



# Investigating the Effect of ADDIE Model on the Effectiveness of Clinical Education of Operating Room Students

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## Abstract

**Introduction:** As a clinical setting, the operating room (OR) is also a complicated system; there are a lot of contrasts and complexities between the OR environment and other clinical areas regarding the teaching and learning process. Effective teaching in the operating room is clearly one of the most important and yet most challenging and difficult-to-define tasks for any educator. There is no instructional model for operating room students. This study was aimed at developing a clinical education model for OR students, in accordance with ADDIE model.

**Methods:** The ADDIE model was used to guide the development of clinical education in five University of Medical Sciences. The ADDIE model includes five steps of Analysis, Design, Development, Implementation, and Evaluation. Qualitative method, literature review and curriculum assessment was used to generate five step ADDIE model.

**Results:** Conceptual model "gaining of clinical competence and approval" was appeared in analysis step ADDIE model. Presenting educational objectives, learning communication skills and teamwork, performing objective evaluation, administering a comprehensive test, as well as learning from surgical team members and peers were also specified.

**Conclusions:** The findings of the research, in relation to the clinical training of students in the operating room field, indicated the uniqueness of the clinical environment of the operating room and how the student copes with the different conditions of the environment and teamwork in the operating room. The present research led to the design of a model based on the general pattern of educational design (ADDIE model). ADDIE provides a model for common understanding of teamwork to increase aptitude and professional competence of operation room students. It also provides evidence the usefulness of ADDIE model on clinical education for OR students.

## INTRODUCTION

Clinical education is taken into account as an integral part of medical education [1]. As a clinical setting, the operating room (OR) is also a complicated system; the coordination of individuals, technologies, and patients in a physical environment to achieve appropriate outcomes [2]. There are a lot of contrasts and

complexities between the OR environment and other clinical areas regarding the teaching and learning process, since there are additional influential factors including teamwork in various patient care situations. A variety of procedures occurring in various rooms in the OR, pace and precision of action, rapid patient turnover,

frequent cases, rapid occurrence of high-risk events in ORs, acute and severe emergency situations, and simultaneous management of multiple tasks and duties. In addition, multicultural environments can shape all educational processes and support, inhibit or restrict learning opportunities for students [3, 4]. Numerous studies have shown the absence of a common understanding of what OR teamwork is or what students do, as members of the OR team in a clinical environment [5]. Therefore, an effective instructional design will be an important key to the success of an educational program in this clinical area. It is noteworthy that the effectiveness of a model is heavily dependent on a field in which it is applied. Educational models are situational but not comprehensive, or universal and they should be utilized in the field created for that purpose [6]. In the present study, the ADDIE model was used because the ease uses of, and inclusion of components of other models. It was choosing for its applicability in clinical education based on behaviorist, cognitivist, and constructivist learning approaches, which encompassed all learning domains i.e., cognitive, affective, and psychomotor. It should be noted that instructional design models often include only the first two phases; analysis and design, and then focusing on analyzing skills or knowledge that must be acquired and turned into such analyses for educational strategies [7]. Clinical education in OR environment is a multifactorial with unknown aspects. In order to cover a specific aspect of education in detail, the use of quality approaches with a comprehensive viewpoint besides quantity approaches is crucial. Grounded theory was implemented to generate Analysis step ADDIE model (Explanation and determination of the current situation). Therefore, the aim of present study was to deliberately develop a clinical education model for OR students, in accordance with ADDIE model.

## METHODS

This research was carried out using a combination method (qualitative stage and Instructional design stage) during two phases in Mashhad University of Medical Sciences in 2015-2017.

### Subjects

The study population included: ( i ) instructors of surgical technology with at least one year teaching experience, ( ii ) surgical technology students of different semesters who completed at least one internship course in the OR, ( iii ) surgeons, ( iv ) head nurses and personnel of the OR with no less than one year working experience, who were experienced and willing to report on their practice and familiarity with the subject.

### ADDIE Model

The ADDIE model comprised five steps, including Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model, as an instructional design model, is a general structure used by its developers to make changes to the education template depending on whether or not the subject is educational, political or cultural, cognitive or practical, or to remove or add parts as appropriate [7]. The qualitative method (Grounded theory) was used to generate the first step in this study. Investigating the clinical training of operating room students, identifying their knowledge input capabilities, abilities, skills and needed, influencing factors in clinical training, challenges related to educational issues and educational strategies used, were among the activities that were carried out in the **analysis** step with qualitative method. In other words, what should students do to achieve the desired competencies? The **design** phase was completed in six steps including designing educational objectives, educational activities, content, educational transfer methods, educational media, and student assessment methods. This stage determines all goals, tools to be used to gauge performance, various tests, subject matter analysis, planning and resources. In the design phase, the focus is on learning objectives, content, subject matter analysis, exercise, lesson planning, assessment instruments used and media selection [8]. To validation the educational model, a focus group (by 10 specialists or experts in education) was used to validation and the quality of an educational model and its concepts [9] (Score between 0 and 10 from 13 evaluation item).

### Ethical Considerations

The study was approved by the regional ethics committee of Mashhad University of Medical Sciences with the code number of 940548 / 2015.08.15. A written informed consent was obtained after explaining the objectives of the research with attention to the main objectives.

## RESULTS

The study setting was the ORs of teaching hospitals, including five universities of medical sciences. The participants were clinical educational stakeholders, presented in [Table 1](#).

Insert [Table 1](#)

The results are presented in sequence of steps'

The Analysis phase: The findings of this step, in relation to the clinical training of students in the operating room field, indicated the uniqueness of the clinical environment of the operating room and how the student copes with the different conditions of the environment and teamwork in the operating room. The data from the qualitative research (grounded theory) was published in article entitled "Educational concern of surgical technology students in the operating room, J Edu Health Promot 2020;9:58"[4] . Students' refusal by

surgical teams was defined as the main concern of OR student. The Interactive and dynamic nature of the OR environment was also identified as the context for this major concern. Gaining clinical competence and approval was obtained as the central process (containing three strategies) regarding the main concern of clinical education that included: ( i ) student’s individual approach to enter a surgical team, ( ii ) learning in the shadow of surgical team members, and (iii) help and support from instructors. Eventually Conceptual model “gaining of clinical competence and approval” was appeared in analysis step. This section finding reveal that during the course of training, the students

experienced demanding conditions correlated to the non-acceptance by the surgical team as an educational member, and subsequently turned to other solutions to acquire the competence and skill they need. The design phase which included six steps, i.e., designing educational objectives, educational activities, content, educational transfer methods, educational media, and students’ assessment methods was formulated based on three information sources; 1- qualitative data, 2- curriculum assessment, and 3- an extensive review of related literature. An example of the use of three sources was given in Table 2, where researcher’s inspired and designed their own instructional model.

**Table1.** Study Participants’ Characteristics’

Participants	n	Age(years)	Sex	Work Experience in OR
Student	14	20-22	11 women/3men	Term 4-8
Educational instructor	7	35-48	5 women/one men	3-20 years
The OR personnel	6	32-55	5 women/one men	8-25 years
Dean of faculty	1	52	men	-
Surgeon assistant	3	32-48	men	4-5 years
Staff	1	53	men	17 years
Head nurses of operating room	4	32-55	men	15-29 years

**Table 2.** Results of qualitative data analysis

Main theme	Sub-Categories
<b>Different educational environment</b>	the value of time; presence of students of other majors at the same time in the operating room; red lines, safety and sterility rules; disproportion of internship programs to curriculum goals; inappropriate evaluation of the student; the interaction between caring and technical roles; less control an instructor over the environment; using of non-specialized instructors, the training of a student in the form of the surgical team; coordination with experienced surgical team members
<b>Operating room culture</b>	Teamwork performance; gender discrimination; hierarchical structure (the atmosphere of physician dominance) ; tension in professional interactions as well as inappropriate interactions; the duality of behaviors / avoiding setting rules and standards; the impact of stress resulting from the surgeon’s assistant team on the education of OR students
<b>Non-acceptance of Student by surgical team</b>	Cumbersome student and lowering the speed of surgery; the probability of student error due to lack of knowledge and prerequisite skills; the probability of un sterilization of surgery field; non-constant supervision of the instructor in the operation room environment; excessive student stress in the real educational environment; inexperienced instructor
<b>Bitter education</b>	unenjoyably learning, stressful atmosphere; the paradox of expectations with the reality ; the humiliating experiences; internal tensions resulting from stressful education
<b>The efforts required to cross the wall of distrust for the student and each student’s individual approach to enter the surgical team</b>	having the pre-requisite knowledge and skills, attempts to ensure the surgical team, satisfaction of the surgeon, constructive interpersonal communication (professional interactions) finding student job
<b>Learning in the Shadow of the surgical team members</b>	Observation and modeling the surgical team members; stress-free training with the supportive personnel; reducing the learning opportunities with the deterrent personnel; seeking help from the design personnel ; bearing the burden of training by the team members; effect of the surgeon’s patience on the training of the student
<b>The help and support that students sought from the instructor</b>	The clinical competence of the instructor; increasing the specialized skills ; the umbrella support and authority of the instructor; the presence and communication skill of the instructor; creating the learning opportunities for the student; the popularity and moral character of the instructor; poor clinical experience, inadequate skills and knowledge of the instructor, and presence of instructors with other/irrelevant specialty; reflection of clinical problems to the authorities by the instructors
<b>The feeling of belonging to the surgical team</b>	experiencing technical skills by the student and joining the surgical team; self-growth and personal excellence; the success and achievement of professional identity of the OR students; experiencing and engaging in surgical team activities
<b>Passivity</b>	Leaving the major ; Continuing education in other majors

**Table 3.** An example of the design stage of education model

The result of qualitative data analysis (related to students)	Assessment of the curriculum	A review of the literature
<b>Use of individual strategies ( self-directedness), The presence of students ,including unmotivated and uninterested students assiduous and interested students, Confusion, indetermination and lack of student effort to gain skills and experience, in the absence of an instructor in the surgical ward, Providing more opportunity for the student to learn through high social interactions with the surgical team members, Search for information from senior students and members of the surgical team members</b>	A combination of instructor based education and Student based education in clinical education	Lack of student decision-making power in the patients’ care planning, The lack of suitable scientific context in the surgical ward, Un simplicity of teamwork training, unwillingness, confusion, indetermination of the student in the absence of an instructor, not providing diverse learning opportunities, the distrust of instructors and surgeons to students caused their reluctance to learn clinical skills, Not receiving proper feedback from instructors, The positive or negative effects of the clinical environment on education (work motivation, job satisfaction, staff familiarity with a job description, and the level and manner of relationship between staff with students

In the design of education Model: Attention to the students’ Individual Differences by educational instructors; students’ self-control over the learning process taking into consideration at least 10% of the evaluation based on the decision and approval of the students of internship groups (two out of twenty scores) encouragement, giving positive feedback to assiduous students (employing the empowered students as mentor or preceptor)

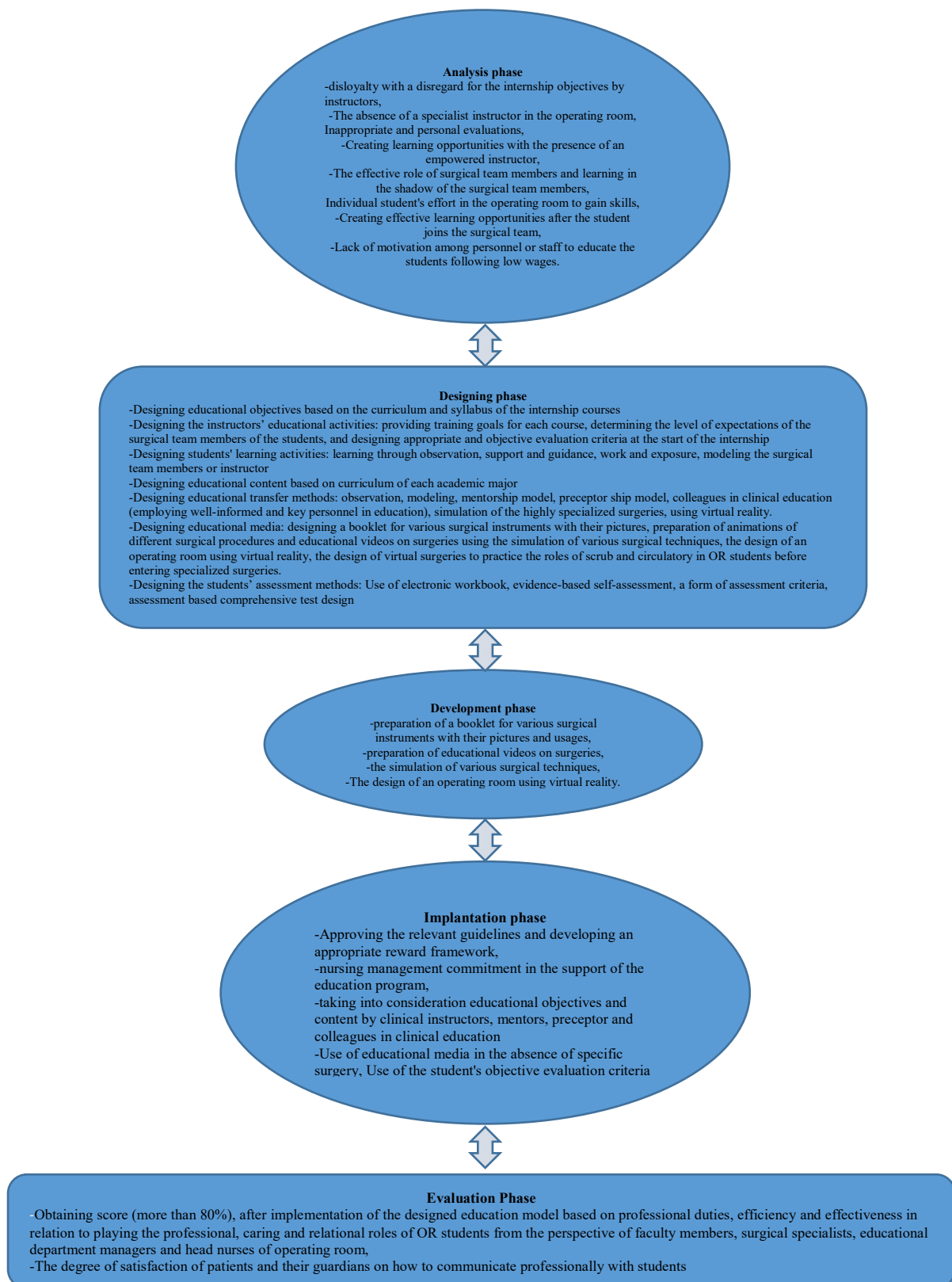


Figure 1. Schematic diagram of education model designed

Figure 1 was showed in detail the findings obtained from the five stages of the ADDIE model. Finally, the most suitable educational model was designed using steps findings and literature review. In conclusion; once the

designed educational model was modified by 10 members of the focus group, it was rated based on a scale from one to ten. The mean score obtained was 9.3,

indicating desirability and suitability of the educational model designed.

## DISCUSSION

This research introduces development of a clinical education model at five medical sciences universities. The educational model was developed based on existing data. Findings suggest that loss of learning opportunities stemmed from the shortage of specialized education instructors or the use of non-specialized instructors in ORs. Several investigations have also shown that in case of a shortage of instructors, the participation model of well-informed and key personnel such as clinical colleagues, mentors, and preceptors was an effective method [10, 11]. This method would make students make better use of facilities and gain skills and techniques more effectively compared with routine internships, leading to an increased feeling of connection to a surgical team and assuming responsibilities in students, as well as self-confidence and understanding. There were inadequacies in the current curriculum, so attempts were made to resolve the inadequacies through teaching. Topics to be included are team work and professional interactions in the form of workshops, use of empowered students as peer educators or the employment of clinical teaching associates in the absence of instructors for internships for conduct in the ORs, sterilization unit, and OR management. The effectiveness of the ADDIE model had been highlighted in various studies [8, 12, 13]. As evidenced in this study a student-centered approach, observational learning, preceptorship and mentorship, clinical colleague programs, and constructive feedback have been introduced as the strengths of this educational model. To the best of this knowledge, no study had been conducted to identify the clinical education process of OR students through a qualitative method using comments and experiences of stakeholders and experts to develop an efficient practice model. Studies executed in Iran have also shown that clinical education programs have little value exhibiting the readiness of the student to pass from the role of a student to a professional [14], stressful experiences of novice nurses in relation to the lack of skills required for patient care [15], and students' dissatisfaction with clinical education [16]. Finally, the quality of clinical education and students' levels of satisfaction could be improved [17, 18]. Therefore, in the case of a shortage of instructors, this educational method can be used in the course of internships, such as in a sterilization unit, OR management, teaching care principles in recovery rooms, and performance in the ORs. Data showed student's individual approach to enter a surgical team, was effective. Result of study by Q Xie, L Zhang also approved that the strongest and weakest predictor of learning approaches were personality and ability,

respectively [19]. The study by Walker, Susan H and Norris, Kellie revealed Preceptors require training and support in the role. General Practice Nurse preceptorship should support the development of existing professional competencies, including the ability to make real-time autonomous clinical decisions. The financial costs, and cost of time away from clinical care, should be ameliorated as far as possible, when instituting a national General Practice Nurse preceptorship program [20] This study and others, have highlighted insufficient supply of qualified instructors and the use of instructors without considering their ability and expertise as clinical educators [2, 18, 21, 22]. As evidences in this model, preceptorship and mentorship programs as well as clinical colleagues were recruited to increase students' collaboration, acceptance, an increase learning opportunity and a sense of belonging to surgical teams, to become a member of surgical teams, and reduce stressors in clinical environments [23].

## CONCLUSION

Findings suggest that the benefit of using the ADDIE model provides a model for common understanding of teamwork it will be used to increase the aptitude and professional competence of the OR surgical technology students. It also provides evidence on the effects of clinical education. The designed model, can lead to gaining surgical team membership and will create learning opportunities for OR students as a surgical team member. Using a qualitative approach in this study along with curriculum assessment and an extensive literature review in designing all phases of the educational model were considered as the strengths of this research.

### Limitations of the Study

Implementation of this model requires creation of an infrastructure including agreements with hospitals on equalizing the benefits of clinical colleagues and supporters of a students' education. It also requires modifications in clinical education programs, approval of relevant guidelines, development of appropriate reward systems, and the financial commitment of nursing management in support of the educational program.

### FUNDING

The authors have not received any funding.

Conflicting Interest

There are no conflicts of interest.

### ETHICAL CONSIDERATIONS

The study was approved by the regional ethics committee of Mashhad University of Medical Sciences with the code number of 940548 / 2015.08.15. A written informed consent was obtained after explaining the objectives of the research with attention to the main objectives.

### AUTHORS' CONTRIBUTION

Study conception and design: Amirmohammad Merajikhah, Roghayeh Zardosht, Mohammad Sahebkar  
Data collection: Roghayeh Zardosht and Susan Malkemes.

Data analysis and interpretation: Mohammad Sahebkar  
Drafting of the article: Mohammad Sahebkar, Susan Malkemes, and Roghayeh Zardosht.

Critical revision of the article: Susan Malkemes, Amirmohammad Merajikhah, Roghayeh Zardosht, and Mohammad Sahebkar.

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