

# An Activity-Based Costing Model For Dental Schools: Is ABC A Feasible Costing Alternative?

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## Abstract

*Few studies related to activity-based costing (ABC) and health-care settings have investigated useful models for the health-care intellectual environment. This focus study targets one area within a dental school, the Restorative Department. The objective of the research is to determine the appropriateness of an activity-based costing system for costing departmental teaching<sup>1</sup>, research and service activities by designing a comprehensive model that describes procedures associated with implementation. The results of the study indicate that there are potential benefits associated with the successful implementation of an ABC system within a health-care intellectual environment. Some of the benefits include cost savings opportunities, enhanced budgetary processes and improved assessment of the efficiency of faculty performances.*

## 1. Introduction

Activity-based costing is a type of cost accounting methodology that focuses on the performance of processes, cost of resources, and cost objects. The basic premise of ABC is that activities consume resources (salaries, supplies expense) to produce an output. Unlike traditional costing methodologies, ABC concentrates on activities. Notably, the traditional view of cost accounting is based on services/products consuming resources. The activity-based costing view, however, is based on services/products consuming processes, then processes consuming resources via cost objects.<sup>2</sup> ABC can provide more accurate service cost compared to traditional costing systems due to the nature and greater number of activity-linked cost drivers used with an ABC system compared to a traditional costing system (Institute Management Accountants (IMA) 1993).<sup>3</sup>

Recent studies on the application of activity-based costing (ABC) to medical practices have focused on a conceptual discussion of ABC benefits. Health-care case studies have also been used to illustrate the application of ABC and its decision-making usefulness. Few studies related to activity-based costing (ABC) and health-care settings have investigated useful models for health-care intellectual environments

The objective of this research is to assess the feasibility of implementing an activity-based costing system for teaching, research and service activities by modeling a system that describe the procedures associated with implementing an ABC system in an academic department. The study also extends previous studies that applied ABC techniques to non-health care academic settings.<sup>4</sup> The next section of the paper provides a profile of the Dental School, while the following sections describe ABC model, related findings and implications. Recommendations are presented and the final section provides a summary.

## 2. Dental School Background

To investigate the appropriateness and to design an ABC model, the study focused on the Restorative department in a large Dental School. The School provides an array of dental education programs, including dental hygiene, graduate degrees in oral and craniofacial biological sciences and seven programs in advanced specialty education. The Dental School also operates several school-based dental clinics. In addition to the restorative department,

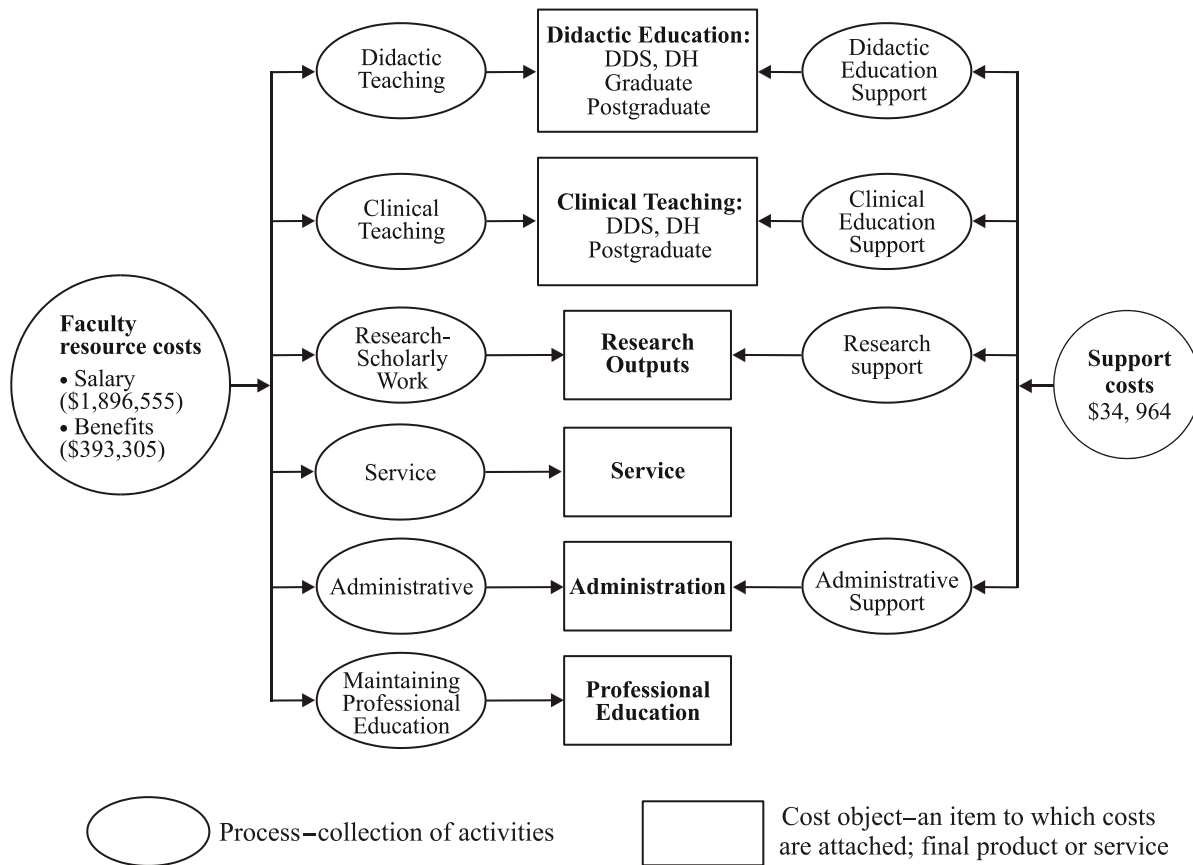
the School is comprised of nine other academic Departments. The faculty consists of approximately 77 tenured faculty, 13 tenure-track faculty and 140 non-tenure faculty. The total student enrollment is approximately 600 students.

The School is a multi-million dollar not-for-profit organization. The economic resources of the School include tuition/fees (19%), state and local funds (44%), patient care revenues (13%), endowments and gifts (3%), research/training (15%), and other educational revenues (6%).

**3. The Layout Of The ABC Model**

The Restorative Department is the second largest Department in the School. Restorative salaries account for approximately 16% of all departmental salaries. The objective of the model, hereafter referred to as Restorative Model, was to create a general model that costs various processes: research, service, continuing education, student teaching and student clinical education. Figure 1 illustrates the Restorative Model:

**Figure 1: Restorative Model**



**4. Designing The Restorative Model**

Faculty activity information was compiled from four primary sources: surveys, faculty interviews, faculty activity reports, and School financial reports. The data for the faculty activity report were collected and summarized by the technology information department of the School. The financial data, which included salaries and operating

expenses, were collected from the University’s computerized financial database. Faculty, student and patient clinic activity was collected from clinic activity databases. The Restorative Department Faculty consisted of 43 faculty members.

Next, the Department resources were identified. The Restorative Faculty resources (\$2,324,824) consisted of faculty salaries, benefits and operating expenses. The Faculty Model (Table 3) assigned the salary/benefits resources (\$2,289,860) to six faculty processes, based on the percentage of annual hours spent in each process. The Operating expenses (\$34,964) were assigned to the processes either directly (e.g., supplies and materials to Didactic Teaching) or spread equally (e.g., communications and contractual expenses) over specific processes.

The categories of effort were identified which represent the typical academic processes/activities performed by the Faculty. The faculty processes include Didactic Teaching, Clinical Teaching, Research/Scholarly Work, Service, Administration, and Maintaining Professional Education. Table 1, describes the activities within each process. The activity descriptions were obtained from interviews, faculty activity data and faculty surveys.

**Table 1: Processes And Related Activities Of Restorative Department Faculty**

	<b>Process</b>	<b>Activities</b>
<b>1.</b>	<b>Didactic Teaching</b> (a). Laboratory (b). Lecture (c). Seminar (d). Advisory (e). Prep	Direct student contact (non-clinical) including advisement on classroom and clinical performance, mentoring, thesis/dissertation guidance and committee involvement, didactic teaching preparation, lecturing, seminar instruction, and lab supervision.
<b>2.</b>	<b>Clinical Teaching</b>	Includes setting-up with students, reviewing of patient’s history and procedures to be performed, evaluation/signing of treatment plans and other clinical documents, student consultations, supervision of procedures/treatments, debriefing students and monitoring student’s preparation of patient’s bill.
<b>3.</b>	<b>Research/Scholarly Work</b>	Presentation of research, research administration and all other activities related to the publication of research. Represents activities associated with the publication of books or chapters, external presentations, editorial activities and other scholarly endeavors.
<b>4.</b>	<b>Service</b>	Includes committee membership participation, faculty practice activities, providing oral health care to the public and participation in University and professional organizations.
<b>5.</b>	<b>Administration</b>	Management activities related to the individual’s title or administrative appointment.
<b>6.</b>	<b>Maintaining Professional Education</b>	Activities include Continuing Education (CE) instruction and preparation of courses/programs for members of the oral health profession.

A cost driver is an item (e.g., patient treatments) that has a direct cause-effect relationship to a cost; it is an activity that creates the cost. While, cost objects, as reported in Table 2, refer to the final product or service provided. The cost objects were selected based on various criteria, which included the extent of available cost driver data (e.g., patient visits, treatment plans). Notably, one particular dental clinic was selected as part of the Restorative Model because it serviced more patients than any other student clinic. Thus, by applying ABC principles to this clinic, using faculty resources, may also provide insights that can be generalized to other School clinics.

A few of the cost drivers that previously linked resources to processes, were used to also link the cost of processes with cost objects. The five cost objects (as reported in Table 2) include the cost of Didactic Education, Clinical Education, Research Outputs, Service, Administration, and Professional Education.

Table 2: Restorative Department Process Costs Linked To Cost Objects

Processes	Cost Driver	Cost Object
<b>Didactic Teaching</b> (a). Laboratory (b). Lecture (c). Seminar (d). Advisory (e). Prep	# of DDS Courses <sup>A</sup> # of DH Courses # of Graduate Courses # of PG Courses	Didactic Education
<b>Clinical Teaching</b>	# of DDS Patient Treatments <sup>B</sup> # of DH Clinic Faculty Hours # of PG Clinic Faculty Hours	Clinical Education
<b>Research/Scholarly Work</b>	# of non-refereed Journals +2* # referred Journals + 3* # of books <sup>C</sup>	Research Outputs
<b>Service</b>	# of Service hours	Service
<b>Administration</b>	# of Administrative hours	Administration
<b>Maintain Professional Education</b>	# of CE hours	Professional Education

<sup>A</sup> DDS-Doctor of Dental Science, DH = Dental Hygiene, Grad = Graduate, and PG = Post Graduate

<sup>B</sup> The cost driver for DDS Clinical Education (cost object) is the total of chargeable treatments plus the cost of each non-chargeable patient treatment.

<sup>C</sup> The Research Outputs cost driver was weighted to capture the complexities of the refereed Journal and book publication process.

**5. Restorative Model Cost Of Processes**

The financial and nonfinancial data were used to calculate the cost of faculty outcomes (cost objects) and the cost of identified processes (e.g., Clinical Education) performed by the Faculty in the Restorative Department. Table 3 reports both the process cost and the cost percentage of each process. For instance, Table 3 shows the total cost expended (\$879,108) by the Restorative Department to educate students in DDS, DH, PG and Graduate programs<sup>5</sup>. The total Restorative Department--Clinical Teaching cost was \$701,093.

Typically, the Department’s cost is presented in a traditional, account-based style, which conveys aggregate information about the costs of resources supplied by the Restorative Department. The aggregated information creates difficulty when determining how the School is fulfilling its mission of providing quality Dental Education. The Activity-Based costing method, illustrated previously, however, presents detailed information (See Table 3) more clearly than the traditional costing methods. ABC may be more valuable when assessing the effectiveness of the Restorative Department in providing various outputs (e.g., clinical and didactic education). For example, the ABC model captures the financial value of DDS Didactic and DDS Clinical Education, while capturing the dollar level of the faculty who instruct and other related support given to the program.

**6. Faculty Model Cost Objects**

The costing of the various outputs of the Restorative Department is calculated by dividing the appropriate cost driver, such as the number of Dental Hygiene (DH) courses, as indicated in Table 2, into the assigned cost object’s process costs (Table 3). For example, \$1,529 is assigned to DH Didactic Education process, and the program has one course taught by a Restorative Department faculty, therefore, the unit cost for DH Didactic Education is \$1,529 per course (\$1,529/1 course). This reflects how DH Didactic Education (the cost object) consumes the DH teaching process.

*Cost of Didactic Education:* Table 4 reports the unit cost of Didactic Education per course. As mentioned previously, the cost provides information about how each cost object consumes the Didactic Teaching process. The results also reflect the financial value of four Dental teaching programs. The sub-unit cost for the four programs, ranges from \$583 to \$4,795. The ABC costing approach shows disparities between various processes (e.g., DDS Didactic versus DH Didactic Teaching). Traditional costing methods would fail to show this level of detail for these

different processes or activities. The number of courses offered and the sub-unit cost percentages for each program are also reported in Table 4.

**Table 3: Cost of Restorative Department Processes**

Process	Program Cost	Process Cost	Cost % of Process
<b>Didactic Teaching by Program*</b>			
(a). Student Contact (Laboratory DDS, Lecture, Seminar, Advisory)	\$476,597		
(b). Preparation	193,738		
<b>Total DDS Didactic Teaching</b>		\$670,335	28.9%
(a). Student Contact (Laboratory DH, Lecture, Seminar, Advisory)	\$1,529		
(b). Preparation	0		
<b>Total DH Didactic Teaching</b>		1,529	.06%
(a). Student Contact (Laboratory PG, Lecture, Seminar, Advisory)	\$147,156		
(b). Preparation	30,339		
<b>Total PG Didactic Teaching</b>		177,495	7.6%
(a). Student Contact (Laboratory Grad, Lecture, Seminar, Advisory)	\$19,181		
(b). Preparation	10,568		
<b>Total Graduate Didactic Teaching</b>		29,749	1.28%
<b>Clinical Teaching</b>			
DDS Clinic	\$611,980		
DH Clinic	1,526		
PG Clinic	87,587	701,093	30.2%
<b>Research/Scholarly Work</b>		219,049	9.4%
<b>Service</b>		332,912	14.3%
<b>Administration</b>		153,390	6.6%
<b>Maintaining Professional Education</b>		39,271	1.7%
<b>TOTAL PROCESS COSTS</b>		<b><u>\$2,324,824</u></b>	<b><u>100%</u></b>
<b>Operating Costs -----</b>	<b>\$34,964**</b>		

\* All Didactic Teaching by the Restorative Faculty total, \$879,108: (or DDS \$670,335 + DH \$1,529 + PG \$177,495 + Graduate \$29,749).

\*\* Operating costs were allocated to processes as follows. Subscriptions, Travel, and Staff Development cost were assigned directly to Research. Contractual Services were distributed proportionally, based on faculty hours spent, to Research and Didactic Teaching Programs. Communications Costs were equally allocated to Administration and Research.

**Table 4: Cost of Restorative Department Didactic Education**

Didactic Education	Total Process Cost*	# of Courses	Unit Cost of Process	Cost % of Process
DDS Didactic Teaching	\$476,597		\$3,404	20.0 %
DDS Preparation	193,738	140	1,384	8.0 %
DH Didactic Teaching	1,529	1	1,529	8.9 %
PG Didactic Teaching	147,156		2,830	16.5 %
PG Preparation	30,339	52	583	3.4 %
Graduate Didactic Teaching	19,181		4,795	27.9 %
Graduate Preparation	<u>10,568</u>	<u>4</u>	<u>2,642</u>	<u>15.3 %</u>
<b>TOTAL COST OF DIDACTIC EDUCATION PER COURSE</b>	<b><u>\$879,108</u></b>	<b><u>197</u></b>	<b><u>\$17,167</u></b>	<b>100 %</b>

\* From Table 3.

*Cost of Clinical Education:* The cost driver of DDS Clinical Education is the total of chargeable treatments plus the cost of each non-chargeable patient treatment. The cost per treatment for the DDS Clinic is shown in Table

5. Only the cost of clinical education provided by the faculty in the DDS clinic is calculated using the patient treatments cost driver. Specifically, DDS Clinical Teaching resources (Table 3) was divided by number of treatments, or  $\$611,980/12,018$  equals  $\$50.92$  per patient treatment. Cost information for the remaining clinics was calculated using Restorative faculty hours spent in each clinic. Dental Hygiene (DH) and Post Graduate Clinical Teaching per hour is  $\$30.52$  and  $\$28.41$ , respectively.<sup>6</sup> If the DDS clinical teaching was calculated using an hourly cost driver then the cost per DDS Clinical education per hour would be  $\$48.82$ . Notably, the selection of cost drivers can influence the unit cost calculation.<sup>7</sup>

**Table 5: Cost Of Restorative Department DDS Clinical Education**

Restorative Department DDS Clinical Teaching	Unit Cost	Number of treatments	Number of Students Paired w/Treatments
<b>TOTAL COST OF DDS CLINICAL EDUCATION PER PATIENT TREATMENT</b>	\$50.92	12,018	137

*Cost of Research/Scholarly Work, Service, Administration and Professional Education:* The costing of the remaining four processes provides insight as to the resources used by the other activities that faculty perform outside the classroom and clinic (See Table 6). In the resource allocation, external processes were not included. One faculty member participated in external education endeavors. However, this may be included in other Department models wherein a significant amount of independent activities are performed.

**Table 6: Restorative Department Cost Of Research/Scholarly Work,  
Service, Administration And Professional Education<sup>8</sup>**

	Cost of Research/Scholarly Work per Output	Cost of Service per Hour	Cost of Administration per Hour	Cost of Professional Education per Hour
<b>TOTAL UNIT COST</b>	\$6,259	\$48	\$54	\$46

## 7. Insights Provided And Implications Of The Faculty Model

The ABC Faculty Model can provide useful information in the following areas:

- Assisting in identifying areas for cost savings;
- Providing quantitative information regarding disparities among various activities;
- Providing useful information for budget preparation and internal decision-making decisions.

ABC will provide the opportunity to facilitate evaluation of faculty. Moreover, information provided by ABC can motivate faculty to evaluate the allocation of their time relevant to the plethora demands of academic life and faculty practice.

The Restorative Model may be useful in making more effective and efficient use of the School's resources, which may better meet and promote the objectives of the University. For example, quantifying the cost of DDS Didactic Teaching (and other processes) may help with future budget planning decisions and the determination of appropriate outputs for each process.

The selection of cost drivers significantly impacts the unit cost calculation. Therefore, the ABC cost system designed for the School must estimate, as accurately as possible, the different cost drivers, thereby, ensuring an accurate calculation of the unit cost for each program. Although the ABC Restorative Model does allow some flexibility in its cost calculation, the results do provide preliminary information on the usefulness of an ABC costing system compared to the traditional costing method.



## **8. Appropriateness Of Implemented Activity-Based Costing Model**

Although, activity-based costing has been recognized and accepted as a valued costing for manufacturing and service entities, its application to intellectual settings is limited. Therefore, the cost of activities and objects applied in this study may not heretofore been calculated or estimated.

The development of the Restorative Model and the ability to use these models to assign dollars to each faculty activity demonstrates that an ABC system should be considered as a feasible alternative to a Dental School's traditional costing system. An ABC model will aid in ensuring that expenditures of departments are aligned with the mission of the School. For example, one program although of primary importance may upon application of activity-costing reveal that it is absorbing a disproportionate amount of resources.

The information gathered from the model was useful in gaining an understanding of specific resources consumed by faculty activities. This study provided a significant amount of detailed costing data that the School's current costing system fails to generate. Health-care intellectual settings can benefit from a well-designed activity-based costing system, which will derive accurate cost for activities and services. This observation should be based on various observations, including the School's efficiency of their existing accounting information system, efficiency of the faculty activity collection process, efficiency of the faculty activity collection process and level of support of administrators, faculty and staff.

ABC implementation concerns were observed during the implementation process which included the:


- Extent to which ABC will be develop within the present management information systems.
- Evaluation of future ABC applications in other departments.
- Faculty and administrators expressed concerns regarding costing priorities and existing reporting systems.

## **9. Summary**

Activity-Based Costing (ABC) acceptance and recognition as a value-added costing method for manufacturing and service entities is well documented. However, only recently have the ABC principles been applied to health care providers and intellectual settings, such as dental and medical faculty departments.

The information gathered from this study is useful in gaining an understanding of the specific costing information related to activities of a Dental School. This preliminary study revealed a significant amount of detailed costing information that a traditional costing system fails to identify. This information can be useful in resource allocation decisions.

The results of this study provide a foundation for further ABC analysis. Full ABC implementation within any setting would require additional analysis and costs. Typical of most ABC implementation designs, assessing the time for particular procedures is difficult. For example, detailed documentation of faculty activities must be maintained in order to develop accurate costing information and to determine the appropriate cost drivers (e.g., number of courses, number of patients).

Given the findings, academic health-care departments should consider implementing a well-designed activity-based costing system. Health-care educational institutions can also use Activity-Based Management, which is the use of ABC information to manage resources more effectively. Such schools can use the increased accurate costing of activities and services to assess the efficiency of faculty performance, to identify cost savings opportunities and improve processes that will augment the productivity of faculty.<sup>9</sup> 



**Endnotes**

1. Siegel, et al. 1999. *Applying Activity-Based Costing in Healthcare*. IMA: Montvale, NJ.
2. Institute of Management Accountants (IMA). 1993. "Statement on Management Accounting (SMA) – Practices and Techniques: Implementing Activity-Based Costing", *Statement No. 4T*. IMA: Montvale, NJ.
3. Granof, Michael, David Platt and Igor Vaysman. 2000. *Using activity-based costing to manage more effectively*. The PricewaterhouseCoopers Endowment for the Business of Government: New York.
4. DDS-Doctor of Dental Science, DH = Dental Hygiene, Grad = Graduate, and PG = Post Graduate.
5. The Restorative Faculty Clinical Teaching per hour is derived by dividing the resource (Table 3, page 5) by the clinic hours.
  - Dental Hygiene Clinic:  $\$1,526/50 = \$30.52$  per hour.
  - Post Graduate Clinic:  $\$87,587/3,083 = \$28.41$  per hour.
  - DDS Clinic hours:  $\$611,982/12,533 = \$48.82$  per hour.
6. The selection of cost drivers can significantly influence the unit cost calculation. The individual programs of the School may alternatively determine another cost driver, which influence resources provided. The selection criteria should be based on the existence of a causal relationship between the cost driver and the cost object.
7. Table 6: Cost of Research/Scholarly Work, Service, Administration and Professional Education unit cost were derived as follows. Resource costs used in calculations are found in Table 3 (page 5).
  - Research/Scholarly Work: Resource cost/weighted outputs:  $\$219,049/35 = \$6,259$  per output.
  - Service: Resource cost/ Service hours:  $\$332,912/6,976 = \$48$  (rounded) per service hour.
  - Administration: Resource cost/ Administration hours:  $\$153,390/2,862 = \$54$  (rounded) per administrative hour.
  - Professional Education: Resource cost/ CPE hours:  $\$39,271/857 = \$46$  (rounded) per professional education hour.
8. Cooper, Robin, and Robert S. Kaplan.1991. *The design of cost management systems*. Englewood Cliffs, MJ: Prentice Hall.

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