.

Image 2. The lecture hall at The University of South Carolina School of Medicine in Greenville, South Carolina. This image illustrates how the back wall of each row becomes a vertical writing surface in addition to movable chairs. Courtesy of CO Architects. The lecture hall at The University of South Carolina School of Medicine in Greenville, South Carolina [Rendering]. (2012). Retrieved on April 15, 2012, from: CO Architects digital library.

Image 3. The Learning Studio at The University of South Carolina School of Medicine in Greenville, South Carolina. This image illustrates movable work stations, multiple projection screens, various lighting zones and round tables for visual proximity. Courtesy of CO Architects. The Learning Studio at The University of South Carolina School of Medicine in Greenville, South Carolina [Rendering]. (2012). Retrieved on April 15, 2012, from: CO Architects digital library.

classroom design for the new University of South Carolina Medical School (see Image 2), for example, allowed for smooth transition between a lecture hall and small group work.

Features associated with flexibility included: movable furniture and walls, raised flooring, horizontal and vertical writing surfaces close to seating and multiple screens for displaying information. Movable furniture, typically tables and chairs, enables multiple configurations for a range of teaching and interactive modalities, including lecture, group exercises and problem-based learning. Movable furniture in informal spaces allows for diverse social groupings as do movable walls. Raised flooring, in which all building infrastructure goes through the flooring, removes usual obstacles to moving furniture. Installations of an array of writing surfaces around seating areas enables learners to draw and write down ideas without having to search out flipcharts, pads or other writing aids. The availability of multiple screens in a defined space is needed to be able to move furniture into needed or desired configurations and not impair visibility to shared information.

There are various other movable features of classrooms that support flexibility. In the classrooms, we examined lighting fixtures and speaking lecterns also could be repositioned to accommodate small and large groups as well as a range of activities.

Visual transparency/proximity

This is the ability to have a direct line of vision and access to instructors, peers and classroom technology for interactive and collaborative work. Features associated with visual transparency and proximity allow for not only unobstructed views of all participants and working spaces, but keep participants close enough to each other to permit easy interaction and discussion (Image 3). In larger classrooms, design features support view and interaction among small work group members and across multiple workgroups.

Examination of collaborative spaces indicates that workspace shape and seating configurations are considered key features for visual transparency and proximity. In some of the newly designed collaborative spaces, large classrooms are built in the round to connect all workgroups visually. Student worktables are typically round or rectangular to allow students to see all group members

Image 4. Level two at The University of Arizona Health Sciences Education Building in Phoenix, Arizona. This image illustrates informal meeting places on the west side of the building. Courtesy of CO Architects. Level two at The University of Arizona Health Sciences Education Building in Phoenix, Arizona [Rendering]. (2012). Retrieved on April 15, 2012, from: CO Architects digital library.

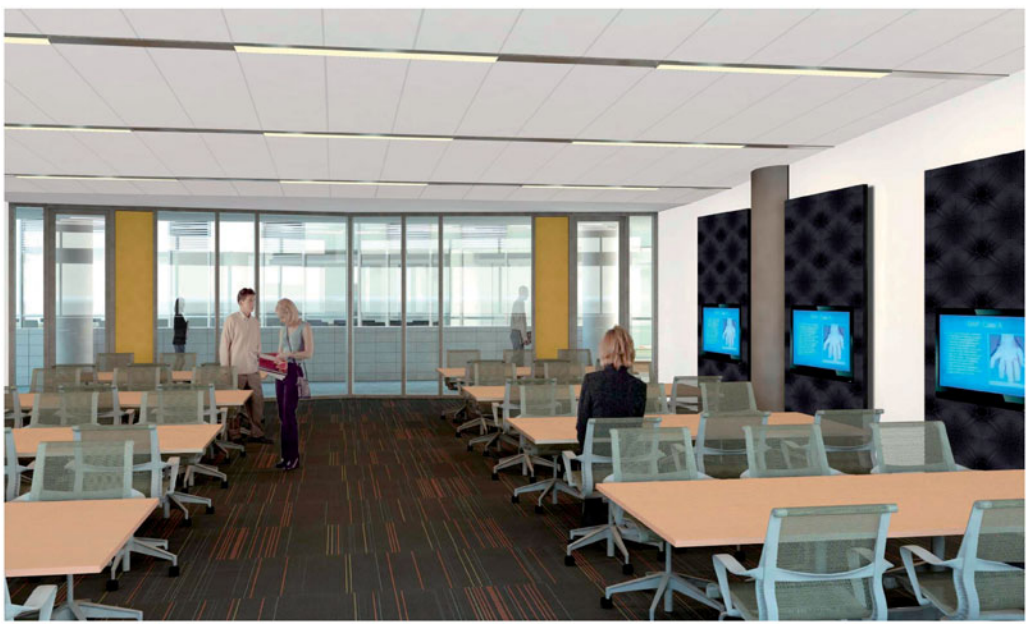

Image 5. The classroom at The University of Arizona Health Sciences Education Building in Phoenix, Arizona. This image illustrates small group's collaborative spaces and flat screen televisions with embedded cameras. Courtesy of CO Architects. The classroom at The University of Arizona Health Sciences Education Building in Phoenix, Arizona [Rendering]. (2012). Retrieved on April 15, 2012, from: CO Architects digital library.

at the same time. The number of seats is usually limited to less than 8 or 10 which is consistent with small group effectiveness and also allows direct line of vision among all members. In the examples from the University of South Carolina Learning Studio and University of Arizona classroom, student work tables accommodate 6–8 students each and are configured for easy viewing and interaction. In the studio example, students spontaneously changed their seats to be in closer proximity to each other.

Other design features associated with achieving visual transparency and proximity include having teaching podiums in the center of group space, multiple projection screens, embedded

cameras, common writing surfaces and raised floors. Each of these features reduces the likelihood of obstructed view to the faculty member and to group writing surfaces and interactive technology. Floors are raised to hide electrical outlets and connections.

Technology

This addresses the characteristics of collaborative spaces that enable students to use a full range of technology to augment and support interaction and group problem-solving. Although technology is clearly a part of achieving flexibility and visual acuity, we included it as a separate theme because the technology aspects of collaborative spaces have a distinct and unique function in collaborative learning.

Design features associated with group use of diverse technologies include: computer and electrical hookups at each student station or seat, facilities for screen sharing and capacity for faculty to customize screen sharing according to the needs and activities of each student work group (see Image 5). Microphones and cameras may be embedded into the worktables and walls to permit additional audio and visual exchanges between faculty and students and across student groups.

Environmental infrastructure

Infrastructure characteristics, like lighting, temperature and noise control, support and augment the design features associated with collaborative spaces. Anecdotal student comments suggest that these characteristics play a significant role in student use and satisfaction with collaborative spaces. One student told us that students do not use a new facility designed for student collaboration at one university because, ''it's too cold and it gets too noisy when there are a lot of students using it''.

Lighting for collaborative environments considers both the amount of lighting and the ability to vary lighting according to the nature of the group work. In the Learning Studio at South Carolina, lighting is zoned to allow it to be adjusted in different areas of the classroom (Image 3). Heating and cooling may be particularly important when students are working closely together in spaces packed with technology, like simulation laboratories. Acoustics also are important in group learning environments. Unlike lecture halls in which there may be a limited number of speakers and activities at one time, group learning environments have greater numbers of simultaneous conversations and louder noise levels. Dropped ceilings were a common feature used in the case studies for noise control. Larger collaborative campuses often included small nooks with lower ceilings for more informal, quiet exchanges.

A new framework for competency-based evaluation of collaborative design spaces

Our preliminary set of design themes and features provides a starting place to devise testable models to evaluate the relationship between physical design features and competency-based performance in teamwork and collaboration. Figure 2 shows hypothesized relationships between specific design themes and features and collaboration competencies. In Figure 3, we begin to add other variables that may influence the development of the teamwork and collaboration competencies.

Figures 2 and 3 contain several elements integral to rigorous study of the relationship between design features and competency development:

- The hypothesized relationships follow a universally recognized and studied structure-process-outcome sequence. This systems model is a common framework used in quality and cost studies funded by the National Institutes of Health and the Agency for Healthcare Research and Quality in the United States.
- Design themes and features are specified and may be studied individually or as a group or bundle.

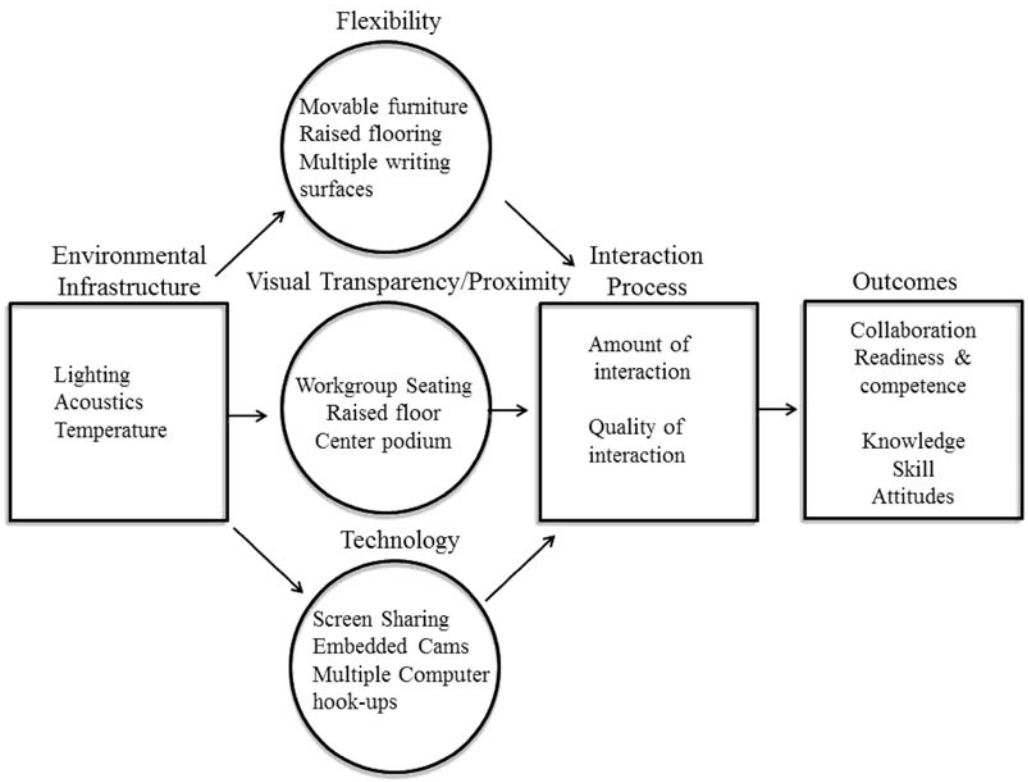

Figure 2. Collaborative learning environment features and collaboration-readiness model.

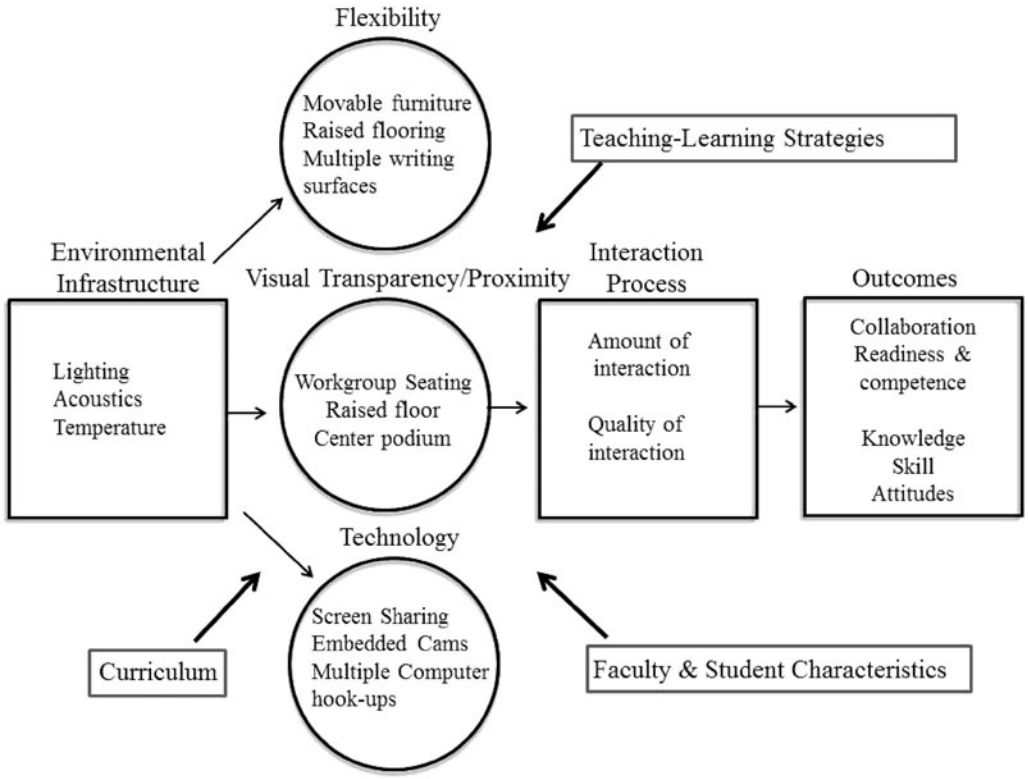

Figure 3. Comprehensive collaboration-readiness model.

- Interaction process concepts, such as amount and type of team interaction, are included as placeholders to encourage examination of mediators and moderators in the relationship between design and competency outcomes. Theories and concepts about teams and group interaction provide important insights about *how* collaborative design influences competency development among interprofessional groups. There is a robust body of research linking design and social interaction. Theories emerging from the growing field of team science also may prove particularly useful in further model development (Salas, Goodwin, & Burke, 2009).
- The conceptualization of outcomes draws directly from national and international consensus documents on competencies for interprofessional practice, such as IPEC.

These sample frameworks permit generation of specific hypotheses related to design features, interactive processes and competency development. For instance, with greater specification of design concepts, like flexibility or transparency (Figure 2) it is possible to examine the relationships between each of the concepts and features and the type and amount of student interaction:

- Do the environmental infrastructure features (light, sound, noise) act as antecedents or moderators to the collaborative design features? Do they have a direct impact on competency development?
- What is the relationship between each of the design themes/features and the amount and type of interaction among students?
- Are different design themes/features associated with different interaction processes? For instance, what is the relationship between seating configuration or shape of tables to the amount and type of interaction?
- Do designs with more of the collaborative features result in more interaction or collaborative problem-solving?

Greater specification of design features within a causal-type framework allows for examination of the process by which design exerts its influence on competency development and its interaction with other factors that may be hypothesized to affect collaborative competence (Figure 3). Research on collaborative teaching-learning strategies, student readiness and propensity for collaborative problem-solving, and team performance may be incorporated. Ultimately, more complete, better specified frameworks are needed to understand the unique and shared contribution that design makes to the development of desired competencies.

The integration of specific design concepts and features with the newly defined IPEC competency statements may be used to test numerous hypotheses linking design and collaborative competence. For instance, we might conjecture that:

- IPE-focused coursework taught in an environment with selected proximity features is associated with more team interaction and more highly rated team products.
- Technology-enhanced classrooms accelerate students' ability to articulate their roles and contributions.
- Students who learn interprofessional education in classrooms and buildings that incorporate features designed for flexibility of interaction are more able to develop interdependent relationships and negotiate conflict more effectively.
- Students who share campus buildings with other professions in which the buildings have lounges and other informal meeting spaces are more likely to value interprofessional interaction.

Currently, there is considerable work underway to operationalize and measure IPEC competencies. Concurrent examination of design concepts and IPEC competencies will advance both areas of study.

Discussion

The contribution of design to outcomes of collaborative learning environments is largely unknown. Post-occupancy evaluations are still relatively uncommon. Faculty and students appear to like the design of collaborative spaces, but anecdotal information suggests

that these spaces may not be used as much as expected or desired. There has been minimal systematic or rigorous study of the relationship between new collaborative classrooms and campuses and the achievement of competence in collaboration. Ultimately, it is critical to subject design to the same standards of rigorous evaluation as other educational interventions. Theory-based evaluation provides an essential foundation for understanding the role of design in competency development and demonstrating its value. Without this evaluation, it is difficult if not impossible to justify the expense of these designs or to propose ways to improve them.

To date, the theoretical work needed to translate collaborative design into measureable concepts has not received sufficient attention. In our article, we suggest that qualitative analysis of emerging classroom and campus designs and post-occupancy data are rich resources to advance this work as are earlier efforts to catalogue collaborative design features (Wolf, 2003). Qualitative data also can provide the foundation for the development of measurement instruments needed for model testing and refinement. Our intent in this article was to demonstrate the value of studying emerging collaborative spaces to advance theory and research and acknowledge that our purposive sampling to start this work likely is limited in generalizability. More detailed and systematic analysis of a larger sample of collaborative spaces is needed.

Integration of design concepts with relevant teaching-learning and team science concepts offers exciting new directions for understanding how the physical environment affects competence development. The recent development of the Interprofessional Education Collaborative (IPEC) competencies provides the necessary blueprint for studying collaborative outcomes and understanding how collaborative design features influence student perceptions of what is happening in the classroom or the experience of teamwork or collaborative problem-solving. There is rich opportunity to bring the study of collaborative learning spaces within the emergent literature on interprofessional education and practice. While we have focused here on functional design themes, the role of the personal and social experience of space – often referred to as place (Lawson, 2001) – also is a critical area for further study. It may be, for instance, that some or all of the collaborative features included in new classroom and campus designs fundamentally change student perceptions of the meaning and expectations associated with their experiences. The contribution of design to the creation of a collaborative culture should be explored.

In the present healthcare environment, it seems reasonable to predict that the emphasis on teamwork and collaboration will grow. Currently, design remains on the periphery of national dialogue about interprofessional education and practice. The current enthusiasm for building classrooms and campuses for enhanced collaboration – and the willingness to spend significant dollars for them – may depend on the commitment and support for educators, researchers, and designers to fast-forward the scholarship of evaluating collaborative learning spaces. Ultimately, evaluation must extend from linking design to collaboration and teamwork competence to the impact on patient and family outcomes. The first step, as we propose, is to build the theory base of collaborative design by encouraging clear identification and specification of collaborative design concepts and including them in models that can be tested and available for scientific scrutiny.

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Declaration of interest

The authors declare no conflicts of interest. The authors alone are responsible for the writing and content of this article.

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