New Models of Dental Education and Curricular Change: Their Potential Impact on Dental Education


Abstract: The collective body of work over the last seventy-five years in the *Journal of Dental Education* has chronicled the ongoing critical issues and trends in dental education. The evolution of the curriculum has run in fits and starts across the twentieth century and into the twenty-first. Today, there has been a resurgence in the introspective work of the profession to examine what is taught, how it is taught, in what sequence it is taught, and the context relating dental education to other health professions and the global reach of the educational and professional environment. In the context of contemporary times, individual as well as organizational leadership has refocused the educational environment from teaching to learning. This article discusses the types of curricular changes documented in the *Journal of Dental Education*.

Dr. Pyle is Professor and Dean, School of Dentistry, University of Missouri-Kansas City. Direct correspondence and requests for reprints to Dr. Marsha Pyle, School of Dentistry, University of Missouri-Kansas City, 650 E. 25th Street, Kansas City, MO 64108; 816-235-2010 phone; PyleM@UMKC.edu.

Keywords: curricular change, curriculum, dental curriculum, dental education

The collective body of work over the last seventy-five years in the *Journal of Dental Education* (JDE) has chronicled the ongoing critical issues and trends in dental education. The evolution of the curriculum has run in fits and starts across the twentieth century and into the twenty-first. Today, there has been a resurgence in the introspective work of the profession to examine what is taught, how it is taught, in what sequence it is taught, and the context relating dental education to other health professions and the global reach of the educational and professional environment. Forces new and reflective have challenged the usual mode of operation and thinking. Recent work has moved dental education forward likely more significantly than in other periods in the history of dental education. These movements have been captured as historical markers of professional growth in dental education via the *JDE*.

### Historical Perspective

It is interesting to examine early topics in the *JDE* as well as those across the years to highlight efforts and imperatives for curricular change and examination of the model of dental education and its suitability for producing competent dental professionals. Early article titles listed in Table 1 note topics that were important early in the history of the *JDE*. A look at the titles gives reference to the philosophical approach to education at the time. Could those early titles be transposed to current day titles? Are the topics of today in the *JDE* regarding curricular change and models of education similar or quite different? Examination of the characteristics of the chronology over time helps define what the future might hold for the curriculum of tomorrow and the nature of how that curriculum is organized and delivered.

Ever since the publication of the Gies report in 1926, dental education has, for the most part, been approached from a traditional perspective—one in which content experts imparted knowledge and practical modeling to groups of students. The Gies report advocated for university-associated, scientifically based dental education that was patterned after medical education, forsaking the apprentice and proprietary model of education that had been commonplace up to that time. A few years later, the 1934 Survey of Dental Education advocated for a dental educational program “that would make it possible for the graduate to be competent in the maintenance of oral health, and in the treatment of oral diseases, disorders, and deficiencies with understanding and appreciation of the relationships between oral and systematic conditions in health and disease.”

It is also clear that the importance of knowledge integration and relevance for dental education was desired. A new design for dental education was then called for in 1947.

In the 1947 *JDE* article “The Need for Reevaluation of the Dental Curriculum,” which discussed work towards changes in the content and organization
of the curriculum, future study was defined in terms of public dental needs, the resources of dentistry, and the aims of dental education. At that time, the recent changes in dental education were viewed as “spectacular in both scope and implication.” Topics such as research, scientific advances, greater appreciation for general and dental health, expansion of public health work, accreditation, and war times impacted how dental education was defined and how it was taught. Many of those topics of concern still hold value today as contemporary conversations include the value of science in dental education, access to dental care (public health), shrinking federal research dollars, and improved teaching methods among others.

Through the twentieth century, however, curricular models remained remarkably static. Various reports across multiple years, especially in the recent past, called for reexamination of the core tenets of dental education in an emerging environment. As the nation prepared for a new century, the calls for change continued, referencing the lack of movement in dental education. Change themes highlighted the need for reorganization of the curriculum, inclusion of oral health-general health association concepts, the value of scientific inquiry and integration of content, interprofessional training of health care workers, concern about the costs and financing of dental education, the professional workforce, and the general direction of the profession. Some of the imperatives referenced rationales internal to dental education and the profession while broader issues represented external influences on schools of dentistry.

By the mid-2000s, two national projects were under way that brought vision and action to change in dental education. The American Dental Education Association (ADEA) launched the Commission on Change and Innovation in Dental Education (ADEA CCI) in 2003, bringing together multiple stakeholders to create and leverage activities leading to meaningful systemic change. The second project, the Macy Study, reviewed national data and trends to advance both educational and economic modeling for the future of dental education, publishing recommendations in 2008. In a following report focusing on leadership to sustain change, Cohen and Tedesco discussed leadership requirements for persistence in sustaining adaptive change efforts called for by current projects. The need for leadership with the future viewed through new lenses was discussed, indicating the same approach to contemporary problems would unlikely be sufficient to solve current challenges in dental education. In the mid-2000s, these converging imperatives resulted in substantive change in dental education, leading the way for widespread national discourse and support for local and national approaches to change.

As a result of these reports and visionary efforts, dental education came to an internal examination of major issues causing tension in traditional systems of education and economics. The cost of education, including student indebtedness, the overcrowded, irrelevant curriculum, the pace of technological and scientific advances, and the need for sustained leadership for change accompanied external forces advancing the need for new models of dental education. The external environment, fraught
with calls to improve the delivery of oral health care services to those underserved, demanded new ways of thinking. The cost and value of dental education in a technological and global market demanded approaches sound in educational methods yet with new economic modeling. These forces and the economic strain imposed by the U.S. economy, with the growing differential between the opportunities of private practice compared to earnings in higher education, made recruiting and retaining quality faculty in dental schools a momentous challenge.

The JDE has chronicled both the years of little change in models of dental education and the instances of significant modification to dental education across the years. While numerous innovations have and are being implemented locally in the area of instruction, economic modeling, and assessment at the institutional level, three major systemic changes have been reported recently in dental education. The three innovations are the incorporation of new instructional models,18-27 economic modeling,16 and distributed/economic models that utilize community clinical training sites.28 Additionally, external influence by regulatory-related bodies has significantly impacted curricular modifications in dental schools. While there is some interrelationship between the models and external influence, there are unique aspects of each.

New Instructional Models and Approaches

Many innovations have been advanced in this area over the last four decades (Table 2). As long as forty-five years ago, dental schools began reorganizing clinical instruction to accommodate comprehensive patient care.18 Discipline-based clinical instruction had prevailed in many schools until the 1990s. There had been a realization that clinical instruction should closely align with how care is provided in the practice of dentistry. Isolation of technical procedures by departmental silos was viewed as a barrier to integration of comprehensive care in the patient’s best interest.19,20 Implementation of clinical instruction in which students were responsible for providing diagnosis and treatment for all categories of care required by individual patients advanced educational processes. Among the first dental schools to implement comprehensive clinical patient care were those at Case Western Reserve University and the University of Missouri-Kansas City. Today, the vast majority of clinical educational models utilize comprehensive care approaches in which students manage most if not all aspects of an individual patient’s dental care.

One of the modifications in the traditional model of education has been the introduction of small-group learning—either problem-based learning or a hybrid variation—in several institutions. An early adopter of this type of educational format with the integration of basic science education between medicine and dentistry was the Harvard School of Dental Medicine.21,22 This school’s model was patterned after the innovative work at McMaster University. The premise across institutions that eventually initiated this change was to support educational theory and the desire for greater student engagement in the learning process. Experiential learning and student engagement are known components in the development of deep learning, knowledge retention, and growth in critical thinking skills.29 Through the late 1990s and 2000s three additional dental schools implemented various aspects of small-group learning as a major component of the complete curriculum or first two years of instruction.23-25 Since that time, several schools initiating this instructional model have modified their approaches, implementing a hybrid small-group learning environment that has a component of traditional instruction to various degrees. Utilizing small-group learning has provided these programs the opportunity to enhance discovery of knowledge, giving students responsibility for their learning, the development of critical thinking skills, integration of basic science into clinical science, and a mindset of lifelong learning.

Learner-centered models of education gained momentum more generally by the 2000s.30 Teacher understanding of both discipline knowledge and pedagogical knowledge emphasized the use of student-directed, active learning strategies. Realization that transfer of knowledge occurs after initial learning and works best in the context of active processes was being applied to instruction in dental education. Building upon previous knowledge, strategies for dental education that engage learners to work with constructs promoting understanding vs. factual memorization were highlighted for promoting the continual development of problem-solving and critical thinking abilities. In the dental literature, topics began surfacing with discussions of strategies for the development of this type of instruction and learning in dental education as a means of moving pedagogical thinking forward.31
In 2006, the Case Western Reserve University (CWRU) School of Dental Medicine implemented a comprehensive curriculum revision that was bold, broad, and innovative. It was premised upon guiding principles of integration of curricular content, small-group learning, student responsibility for learning, decompression of the existing curriculum, preservation of comprehensive care, a culture of inquiry, just-in-time learning paired with related early clinical experiences, and relevance. The faculty made decisions to not teach everything and implement active learning approaches, defining the curriculum by themes. This approach was consistent with educational underpinnings and was implemented to foster student growth in independent learning and critical thinking skills.

New instructional methods have also emerged that capitalize on the growth of the technology industry. Simulation technology became prevalent in preclinical laboratory instruction where dentoforms were placed in units that represented patient positioning and ergonomics modeled in the practice of dentistry. At the same time, virtual reality simulation technology advanced and was adopted by several institutions incorporating the technology into the curriculum. The JDE documented educational research studies that examined the utility of this technology in improving learning.

Concurrent with educational approaches to improve curriculum and its delivery was the growing emergence of content and instructional practice based in scientific evidence. The evidence-based dentistry movement was encouraged by the American Dental Association with national workshops and web-based content and increasingly adopted by dental educators and began appearing in articles published in the JDE.

Several institutions planned and implemented curricula to highlight principles of integration for concepts that run as threads across the four-year programs. By weaving new science and technology into the curriculum through educational tracks, research/scholarly content was emphasized. The University of California, San Francisco School of Dentistry intended to remove redundancy and overcrowding, engage students in active learning, and plan improved content coordination via its approach to curriculum revision. Four strategic approaches defined the school’s planning: creating a curriculum that was scientifically current, challenging, and biomedically oriented; developing students’ problem-solving and critical thinking skills; integrating oral health, clinical medicine, and physical and psychological diagnosis; and promoting lifelong learning. The resultant change created thematic streams of knowledge that crossed disciplines and departments.

In a JDE article, Iacopino described Marquette’s project that endeavored to help students apply scientific discoveries to clinical practice. Creating curricular mechanisms to understand evidence-based decision making and advance the adoption of relevant scientific discoveries into dental practice would help future practitioners operate in an environment that could rapidly adapt to advancing science and technology. One of the main principles was to bridge basic science into clinical science applications that faculty and students could embrace and incorporate as a common philosophical approach to patient care.

<table>
<thead>
<tr>
<th>Change</th>
<th>Rationale/Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive patient care</td>
<td>Coordinated care in the interest of the patient</td>
</tr>
<tr>
<td>Competency-based education</td>
<td>Setting mastery level educational expectations based in outcomes</td>
</tr>
<tr>
<td>Educational format:</td>
<td>Develop critical thinking and lifelong learners</td>
</tr>
<tr>
<td>Small-group learning/simulation</td>
<td>Foster deep learning</td>
</tr>
<tr>
<td>Economic models focusing on clinical education:</td>
<td>Give students more responsibility for their learning</td>
</tr>
<tr>
<td>Patient-centered care</td>
<td>High cost of clinical education model</td>
</tr>
<tr>
<td>Community models of clinical education:</td>
<td>High cost of clinical education and need to address oral health needs of underserved populations</td>
</tr>
<tr>
<td>Federally Qualified Health Centers (FQHCS)</td>
<td></td>
</tr>
<tr>
<td>Reorganization of curriculum:</td>
<td>Integration of basic and clinical sciences; introduction of science and technology</td>
</tr>
<tr>
<td>Tracks of themed curricula</td>
<td></td>
</tr>
</tbody>
</table>
Clinical Education. Formicola noted that traditional
focus is patient-centered with faculty treating patients
while supervising dental students at the same time.

This more closely resembles the medical model of
practice thus preserving the requirement of consistent
scientific infusion across the four-year curriculum. 26

Economic Modeling

By the mid-1990s the impact of the national and
state economies of the late 1980s and other institutional
factors had resulted in the closing of several
dental schools. Several other schools embarked upon
more responsible business models of education,
decreasing the degree of reliance on tuition income
to sustain their operations. Both New York University
College of Dentistry (NYU) and CWRU have
prospered under a new business model. At NYU,
among others, the implementation of an international
dental student training program, growing its research
program, and advocating for the school among philan-
thropists has resulted in a stable program that has
demonstrated value to the region and growth in the
last decade. 35 Likewise at CWRU, the implementa-
tion of a sound business model that included “right-
sizing” the student body and faculty, growth of the
research enterprise, and reducing reliance on tuition
dollars for operations has resulted in a program that
has been able to sustain significant growth. 18 These
institutions represent educational models that have
provided for the advancement of innovation and
program growth by establishing sufficient funding for
reinvestment in the school’s core values in teaching,
research, and service mission areas.

The Macy Project of 2008 concluded that the
fiscal outlook for dental education was challenging,
that current responses to the economic challenges
were inadequate, and that revamping the clinical
educational model could hold promise for the fu-
ture. 36 The report advocated for modifying the cur-
rent system of clinical education to one in which the
focus is patient-centered with faculty treating patients
while supervising dental students at the same time.
This more closely resembles the medical model of
clinical education. Formicola noted that traditional
dental school clinics require significant subsidy
from schools, in part because faculty members do
not contribute to the provision of care and because
many schools continue operating with a semblance
of a requirement-based system for student education.
The report identified three principles key to imple-
mentation of successful clinical education models:
distinct patient care and educational missions that
permit an efficient clinical program organization;
efficient systems that reflect patient perspectives; and
student involvement in clinical systems that reflect
contemporary delivery systems operated by general
dentists. Several schools have implemented aspects
of this model, yet their general clinics continue to
be student-operator focused. Midwestern University
School of Dentistry in Glendale, AZ, has recently
opened its clinical facility under the premise of this
model with faculty directing and incentivized to
supervise student completed patient care. 37 Of the
dental schools implementing this system of clinical
operation, the long-term impact on clinical fiscal
health is yet unknown.

The Macy Report also recommended models of
clinical education that utilized community health cen-
ters as training sites for fourth-year dental students. 18
Estimating costs savings vs. revenue loss utilizing a
scenario in which students would spend 70 percent
of their fourth year in community health centers,
Bailit predicted that dental schools could save $2.7
million. It is not yet known if this clinical model is
generalizable or if the breadth of factors studied might
impact this as a potential educational and economic
solution for most dental schools.

The recent growth of new dental schools with
entrepreneurial spirit has also fostered intriguing
economic curricular models for dental education.
That and the outcomes of the Pipeline, Profession,
and Practice: Community-Based Dental Educa-
tion program has created new vision and data for
community-based clinical education options. 39,41
These models are couched in the realities of societal
needs for improving access to care for underserved
populations and for efficient clinical education sys-
tems. The Macy Project concluded that expansion
of community-based dental clinical education was
feasible and desirable and could improve clinical
training finances, provide service-learning opportu-
nities, and support the dentist’s role in giving back
to society.

In response to the advancing of this clinical
fiscal model and other current challenges in dental
education, Walker et al. later discussed the challenges
of the economics of dental education.\textsuperscript{42} Noting that the costs of patient care in public institutions rose about 35 percent in the ten years between 1990 and 2000 and that most clinical operations are subsidized by their institutions, these authors reported the schools that have implemented patient-centered care in some fashion remain dependent on additional subsidies. Faculty reluctance to implement faculty-led care while supervising students concurrently was cited as a barrier to fully understanding the potential impact of this change.

**Distributed Community Models**

The A.T. Still University Arizona School of Dentistry and Oral Health has adopted a model utilizing community health centers as a significant component of students’ clinical education.\textsuperscript{28} The curricular model of this program also utilizes adjunct visiting professors from other dental schools to provide block instruction in specific content areas. This structure represents significant financial savings in the cost of salary and benefits for the faculty, coupled with the need for smaller on-site clinical education facilities.

Schools whose faculty members serve in this adjunct capacity have expressed concern about detracting from the primary role of the faculty and the dearth of faculty members who would support research and scholarship endeavors to maintain the profession as a learned profession, stimulating the next generation of practitioners to understand the scientific base of the practice of dentistry. The long-term sustainability of this model remains unknown as geographic factors, economics, and faculty resources are significant variables in flux.

**Effect of Accrediting and Licensing Bodies**

Among the external influences that have played a significant role in modifications to dental educational models in the recent past, one of the areas of greatest impact has been caused by changes in the accrediting and licensing sectors. The Commission on Dental Accreditation in the early 1990s implemented competency-based standards requiring schools of dentistry to modify their educational programming from process-related documentation defined by numeric requirements to mastery level expectations and outcomes.\textsuperscript{43}

As a result, all schools began transitioning to defining expectations of student learning outcomes and improving measurements to support the evidence of attainment. Schools defined competencies that they expected graduates to attain during the educational program. Curricula were then designed to satisfy the adopted individual school competencies that aligned with the accreditation standards. Perhaps no other external influence had such a far-reaching influence on the state of dental education at the time. Smaller modifications to the clinical licensure examination processes also affected the clinical curriculum and its timing.

**The Future**

Many questions remain about the future of health care, its organization, and dentistry’s role in it. There is significant potential for the primary tenets of dental education to continue to be challenged by future societal and environmental changes requiring the continued development of new models of dental education. The extent to which the profession can advance with changing times will depend on factors that currently challenge it and its willingness to address them. High tuition and associated student indebtedness, the inaccessibility of dental education to diverse groups of students because of the cost of education, the lack of a new pipeline of qualified, adequately paid faculty members, national and state economies, the duplication of effort of multiple existing and new schools of dentistry, and dentistry’s role in the future of health care are among some of the most important pressures faced today.

Further external pressures from licensing bodies and the Commission on Dental Accreditation can be expected to initiate significant changes in dental education curricula into the future. Recent plans of the Joint Commission on National Dental Examinations to modify the National Dental Board Examination to one exam rather than two within several years of the educational programming will require immediate response in the organization, instructional methods, content, context, faculty development, and delivery of curricula that merge basic science and clinical science throughout the curriculum and across program years. This has the potential to require integrated approaches to instruction that necessarily remove many of the disciplinary silo barriers that
remain in some programs. Likewise, contemporary thinking will guide the development of accreditation standards that impact curriculum modifications to address changes.

Future models of dental education and curricula will, no doubt, look different from those today. Many universities will likely be unwilling to continue to support operations that do not accomplish their overarching mission by supporting their strategic direction in both efficient and effective operations. Additionally, external pressures from the changing health care system, access to oral health care and to professional dental education, and the nation’s economy will impact the direction and speed of change in dental education. For the future, several of the following ideas may shape dental education models.

In light of current initiatives in health care reform, dental education may have the opportunity or the imperative to take a new role in primary care. If the public visits dental offices more frequently than physicians’ offices, then dentistry could take on new roles in primary care, especially in the monitoring of chronic disease. Likewise, if health professions students were educated together in specific common aspects of health care such as patient communication, physical evaluation and diagnosis, ethics, and physiology of disease, then all patients might be well served in accessing appropriate health care, no matter their entry point into the health care system. Whether the patient sees a dentist, nurse practitioner, or physician, he or she could be assured of quick, appropriate access to meet health care needs. This would require significant modification to educational systems across the health professions to prioritize core curricula common to all health care professionals. It could also result in a new kind of dental professional, one who is dual-trained (D.M.D., M.D./D.O.) and credentialed to monitor and treat medical disease. Many peripheral systems would need monumental change for this to be efficient. Both Nova Southeastern University and CWRU School of Dental Medicine have pioneered dual degree programs in this area. Currently, Nova Southeastern University has ten students enrolled in its program, which is six years in length. CWRU has yet to recruit any students into the program since it was approved in 2008 and is planning modifications to the program length and organization to advance it. Uncertainty of career path, intensity of programming, and untested sustainability of the program and its outcome have likely contributed to the challenges of recruiting candidates for the program. Accreditation, licensure, third-party payer systems, and health care organizations would need to change to fully integrate graduates of such programs into the health care system.

The current traditional lockstep view of curricula in both medical and dental education represents a barrier to implementation of joint projects of this type and of collaborative work in interprofessional education. However, through a collaborative project of six professional education organizations, core competencies for interprofessional collaborative practice have been advanced. The report of an expert panel represents the first step in a potential reorganization of health professions curricula to advance the development of adequately trained health care teams for future health care practice. The initiative has advanced the concept that developing well-trained teams of health care professionals will foster improved patient care and outcomes.

While Bailit was skeptical about the possibility of regionalization of dental education programs, it may be possible to do so with use of distance education and online learning. Today’s mantra in many public institutions is collaboration and sharing of resources to accommodate difficult economic times. Although there are expenses associated with setting up distance education systems, there are successful projects in the health professions and in dental education that warrant study for general application. The technological advances of the last decade have brought the possibility of applications to dental education to reality.

With the graying of the faculty, difficulty in recruiting and retaining individuals for academic positions, and the struggling economic environment, consolidation of some educational efforts could create economies of scale for institutions. Institutions with programs deemed of the highest quality with efficient operation may emerge as preeminent institutions that share faculty and curricular resources with other institutions via distance education and online learning. If the difficulty in recruiting qualified faculty members continues to grow, institutions may be forced to collaborate, implementing online learning to share both human and educational resources in order to maintain viable programs.

The current expansion of traditional and non-university-based educational systems is likely unsustainable based on the outcomes of an expansion of capacity in the 1970s. While times are different, it is possible that the challenges currently facing dental education will remain despite this growth in new dental schools. Duplication of effort would
seem to be antagonistic to the idea of regionalization of programs and sharing of limited resources. What may emerge are educational leaders in institutions that refine their educational model to align with a sustainable economic model that maintains dentistry as a learned profession and takes advantage of growth opportunities through distance education and online learning.

There is also the possibility that further differentiation of dental schools’ mission and emphasis could lead to the development of a cadre of niche or boutique dental schools that exist complimentary to more traditional models. Many dental schools have developed strengths in specific areas while all maintain the general tenets of dental education sufficient to satisfy the scrutiny of the Commission on Dental Accreditation. Some schools have strengths in basic science or clinical translational research, some in educational innovation, others in distance education/online learning or community-based service-learning. The development of future models that have specific goals will be predicated on health care reform, economic needs, and the environment, as well as flexibility of the accreditation system in dental education and market trends.

To date, much of the needed change in dental education has been slow to emerge. Yet, in the last several decades, curricular modifications focused on student learning vs. teaching have created some of the most important advances in dental education in the recent past. Current efforts have resulted in innovations in educational models causing systemic change and in smaller efforts at the institutional level, all contributing to the advancement of dental education. To the extent that these efforts in concert with other health professions and health systems are sustainable, dental education will continue its growth towards the future. An anonymous quote sums up an idea relevant to the future of dental education: “If you do what you’ve always done, you’ll get what you’ve always gotten.” Several effective new business and curricular models have demonstrated value in program growth and advancement. Adaptation of these effective models and implementation of new and emerging approaches will be necessary to ensure dental education is on a solid path to the future. The future of dental education will pivot on the strength of thought leaders who have the courage to advance new ideas and the will to persevere when political forces and the will to change discourage the vision.

REFERENCES

18. Personal communication, Dr. Jerold S. Goldberg, Dean, Case Western Reserve University School of Dental Medicine, September 4, 2011.


35. Personal communication, Dr. Richard Vogel, Executive Vice Dean, New York University College of Dentistry, New York, NY, September 12, 2011.


37. Personal communication, Dr. Russell Gilpatrick, Dean, Midwestern University School of Dentistry, Glendale, AZ, August 17, 2011.


44. Personal communication, Dr. Dominick DePaola, Associate Dean, Academic Affairs, Nova Southeastern University College of Dental Medicine, Fort Lauderdale, FL, August 31, 2011.


