

Dental Education Economics: Challenges and Innovative Strategies

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Abstract: This article reviews current dental education economic challenges such as increasing student tuition and debt, decreasing funds for faculty salaries and the associated faculty shortage, and the high cost of clinic operations and their effect on the future of dentistry. Management tactics to address these issues are also reviewed. Despite recent efforts to change the clinical education model, implementation of proposed faculty recruitment and compensation programs, and creation of education-corporate partnerships, the authors argue that the current economics of public dental education is not sustainable. To remain viable, the dental education system must adopt transformational actions to re-engineer the program for long-term stability. The proposed re-engineering includes strategies in the following three areas: 1) educational process redesign, 2) reduction and redistribution of time in dental school, and 3) development of a regional curriculum. The intent of these strategies is to address the financial challenges, while educating adequate numbers of dentists at a reasonable cost to both the student and the institution in addition to maintaining dental education within research universities as a learned profession.

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Key words: dental education, finances, strategy, redesign

Submitted for publication 3/16/08; accepted 9/19/08

In response to *The Survey of Dentistry* by the American Council on Education in 1961, dental education enrollment in the United States grew dramatically during the 1960s and early 1970s in anticipation of the country's increasing population and associated dental needs. To meet these potential needs, the federal government mandated an expansion for dental education, with the largest growth occurring in publicly funded dental schools. Federal funds made available during this time period facilitated construction of fourteen new dental schools, with concurrent expansion and renovation of almost all existing schools with a goal of graduating 6,180 dentists annually by 1975.¹ Moreover, until the early 1970s, the federal government provided capitation grant funding (Health Professions Capitation Grant) for at least one-third the cost of dental education.^{2,3} However, predictions for future dental need and demand were not realized due to the impact of fluoride.¹ Therefore, by the mid-1970s, the federal government concluded that the number of health professionals being trained was adequate. Consequently, support for dental education significantly decreased over the

next two decades to the point at which by FY2001 less than 1 percent of predoctoral public dental education support came from federal revenues.⁴ Due to the decrease in federal support, the responsibility of public dental education financing shifted to the states in the 1980s. However, most states began having financial difficulties in the early 1990s, which further stressed revenue streams for public dental education.⁵

The curtailment of federal and state support has created a financial challenge for public dental education.^{2,5-10} Dental education is one of the most expensive health professions education programs on a per student basis. The estimated marginal cost of financing physician training at a U.S. public school is \$251,085 per student, compared to \$312,040 for educating a dental student.^{4,11} A revealing cliché frequently repeated by university advancement and development administrators reflects diminishing state support for higher education: “public universities,” they say, “were state-supported, then they were state-assisted, and now they are state-located.” The drastic decline in public support has been linked to critical issues currently facing dental education, such

as increases in tuition and fees with a corresponding increased student debt load and less money to pay faculty, adding to faculty shortages or increased teaching workloads with associated declines in research and scholarship.^{8,12-14} Additional problems still exist, such as the high cost of clinic operations, aging dental school infrastructure, and lack of funds to continue incorporating information technology into the dental curriculum.

There is justified concern that these financially driven resource issues, besides adversely affecting day-to-day operations of dental schools, might have more long-term negative effects on schools' ability to sustain an adequate research base, educate a diverse workforce, and prepare graduates to deliver dental services to underserved patient populations; hence, the esteem of the overall dental profession may be in jeopardy. In light of these challenges, the objectives of this article are to review current dental education financial issues and management models and present innovative strategies for addressing these issues in the future. Our collective investigation of this topic was part of the learning experience we had as fellows, along with our mentor, Dean Williams, in the American Dental Education Association (ADEA) Leadership Institute class of 2008.

Financial Challenges to Dental Education

Tuition and Student Debt

From 1991 to 2000, average state support for dental education dropped from approximately 45 to 32 percent of a school's annual budget. Even though this average suggests schools receive approximately one-third of their funding from state support, this level varies, so that a significant number of state or state-related schools (private schools that receive a per capita enrollment subsidy from the state, such as the Maurice H. Kornberg School of Dentistry at Temple University and the University of Pittsburgh School of Dental Medicine⁴) are functioning almost like private schools due to the minimal state support they receive.⁵ Many state/state-related schools now have to generate 70 percent or more of their operating budgets from tuition, extramural support (grants), revenues derived from clinical services, and charitable donations.

A common response by dental schools to the decline in state funding has been to increase tuition and fees, approximately 7 to 10 percent per year since 1993.^{5,7} Consequently, student debt at graduation has grown dramatically.^{6,12,14-17} Between 2000 and 2006, educational debt at graduation increased 38 percent. Average indebtedness for all dental school graduates was reported to be \$145,465 in 2006, with public school graduates averaging \$124,700 and private/state-related graduates averaging \$174,241.¹⁸ Even with the rising cost of tuition and fees and the resulting higher student debt level, to date, dental schools are still attracting many well-qualified applicants to fill their classes due to dentistry's high private practice income potential.^{8,18}

However, one outcome of the increasing tuition is that the number of enrollees from higher income families has increased substantially. From 1998 to 2006, the number of students with parental incomes of \$100,000 or greater increased from 35.1 to 44.2 percent, while the number of students with parental incomes less than \$50,000 declined from 32.4 to 25.8 percent.¹⁸ Furthermore, current dental school enrollment of African Americans and Hispanic/Latinos at 4.7 and 5.3 percent, respectively, does not reflect the equivalent representation of those minorities in the overall population of the United States (12.4 and 15 percent, respectively).^{19,20} Thus, it would appear that tuition and fee increases are contributing to the factors discouraging talented students from lower income families and underrepresented minorities from pursuing dental careers.

As the student debt load has increased, the number of students receiving financial assistance in the form of loans has increased from 82.3 percent in 1990-91 to a range of from 89.5 to 90.8 percent, depending upon whether the school is private, private/state-related, or public, with public school students receiving the most financial assistance.¹⁵ The amount of financial assistance needed continues to exceed tuition and fees, since it also covers living expenses and the cost of books and other supplies and materials. Because the cost of obtaining a dental education is no longer covered by low-cost government loan programs, students are increasingly finding it necessary to obtain loans from private sources with higher, non-fixed interest rates. However, many students, because they have no credit history or a history of bad credit, have a difficult time qualifying for private loans.^{15,21} Many students are, therefore, concerned with how to finance their

dental education; this is especially true for students from disadvantaged backgrounds.¹⁵

In addition to high tuition levels affecting student diversity, graduates' career and practice decisions may be impacted. For example, a high debt load makes it less likely that a graduate will choose to practice in a community health center or provide care in underserved areas.^{14,18} Perhaps, the increased debt level and its subsequent effect on dental practice might be related to the increased focus on the business of dentistry, as recently reported in the *New York Times*.²² Critics have blamed dentists' interest in money for the access to care issues in the country, going so far as to imply that the profession's resistance to a two-tiered level of care system is based on financial interests. Continually rising dental school tuition, absent a plan to contain costs, might provide justification for this criticism.

Faculty Shortages

Dental school budget cuts have also had a negative effect on faculty salaries. By 2000, the private practice general dentist annually earned \$86,000 more than his or her dental school faculty counterpart, and the private practice specialist earned \$170,000 more than his or her faculty counterpart.⁸ By 2015, Bailit et al. have projected that this annual difference will increase to \$278,000 and \$454,000, respectively.⁸ With the growing discrepancy between faculty and private practice income, it is not surprising that many faculty members are leaving academia.²³ Moreover, dental school graduates with a high debt level are not likely to choose academic dentistry over the more profitable private practice. This fact was recently confirmed by the ADEA survey of the 2006 graduating class, which found that less than 1 percent of the responding graduates were even considering an academic career.¹⁸ Collectively, these factors have led to an ever-increasing faculty shortage.^{13,17,24} There are currently 406 vacant faculty positions, which averages to approximately seven vacancies per dental school.²⁵

Beyond filling the vacancies, there is concern about schools' ability to attract and retain faculty members noted for excellence, research, and recognized scholarly activity with current faculty compensation. With the extreme faculty shortage, institutions might be tempted or forced to increase teaching or service workloads, thereby reducing release time for scholarly efforts and minimizing the importance of research and scholarship, leading to the erosion of the

profession to the point that dentistry is considered a vocation rather than a learned profession.¹⁴

Clinic Operations and Facilities

The high cost of clinical operations is another factor for consideration when attempting to understand the cost of dental education.¹⁰ In medical education, most clinical learning and patient care experiences take place in hospital facilities during the third- and fourth-year clerkships and then in residencies after graduation. The costs of the medical school clerkships are to some extent shared between the school (which provides faculty who double as attending physicians and who are often compensated by both school and hospital) and the teaching hospital through a variety of mechanisms. The expenses for residency education are almost wholly underwritten by the hospital and the federal government, through a combination of revenue sources including clinical fees generated by the residents' provision of patient care. In contrast, the majority of dental clinical instruction takes place in non-hospital clinics operated by the schools. Between 1990 and 2000, patient care expenses in public dental schools increased approximately 35 percent.²⁶ However, predoctoral student-generated clinic income does not cover the costs of operation, because dental school clinics operate as teaching laboratories with students seeing no more than two or three patients per day at substantially reduced fees to compensate for the additional time required for care.⁷ On average, clinical income covers only approximately 32 percent of the school's costs of clinic instruction and operation.⁴

Another issue related to clinic operations and facilities is the fact that most universities' investment in the extensive patient care facilities within dental schools (essentially an ambulatory care, outpatient clinic that is larger than found in major hospital systems) and supporting infrastructure has not kept pace with the routine maintenance and replacement expenses associated with operating such a facility. This is a major concern when the physical plants of many schools, including the so-called "new" schools started in the 1970s, are thirty to forty years old.⁸ As a result, dental schools typically cannot afford to incorporate technological advancements in patient assessment and treatment into the curriculum, so students graduate with limited knowledge of current technology and equipment that is standard in dental practices.²⁰

Current Models to Address Financial Challenges

Clinical Education Models

New revenue strategies must be explored to find alternatives to the reliance on tuition increases and associated student debt load. While dental education is not a for-profit business, with increasing clinic operation costs and rising tuition, sound business management principles should be considered.²⁷ One example of this approach is implementation of a model using private practice principles to increase senior dental student production. In one dental school during the 2003–04 academic year, a private practice model was implemented and resulted in a 63 percent increase in revenue, more care for more patients, and expanded educational opportunities for students in the business aspect of dentistry.²⁸

Community-based and patient-centered education/delivery systems have been recommended as potential alternate approaches to dental clinical education;⁷ most recently, this paradigm shift in dental education has also been recommended as part of the Macy Study report.²⁹ Community-based education usually incorporates community-based rotations into the senior dental curriculum, with the primary goal of these programs being the efficient delivery of high-quality patient care. Additional advantages are increased student productivity and the fact that, in many situations, underserved patients benefit by receiving oral health care that might not otherwise be available. The University of Colorado was the first to implement community-based rotations in both community clinics and private practices as an integral part of its program.³⁰

In addition to community-based education, the Macy Study also proposed that the patient-centered education/delivery model should be used within the dental school rather than teaching clinics that resemble preclinical laboratories with patients replacing the mannequins.²⁹ Within the proposed patient-centered system, a comprehensive care approach is used in which faculty members treat patients while supervising students, who gain experience as part of the team of providers. Each clinical team would typically consist of a small core of faculty members, junior and senior students, dental assistants, and patient care coordinators.

Bailit et al. calculated how community-based or patient-centered education could potentially increase revenues.⁷ Outcomes related to community-based education predicted a net savings per school of \$2.7 million, or 8.1 percent of total school expenses. Patient-centered care would potentially generate \$27.7 million in gross revenues, of which there would be \$18.6 million in overhead for net revenue over expense of \$9 million. In either case, these outcomes are significant, since the average dental school had approximately a \$5 million deficit from clinical operations in 2003.⁷ However, it's important to note that, with Bailit et al.'s proposed patient-centered model, the analysis assumes that patients are charged usual and customary fees for care provided by the faculty, while there is a 50 percent fee reduction for treatment provided by the students.

While the patient-centered education and delivery system has been more commonly incorporated into oral surgery and specialty clinics,^{7,24} it is only in the last five to ten years that some dental schools adopted a patient-centered model. Although not exactly the same as the proposed model in the Macy Study, a faculty practice-team approach is used within some predoctoral clinics.²⁹ While faculty members do not treat patients, this clinic model incorporates a comprehensive care approach, so that the patient's needs come first, rather than students treating patients only to meet their educational requirements. Three dental schools (University of Maryland, Columbia University, and University of Louisville) that reorganized their clinics to implement patient-centered delivery were evaluated as part of a case study that reported that increased efficiency and student patient billings occurred following the reorganization.³¹ However, despite the implementation of patient-centered delivery in these schools, with only students providing care, the clinics are still not self-supporting. As reported by Formicola, there are some lessons to be learned from the schools in that study.²⁹ The culture of teaching clinics is difficult to overcome, for example, since faculty members are resistant to becoming active practitioners. In addition, the patient mix, school location, and opposition to potential competition from local practitioners may also make transitioning to a patient-centered model in which faculty also treat patients more difficult.

Another model incorporating outsourced clinical education is used by A.T. Still University's Arizona School of Dentistry and Oral Health, where a portion of students' clinical education is conducted

in outlying clinics. In addition, didactic education is outsourced via adjunct visiting professors, who teach one- to two-week modules in their area of expertise.³² However, in most situations, other more traditional dental schools are subsidizing the true costs of providing instruction in the modular format by allowing their faculty to serve as visiting professors and not recovering the full costs of ongoing faculty benefits and time away from the university. Despite the major infrastructure cost savings at A.T. Still, where the dental school does not incur the legacy costs of maintaining a large full-time faculty, the students' yearly tuition, excluding fees, is currently estimated at \$39,860.³² Thus, this model does not appear to alleviate high tuition or student debt problems considering that the national average for predoctoral tuition and fees for 2005–06 was \$25,490.³³ However, the model does address the faculty shortage issue by having only nineteen full-time faculty available for a class size of sixty students. On the other hand, this methodology for staffing a dental school also makes it more difficult to maintain dentistry as a learned health science profession with so few dental faculty members able to contribute to research and scholarship.

Moreover, with the shift to adjunct faculty in outlying clinics and the creation of the non-tenure clinical educator track in many schools, these faculty members are typically not required, encouraged, or given release time to be involved in scholarly or research activities.^{14,34} With the increasing faculty shortages²⁵ at most dental schools, the clinical faculty spend the majority of their time involved with clinical instruction.

Dental School Faculty for the Future

If dentistry is going to remain aligned with the research university system, the ongoing faculty shortage must be addressed. As discussed, the combination of high student debt and the discrepancy between academic and private practice income is a prohibiting factor to dental graduates considering dental education as a career. As a result, dental schools tend to tap retired dentists, including retired military dentists, as a source for faculty. However, as pointed out in a recent article by Bertolami,³⁵ what retirees offer to dental education is sometimes limited to clinical supervision. It is not likely that baby boomer (aged fifty-five to sixty-five) faculty members will support or participate in efforts to introduce new teaching

and learning methods into the curriculum, figuring that they are relatively short-term employees in the interval between closing their practices and full retirement. This recruitment model for dental school faculty also sends the message to students that academics is not a first choice, but rather something to do when you retire from your primary career.³⁶

Perhaps dental education should be considered as a discrete category of dentistry, since practicing dentistry is very different from teaching dentistry. Anyone pursuing dentistry as a career, whether for private practice or academics, must be willing to incur significant direct educational expenses; forgo other income while in dental school; undertake grueling classwork, training, and examination; anticipate a future that begins with debt reduction; and face uncertainty about the amount and course of future earnings.³⁷ It has been suggested that dental students who would consider academics might be a distinct subset of dental students.^{35,38} For example, many students accepted into dental school have a higher sense of entrepreneurship and are willing to put their own financial assets at risk in order to develop a business-based dental practice, in return for significant economic gain.³⁵ In contrast, there are others who would rather be employed as dentists rather than filling the role of dental practice owner/proprietor. When comparing the lifetime income of employed dentists versus full-time faculty, the income differential is small because typically, as an employee, there is no production-based mechanism for increasing salary as is the case with clinical practice.³⁷ Dental schools should consider identifying and accepting some of those applicants who might prefer positions as employees and, accordingly, develop a pool of students who could be groomed for an academic career. The recruitment of such applicants should be included not only in the admissions process but also occur prior to admissions. One early opportunity for such recruitment could be through meetings with preprofessional health science groups such as pre dental and premedical college organizations. Despite the recommendation, there are currently no tested criteria or mechanisms that could be used to identify these students.

Even with identifying a pool of dental students better suited for careers in dental education, faculty compensation must also be addressed if dental schools hope to recruit and retain excellent academicians. It has been recommended that dental education consider the model of compensation policies typically employed in medical education.²⁴

Academic physicians bill for the patient care services that they provide while they simultaneously supervise and assist trainees. Although this might be difficult to implement initially, dental school faculty would receive extra income based on student productivity, or their own productivity, because faculty will undoubtedly provide more direct patient care if an approximation of the medical model is pursued within a dental school-operated treatment facility. In addition to increasing faculty compensation via supplementary income derived from patient care billing, several medical schools have implemented performance-based compensation for teaching, research, and academic service activities.³⁹⁻⁴¹ Survey evaluations of these programs indicate that the majority of respondents are satisfied with the incentive system and the associated income bonus. Utilizing these compensation plans in dental education could improve the financial benefits of an academic career and potentially increase the number of applicants for faculty positions.

Another way the dental profession has tried to address the faculty shortage problem is by instituting the D.D.S.-Ph.D. dual degree program. It was hoped that these programs would attract students with a genuine interest in an academic career, but the reality is that many of these individuals leave academics due to the burden of high debt, the lure of high income, or both.³⁵

There has been an increasing interest in having the Commission on Dental Accreditation (CODA) of the American Dental Association (ADA) provide accreditation for international dental schools.^{42,43} The most commonly cited reason for exporting accreditation is legislative pressure to import dentists to increase access to care;⁴² on the other hand, imported dentists might also help relieve the faculty shortage. However, with no requirement as to where these dentists should practice, international accreditation may not address access to care or faculty shortages. Currently, most internationally trained dentists integrate themselves into the U.S. system by earning a D.D.S. or D.M.D. in one of the advanced-standing programs available at thirty-seven of the fifty-six U.S. dental schools.⁴² Dental schools might use these advanced standing training programs as part of a faculty recruitment and hiring package for foreign-trained dentists. For example, qualified internationally trained dentists could be recruited for faculty positions and then allowed to participate at no charge in a modified advanced standing program, while serving as an active faculty member. To address retention following

program completion, the faculty member would be required to sign documentation agreeing to remain at the school for some period of time. If they left prior to the agreed period, they would be required to reimburse the school for the tuition costs of the advanced standing program.

The advanced education or specialty programs are another significant source of new faculty. In the last two years, 21 percent of new faculty were individuals who had just graduated from such a program.²⁵ Another potential benefit of the advanced education programs is that, while in the residency, these individuals could be involved with teaching predoctoral students to help ease the faculty shortage.

Collaborations with Private Industry

Previously, there was an arm's length model between dental education and industry due to concerns about commercialism.^{44,45} In spite of posing potential ethical risks, partnership models have evolved into mutually beneficial relationships, with dental school partnerships with private industry increasing.⁴⁵ Examples of such partnerships include donations for capital projects, endowed professorships, symposia, continuing education courses, educational materials, scholarships, fellowships, research funding, and access programs.^{44,46} Another common example of corporate support for dental schools is dental suppliers providing products and equipment at a significantly reduced cost to the schools. While corporate support reduces clinic operation costs, it also exposes students to the various companies and their products.

Many schools also have educational grants from implant companies. Besides providing students with the opportunity to place and restore implants in patients who might not ordinarily be able to afford them, the programs also establish student familiarity with particular implant systems. In addition, these implant grants might be related to the continuing decline in the percentage of graduating seniors reporting inadequate implant education, down from 50 percent in 2001 to 38.7 percent in 2006.¹⁸ Other potential areas of corporate support would be access to newer technologies such as digital impressions and associated computer-based systems such as CAD/CAM for generating indirect restorations.

Another mechanism for generating revenue, the selling of naming rights by secondary schools and local governments, is increasing.⁴⁷⁻⁵⁰ We could find only one example in dental education: Nobel

Biocare AB of Sweden awarded \$4 million to Tufts University School of Dental Medicine to name the Oral and Maxillofacial Surgery Clinic and further develop the study of dental implant applications.⁵¹ Financing dental education through naming rights may not be feasible for some dental schools and will be debated within the context of dental education and its institutions.

A novel example of private industry partnering with a dental school is the case of Nara Bank and the University of California, Los Angeles (UCLA), School of Dentistry. Nara Bank provided funding and facilities support for community-based health fairs, established a special loan program to enable low-income patients to receive dental treatment, and extended lines of credit to UCLA dental graduates to help them establish or buy practices in underserved areas.⁵² The concept of a public-private partnership of dissimilar business entities offers the possibility of a new means of support for dental schools. This partnership is a shift from largely top-down public funding to a combination of public/private/corporate funding. This approach has been proposed throughout higher education and continues to be explored in many different settings.⁵³

An additional corporate partnership approach was recently developed to finance orthodontic specialty programs sponsored by a for-profit company. The corporate/orthodontic graduate program was implemented within three universities, one private and two public.⁴⁴ However, within three years, the corporation had filed for bankruptcy, and the partnership is no longer in existence. Despite the fact that the university officials expressed surprise and stated the corporation appeared to be stable and well run, it was reported there were repeated warnings about the company that went unheeded.⁵⁴ This example points to the need for exercising extreme care in the development of education-industry partnerships.

The potential conflict of interest in the interactions of academics with industry and health professionals with pharmaceutical companies is being highly scrutinized. Stringent regulations are now enforced in many academic centers, so that, for example, academicians/health professionals do not accept products, gifts, meals, or payment to attend meetings.⁵⁵⁻⁵⁷ The intent of these regulations is to eliminate any industry influence or motivational factors that would bias the selection of a product that may affect patient care.

Besides direct dental education-industry partnerships, the ADA Foundation has initiated Dental

Education: Our Legacy, Our Future, a collaborative effort of partner organizations, such as dental schools, specialty associations, and other dental organizations, to raise awareness of the challenges facing dental education and promote philanthropy within dentistry to address these issues. It is estimated that, by 2014, these partner organizations will have raised \$500 million to address issues facing the future of dental education.^{20,58} These funds should be available for scholarships, fellowships, and loan forgiveness programs, in addition to supporting innovative educational technology efforts. However, despite these lofty goals, there will likely be limitations associated with this program.

Other Innovations to Address the Economics of Dental Education

Regardless of the numerous strategies that have been implemented, the current model of public dental education economics is not sustainable. To date, the fiscal problems have predominantly been addressed by increasing revenues via tuition increases and education models that potentially increase clinic income. However, to remain viable, the dental education system must adopt transformational actions to address its fiscal problems for the long term. In short, public dental education must re-engineer itself in order to be sustainable for the future. The proposed re-engineering might begin by exploring the following three ideas: 1) redesign the educational process, 2) reduce and redistribute time in dental school, and 3) develop a regional curriculum.

Application of Business Principles to Achieve Savings

Dental education and the curriculum have not changed much during the past century.^{14,59} By radically examining all aspects of the dental education process with an emphasis on quality, delivery, cost, and innovation, there is reason to believe that cost savings can be made. In FY2005, the overall dental education enterprise represented a \$2.4 billion operation.³³ By re-engineering a 10 or 20 percent savings in the entire enterprise, \$240 to \$480 million could be freed up for reinvestment, reduction in tuition, or improvement in faculty salaries. Business principles such as Total Quality Management (TQM)⁶⁰ or Kai-

zen⁶¹ among others should be explored on a pilot basis to determine feasibility and then implemented at those dental education institutions whose culture would support a major redesign process. Planning for new dental schools should incorporate the most efficient use of resources possible and subscribe to a continuous quality improvement philosophy.

Reduction in Education Time

Undergraduates utilize advanced placement (AP) courses and are able to test out of various courses to gain course credit, thus reducing their total instructional time in college. This happens in dental education with advanced placement students such as those internationally trained dentists who enroll in U.S. degree programs. What if dental students could take challenge exams or AP courses and thus reduce their total enrollment time in dental school? The ability of a student to reduce one semester or up to a full year would save up to 25 percent of the total tuition costs for a traditional four-year program. The key is having students certified as being competent in equivalent courses. This would force a restructuring of the first year of dental school, but could prove more useful and less costly for students. The savings might also translate to dental education programs as a result of the reduction of the instructional costs for providing the courses. However, to realize this savings, all students within a dental school class would have to participate in the AP program for particular courses; otherwise, if only a portion of the students opt out, the course would still have to be offered. Thus, although the advanced placement scenario might have merit, there are unanswered feasibility questions that would need to be addressed.

Restructuring across the dental school curriculum to eliminate redundancies and outdated methodologies along with the increased use of information technology could conceivably open up more time in the curriculum. This could be extremely important since most dental students feel overwhelmed in their first two years and would allow the dental school curriculum to remain at four years. Dental education in North America has historically been resistant to change.^{62,63} However, in 2005, the ADEA Board of Directors appointed an oversight committee, the Commission on Change and Innovation in Dental Education, to provide oversight to systemic, collaborative innovative change in general dentistry education.⁶³ A series of white papers has been developed to

detail the case for change and associated strategies for curricular and other areas of change.^{14,64,65}

Regional Education

Another redesign idea for dental education is to create a consortium of regional educational centers that prepare dental students for the biomedical, behavioral, and preclinical sciences curriculum. Institutions would share the cost of faculty and curriculum in this model. The regional facilities would be used efficiently by operating twelve months a year at a minimum of forty hours per week, unlike the utilization at current educational facilities, which often have minimal educational activities for ten to twelve weeks annually, especially in the summer. The use of costly teaching technology and preclinical simulation could be spread across a number of participating schools to reduce the high per student cost of instruction. For example, a \$60,000 simulator shared by four schools would only cost each school \$15,000 initially along with an annual maintenance fee. A 100-station preclinical lab would cost \$6 million for the simulators, but each school would only need to pay \$1.5 million to participate. An alternative to this purchase model could be a lease arranged by a dental school to spread the costs over time. In either financial arrangement, the major benefit of a regional consortium is sharing costs, thus lowering an individual dental school's costs for instruction in the biomedical, behavioral, and preclinical sciences curriculum and more efficient use of educational facilities. However, in either situation, schools would need to consider the annual cost of transporting students and faculty to where the simulator is housed and the impact on the anticipated savings.

Thomas Friedman in his book *The World Is Flat* describes how technology has been instrumental in changing the way we interact and interface with businesses and individuals across the world.⁶⁶ Utilizing these technologies can expand dental education from the traditional brick and mortar dental school to greater regional, national, and even international collaborations. It is not inconceivable for a lecture or symposium at one site to be teleconferenced worldwide. In addition, making didactic materials available to students 24/7 through the use of technology would allow for less time in the classroom and more in the lab or clinic.⁴³ The problem in implementing these innovations can be twofold: the lack of information systems infrastructure, and faculty inertia and resistance to change.

For the foreseeable future, a return to the federal government capitation grant program of the 1960s and 1970s is not anticipated. By considering some re-engineering initiatives, however, dental school leaders can begin to think and perhaps function differently. The ideas suggested to address the financial challenges facing dental education support the intent to continue to educate adequate numbers of dentists at a reasonable cost both to the student and the institution, while maintaining the position of dentistry as a learned profession. Failure to explore and implement new ways of educating dental students in a more cost-effective manner may result in less than desirable outcomes for the profession of dentistry in the future.

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