



Virtual or In-Person Training: Applying Activity-Based Costing in Nursing Education

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ABSTRACT

Background: Cost assessment with modern costing systems can be conducive to the efficiency of education. In this study, activity-based costing was applied to calculate the cost of in-person training for undergraduate nursing students, and to evaluate the adjustable cost in virtual education.

Methods: It was a descriptive-applied research using cross-sectional economic analysis based on activity-based costing system. The statistical population included undergraduate nursing students in Lamerd, Iran. Data analysis was performed using the data obtained from a 4-year undergraduate program (2012 to 2016). The data were compiled in three categories, namely educational costs, support costs and cultural-welfare expenditure. The acquired data in face-to-face education were considered as the reference for comparison. Furthermore, the adjustable costs for the alternative e-learning approach were measured.

Results: The total training cost at Lamerd Nursing School during the four-year study program stood at US\$382,761. The per capita cost in this period was equal to US\$13,693. It was measured at US\$8,659 for educational activities, US\$3,933 for support, and US\$1,077 for welfare. Therefore, the highest per capita cost was in the area of education and the lowest cost was attributed to welfare. Furthermore, the curriculum cost in face-to-face training was calculated to be US\$664. Finally, it was found that virtual education would reduce the total cost by US\$156,199.

Conclusion: Activity-based costing system is a new model that helps restructure the financial systems of universities. It enables the senior management in these institutions to make informed decisions on adjusting educational activities based on the information acquired. One of these decisions involves comparing the cost-effectiveness of in-person paramedical training with that of virtual training. This is especially important in adopting modern educational models.

Keywords: Activity-based costing system, Learning, Training, Virtual education, Nursing students

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Introduction

Being the central activities in educational settings, learning and training require appropriate investment (1, 2). This is highly imperative in medical disciplines, especially in applied fields like nursing (3, 4). Higher education imposes significant direct and indirect costs on governments. In this respect, an estimation and comparison of educational costs in traditional and alternative models could help policymakers achieve substantial savings in higher education. New virtual methods may provide further transparency, and the advances in science and technology have enhanced the preference for these methods in various fields including education.

A critical objective in all organizational analyses is to improve cost-efficiency (5). Accordingly, health service planning and provision should be conducted with the available financial and human resources. Given that preparing professional workforce is a complex and time-consuming process, long-term health service planning is warranted (6, 7). On the other hand, universities' financial systems are influenced by external and internal factors, and changes in these factors may affect the efficiency of these systems (8).

Researchers worldwide have demonstrated that standardized costing systems can be an effective means of calculating the costs of goods and services (9). Therefore, considering the role of cost assessment in decision making, the design and implementation of a costing system for accurate calculation of the costs appears to be growing in importance (10).

Activity-based costing (ABC), is intended to calculate the cost of products and services. It involves applying special methods to evaluate the costs associated with complex and diverse procedures, changes in activities, and specific features of each activity. It also organizes and classifies information in order to identify unused resources and capacities, thereby reducing the costs of providing services (11-13). ABC can also help regulate the costs of services by providing comprehensive information about all the available resources (14, 15). A distinct feature of this system is its

ability to generate non-financial information required for improving the performance and efficiency of activities (15, 16).

This method is used in universities to calculate the cost per student, which is the estimated sum of the costs for different activities in the process of educating each student. Based on this information, planners and policy makers find out which activities have a larger share of costs, so that they can plan for the most efficient arrangement of activities (17). Several studies have been conducted using this method in different settings (18-22). Given the societies' urgent needs and the positive feedback from university officials around the world, ABC appears to be a valuable source of information for decision makers (23). This method provides data for customer profitability analytics, planning, modeling, support, budget development and measures for scorecards (24).

Aeenparast et al. (25) analyzed this method in medical settings, and the results indicated that the activity-based costing system is the most effective means of controlling the healthcare costs. This method was applied to improve financial documentation in public and private hospitals (25). The studies by Özyürek and Ulutürk (26), Ebadi Azar (27), Javid (14) and Najafi (28) showed that ABC could be used to gather accurate information for new training methods and strategic decision making. Although training nurses in the field is critical to their professional development, there are numerous other problems that should be addressed in nursing education (29).

Virtual education has emerged as a new alternative to traditional face-to-face training especially in remote areas. The rapid spread of Covid-19 has triggered massive changes in social conduct and educational policies around the world, leading to a rise in the use of e-learning and virtual technologies (30, 31). This is indicative of extensive developments in university education. Meanwhile, the all-too-familiar financial burdens in face-to-face education do further justify an evaluation of cost-effectiveness and usefulness of virtual

training for the purpose of adjusting the costs.

As a result, modern costing methods are conducive to effective cost management in universities. These methods can serve as a tool for advancing a systematic approach to nursing education, especially given the fact that no comprehensive research has been conducted on cost assessment in this field. Therefore, in view of the public requests and the support provided by donors and stakeholders in the field of public health, this study was conducted to evaluate the cost-effectiveness of nursing education at Lamerd Nursing Faculty.

Methods

Target Population, Setting and Location

This was a descriptive, applied, and cross-sectional study. The data were collected retrospectively based on the activity-based costing model.

After obtaining the approval of ethics committee of Shiraz University of Medical Sciences, the field researcher was referred to Lamerd University of Medical Sciences with a letter of introduction. After introducing himself and expressing the objectives of the study, he obtained the permission of the authorities; then, he contacted the Finance Department of Lamerd University. In this study, the costs of a four-year undergraduate nursing course were reviewed from February 2012 to 2016 using a checklist.

Choice of Model

The activity-based costing model (ABC) was used in calculating the cost price of services provided per student and the cost price of education per student. The cost of the nursing school was extracted from the university accounting department. The data related to the number of students and courses provided in each year were extracted from the curriculum documents available in the education office of the Nursing School.

Data Collection

A total of 1902 accounting documents from Lamerd School of Nursing were reviewed

under the supervision of the University's Finance Office. The researcher has complied with the moral obligation to maintain fiduciary duty regarding the University's financial documents. All data were collected by asking questions and looking into the documents at the Finance Office of Lamerd University of Medical Sciences, to reach the cost of a bachelor's degree in nursing.

Data were extracted using the accrual accounting system in three repositories of face-to-face training costs, cultural support, and the costs of addressing the needs in different time periods. The cost of three educational activities were extracted from theoretical courses, practical courses in clinical sciences, and accommodations including rental buildings, transportation, food, utilities and internet expenses. The cultural-welfare activities, on the other hand, included dormitory accommodations, sport competitions, student activities, book token, and cultural camping. Therefore, the total cost belonged to administrative, educational, training, and other expenses.

Data Analysis

The descriptive analysis of the data, the tabulations and the calculations were entered into Excel 2010. The precision of data collection was compared with the annual balance using the accrual accounting system. The output simply provided a table of college fees per student (per capita rate) in the academic years under study. Moreover, cost analysis based on student per capita was conducted through budget segregation. In this regard, all the expenses considered during the student education were calculated.

Therefore, after identifying the cost items and thorough analysis of the financial processes of Lamerd Nursing School as a newly established faculty, and during the second year of its activity, we made an attempt to adapt the cost-based method of activity. Using the financial information of the faculty during the course of the study, we categorized the necessary budgets under the themes of 1-training 2- support, and 3-welfare-cultural

development in face-to-face education. Furthermore, adjustable costs were set out in the alternative method of e-learning.

Results

This study aimed to investigate the cost of training undergraduate nursing students using ABC system in face-to-face method, and to evaluate the adjustable cost in virtual education. The results, as shown in Table 1, revealed that the cost of face-to-face training of 28 nursing students in the four-year period (2012-2016), based on the monetary value of 2016, was 11,482,853,000 Rials (\$382,762). Therefore, the per capita cost of student education was found to be 410,101,000 Rials (\$13,670) in the four-year curriculum. According to the results, the share of educational affairs was 7,274,317,850 Rials (\$242,477), with per capita student expenditure in the education sector being 259,797,000 Rials (\$8,659), which comprised 63.3% of the total expenses.

The price of the support unit action was 3,303,754,000 Rials (\$110,126), with per capita student support costs being 117,992,527 IRR (\$3,933), which is 28.8% of the total expenditure and ranked as the second highest

expenditure. The cost of the welfare-cultural activity was 904,744,400 Rials (\$30,158), with per capita student expenses of 32,312,303 Rials (\$1,077) which is 7.9% of the total costs. According to these results, the welfare-cultural sector was ranked third in terms of the cost. The cost of the completed classroom course divided by 144 units based on total expenditure in the four-year period was 79,742,000 Rials (\$2,658).

As displayed in Table 2, the total share (%) of the whole tuition fees and cost of human resources including salary, educational, administrative-support, extracurricular activities, and other related costs was referred to as the overhead cost. This cost amounted to 7,274,317,850 Rials (\$242,477) accounting for 63.35% of the total expenses. After the cost of human resource, that of contracts (rental of buildings and hospitality) with 24% of the total cost of living in the dormitory as 4.38% had the highest proportion.

This Table is based on the cost of thirteen activities divided by the expenses, cost of ownership, and percentage of costs to the total and students' costs per activity.

In terms of educational expenses in theoretical courses, the cost of each unit

Table 1: Student Nursing Education (Face-to-Face) Costs at Lamerd School of Nursing (Figures to 1000IRR)

Type of Activity	Student per capita cost	The cost in four-year period	Percentage of cost
Educational	259,797	7,274,317	63.3
Support	117,992	3,303,754	28.8
Welfare-cultural	32,312	904,744	7.9
Total	410,101	11,482,853	100

Table 2: Percentage of total cost shared of the student training fee (Figures in thousand Rials)

The kind of activity	Cost	Education	
	No. (%) (Thousand Rials)	Face to Face	Virtual
Human Workforce	7,274,317 (63.35)	Essential	Adjustable
Dormitory accommodations	504,000 (4.38)	Essential	Removable
Contracts	2,750,666 (24)	Essential	Adjustable
Sports	156,592 (1.36)	Essential	Adjustable
Book token	48,692 (0.42)	Essential	Adjustable
Food	313,563 (2.73)	Essential	Removable
Student activities	64,075 (0.65)	Essential	Adjustable
Cultural camp	120,000 (1.04)	Essential	Adjustable
Internet subscription	8,000 (0.06)	Essential	Adjustable

Table 3: Relative adjustable costs in virtual education per capita and percentage cost of nursing expertise in face-to-face training (Figures in thousand Rials)

Row	Type of activity	Student per capita	Percent	Unit cost	Unit number	Quantitative Unit	The final cost	Cost field	Adjustable cost
1	Theoretical Courses	222,126	54.16	66,165	49	Theory unit	6,219,541	Educational	No
2	Practical Courses	5,949	1.45	15,143	11	Practical unit	166,581	Educational	No
3	Clinical Courses	31,721	7.73	22,774	93	Clinical unit	888,194	Educational	Yes
4	School Building (Rental)	18,528	4.51	18,528	82	People	518,800	Supporting	Yes
5	Transportation	79,709	19.43	79,709	82	People	2,231,866	Supporting	Yes
6	Nutrition	11,198	2.73	11,198	82	People	313,563	Supporting	Yes
7	Internet subscription	582	0.06	0.231	34,560	Hours	8,000	Supporting	No
8	Energy (water and electricity)	8,270	2.05	812	1,058	Square meters	231,561	Supporting	Yes
9	Accommodation in the dormitory	18,000	4.4	18,000	82	People	504,000	Welfare	Yes
10	Sport competitions	5,592	1.36	19,574	8	The period	156,592	Welfare	No
11	Student work	2,695	0.65	12,576	6	People	75,460	Welfare	No
12	Book token	1,739	0.42	1,739	82	People	48,692	Welfare	No
13	Cultural camp	4,285	1.05	15,000	8	The period	120,000	Welfare	No
	Total	410,101	100	410,101	82	People	8 11,482,853	As a whole	4,687,984

was 66,165,000 Rials (\$2,205) with the student's cost of 222,126,000 Rials (\$7,404), which comprised the highest percentage in educational activities (54.16%). The cost of training for all practical courses for each student was 166,581,000 Rials (\$5,553) and per capita cost per unit for each student was 15,143,000 Rials (\$505). The cost of the clinical courses at the Faculty in the four-year period was 888,194,000 Rials (\$29,606), with each clinical course cost of 22,774,000 Rials (\$759). The cost of personal support and transportation was 2,231,866,000 Rials (\$74,395) with 19.43% as the highest percentage.

Internet expenses amounted to 8,000,000 Rials (\$267), with 0.06% as the lowest cost. The cost of the dormitory was 504,000,000

Rials (\$16,800) with 44% as the highest expenditure. In the welfare activity, the lowest expenditure was related to book token by allocating book token with 42%. In general, it was estimated that virtual education would reduce the overall costs by almost 4,687,984,000 Rials (\$156,266).

Discussion

Training nursing students during the four-year period based on monetary value of the year 2016 was 11,482,853,104 Rials (\$382,761) at Lamerd Nursing School. The expenditure included education, welfare, and cultural support. The educational activities and costs were related to theoretical courses, practical courses providing clinical sciences, and support including rentals, transportation, food,

utilities and internet expenses. The cultural-welfare activities, on the other hand, included dormitory, sports competitions, student work, book token, and cultural camp. Thus, the total cost was related to administrative, educational, and other expenses.

According to the results, the highest expenditure was in the area of education and the lowest was in cultural-welfare activities. However, the significant cost of this face-to-face training can be reduced by switching to virtual training. Furthermore, the cost of welfare can be eliminated.

The results showed that despite the initial perception, the cost per capita was low and the amount of the cost was high at the faculty with its major contribution to human resources including salaries, educational wages, administrative support, and other related costs. A large portion of these costs was concentrated in the university and paid as salaries and personnel costs. This issue reflects the focus of management at the university level and lack of independence in the schools that could fade and eventually reduce the performance of management productivity and efficiency.

Similar to Ebadi et al.'s research (27), the financial documents studied in this work showed that the accounting system used was based on traditional methods that do not have the capability of fast response to university administrators when information is needed.

Since human resources are key factors in improving the performance of the faculty, the selection and recruitment of faculty members according to academic and professional qualifications are important for increasing creativity, dynamics, and emergence of new ideas in scientific and professional contexts. Ebadi Azar et al., in a study calculated the cost of undergraduate education at the Faculty of Management and Medical Informatics of Iran University of Medical Sciences in the academic year 2006-2007, using the ABC method. After the final calculations, the cost of education in all sections of the faculty in this academic year was 18,586 Rials and the average cost of undergraduate

education was calculated as 12,987 Rials (27). Compared to the cost per student at the level of undergraduate education at Lamard Nursing Faculty, it was about eight times higher during the four-year period of the college education in Faculty of Management and Informatics, Iran University of Medical Sciences in a school year with the sum of 98,712 Rials.

In Ebadi Azar et al.'s study, however, the cost of providing a unit of study in one academic year was calculated for all sections at 8,902,854 IRR (\$890) (5), while e-learning can reduce adjustable costs per capita, as shown in Table 3. The 6 factors in the areas of welfare, education and support can typically be adjusted to virtual education, reducing the estimated costs of nursing undergraduate students to 4,687,984,000 Rials (\$156,266).

A review of studies show that the cost analysis in the fields of education, support and cultural-welfare has been very limited, while this study examined these costs in a four-year period. Cost analysis in different areas helps educational planners and policymakers make the least cost possible by estimating the fixed costs, i.e. determining a consistent level of benefit to make universities more accurate and efficient in using their available resources. Accordingly, the exact compilation of the costs of faculty studies can be extended to similar colleges.

Therefore, it suggested that similar studies should be conducted in educational economics that provides, calculates, and accurately estimates the budget based on the affairs of nursing faculties, providing an appropriate basis for increasing efficiency and administration of educational affairs.

Virtual education for paramedical students can reduce the cost of transportation, accommodation or dormitory, and some related costs such as food. Although the provision of infrastructure is a significant issue, the initial investment cost will lead to a reduction in consumption costs in subsequent years. The use of rapid technology for education such as artificial intelligence to adapt learning and virtual reality to the

fundamental components of the evolution and future of medical education has attracted attention of authorities around the world (32).

Eslami (2016) acknowledged that virtual education is equal or more effective than traditional education. Also, a positive attitude and high satisfaction among students and faculty members regarding the use of virtual education has been mentioned in most studies. However, the effect of virtual education on learning and satisfaction of learners and teachers can be different depending on the method used and different disciplines in medical sciences which also need to be studied (33) CERMS (Center of Educational Research in Medical Sciences).

COVID-19 pandemic has made a major change in medical education around the world, with the use of rapid technology and innovation, especially e-learning to sustain education and learning more than ever before (34, 35); this can somehow reduce the cost of face-to-face or traditional training. Transforming traditional face-to-face learning into online and virtual formats for undergraduate and postgraduate clinical programs in Covid 19 could be a new learning opportunity (36, 37). The opportunity to use e-learning will enable the students to benefit more widely both inside and outside the country due to time constraints (32).

In addition, it is cost-effective to study the establishment of paramedical disciplines, especially clinical ones with special infrastructural needs in small cities; in this regard, the facilities of neighboring cities and provincial centers can be used to perform the desired training at a lower cost. This issue needs research and investigation. When we have virtual and blended training in such a way that we hold part of the training face-to-face and partly as a virtual course, we can actually reduce the cost of training and invest in equipping the infrastructure.

Knowing the cost benefit analysis in terms of the type of activity helps the educational planners create the least cost possible by estimation, through determining a consistent level of benefit to make universities more

accurate and efficient in the use of their available resources. Accordingly, the exact formulation of the cost of study is applicable to similar schools and budgets need to be accurately estimated with simple changes in inputs. The cost of nursing student education which is remarkable makes the apparent need for reviewing the students' selection mechanisms for the graduates and maximizing the productivity of the workforce remarkably. For this reason, establishment of the field should be done according to the actual needs of the country. Although there is no specific standard for sharing different costs for human resource training in the country, training and support costs seem to be a considerable amount and requires a review of the cost control. Therefore, the professors and experts' efforts to provide standard cost indicators for all disciplines in the medical group can be effective in formulating a program budget and controlling the costs of student education.

In recent years, when attention to e-learning has been significantly considered in universities, while removing space and time constraints, the cost of face-to-face education compared to e-learning for disciplines such as nursing in small cities is a challenge that should be surveyed. Furthermore, influential practical teaching of different types is recommended to be studied.

Apparently, holding training courses on health economics for university medical students and research on the use of human resources is very useful in controlling the costs and making optimal use of available resources, especially during natural disasters such as Covid-19 event. The development of virtual learning in Covid-19 era, and also further studies about the expenses in this period are recommended to be considered. However, the significant cost of this face-to-face training can be reduced by changing to a virtual training status; on the other hand, the welfare costs can be eliminated, but the cost of providing infrastructure must be considered.

Limitation

One of the limitations of this study was the

access to information of only one university. On the other hand, it is recommended that the costs of virtual education as a result of the Covid-19 event should be studied and calculated in future studies.

Ethical Considerations

This paper was approved by the ethics committee of Medical Education Research and Development (EDC) at Shiraz University of Medical Sciences with ethics code of IR.SUMS.13504.

Authors' Contribution

L.B. contributed to the concept and design of the experiments and interpreted the data. L.M. contributed to the concept, designed the experiments, and wrote the English draft. M.N. gathered the data under the supervision of L.B. and also analyzed and interpreted the data. All authors were actively involved in writing and critically revising the paper.

Conflict of Interest

Authors declare no conflict of interest.

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