# Evaluation of the Effect of the Internship Training Course on the Skill of Diagnosing Common Skin Diseases among the Interns of the Dermatology Department of Hazrat Rasool Akram Hospital Using Computer-assisted Assessment (CAA) Method

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## Abstract

**Introduction:** Internship is a crucial period of the general medicine doctorate that plays a key role in shaping the basic skills and professional abilities of medical students and is a major part of the educational programs in this field. It is also essential in better preparing medical students for their future professional roles. Clinical evaluation and the use of methods capable of measuring the skills, competencies, and abilities of students are of special importance. Therefore, the aim of this study was to investigate the effect of the internship training course on the diagnosis of common skin diseases using the computer-assisted assessment method (CAA).

**Method:** In this pre-experimental study, one-group pre- and post-testing were performed, and the efficacy of the internship training course on the skill of diagnosing common skin diseases was investigated among the interns of the dermatology department of Hazrat Rasool Akram Hospital, Tehran, Iran, from October 2018 to March 2020. To conduct this study, a Computer-Assisted-Assessment (CAA) test in the form of a PowerPoint presentation consisting of typical images of 25 common skin diseases at the time of entry and also a similar test of typical but different and cluttered images of the same 25 common skin diseases was performed on the last day of each internship course, and the interns recorded the diagnosis of the diseases displayed on the answer sheet during a fixed period of time. Then, the pre-and post-testing information was recorded during the consecutive periods of the interns' presence in the dermatology department. This information included the exam scores, age, sex, marital status, months of internship, year of entering the university, being an international campus student, and month of completing the internship period. After analyzing the data, the effectiveness of the training received during the internship period was assessed.

**Results:** In this study, 252 medical students with an average age of 25.35 ± 2.0 years were investigated. Among the participants, 32 people (12.7%) were international campus students, and 220 people (87.3%) were non-campus students. Also, 56 students were married (22.2%), and 196 participants (77.8%) were single. The average score of interns before the course was 8.19±2.6, and after the course was 19.39±3.4, and the difference between them was significant (P<0.001). Also, the mean difference between the scores before and after the training course was 11.19 +/- 2.1 and the scores of all participants in the study increased after the training course, which ranged from 3 to 17 scores. Pre- and post-course scores in single people were significantly higher compared to married people (P<0.001 for both). However, there was no significant difference between mean grade changes of pre-and post-course scores in single and married people (P=0.092). Also, pre-and post-course grades and grade changes in the international campus students were significantly lower than other interns (P<0.001). On the other hand, there was a significant relationship between being an international campus student and grades before the course (P=.005), grades after the course (P<0.001), and grade changes (P<0.001).

**Conclusion:** Our results showed that the internship training course of the dermatology department of Hazrat Rasool Akram Hospital would efficiently increase the ability to diagnose common skin diseases by interns. This study also showed that the pre-course and post-course scores and their changes in international campus students are significantly lower compared to other students. Also, older age and being married reduce the pre-course and post-course scores in interns compared to others.

**Keywords:** Internship, Computer-assisted Assessment, CAA, Medical Education, Dermatology Department.

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## Introduction

The internship period is a very important period of general medical doctorate education, which plays an essential role in shaping the basic skills and professional abilities of medical students and occupies a major part of the educational programs in this field. In addition, this course is an essential resource in better preparing medical students for their professional roles in the future [[1, 2] . Clinical training in the internship period provides the opportunity for the student to transform theoretical knowledge into various psycho-motor skills that are necessary for patient care [3] . The conducted research shows that the medical students who enter the internship stage with more scientific and practical preparation will be able to better perform their assigned tasks in diagnosis, treatment, and providing rehabilitation services to patients. During the internship, students are required to spend 18 months in different departments of hospitals. They will spend 12 months in the major departments, including internal diseases, children's diseases, gynecological diseases, and surgery. The remaining 6 months would be spent in minor departments, based on the capacity of teaching hospitals [4, 5] .

One of the minor departments is the department of skin diseases, and patients with skin disorders make up a large part of the clients to the general practitioner's office. Also, the initial manifestations of a wide range of diseases, including internal diseases, psychiatric disorders, malignancies, drug reactions, allergies, etc., occur in the skin, and certainly, the correct and early diagnosis of these skin lesions can play an important role in the early diagnosis and timely treatment of related underlying diseases [6, 7] . Therefore, assessing the competence and learning performance of students in this department is an essential part of the education process.

The concept of clinical competence and classroom performance in evaluations are accepted and expressed objectively and subjectively in the medical education [8] . The use of the computer-assisted assessment (CAA) method is an emerging technology that offers many advantages over traditional evaluation methods, which include the use of a wide range of audio and video media, online feedback to the individuals, requiring less time to present the course results, designing each question based on a specific point and evaluating it, managing and holding the course easier, and increasing the quality and efficiency of data collection for statistical analysis. The use of computers makes the evaluation easier and frees the faculty from the heavy work of care and grading [11] . Medical students have been reported to understand CAA better than the traditional assessment method. Therefore, various models of CAA implementation have been proposed, ranging from the use of single computers to public course locations with multiple computers, and models based on portable Internet devices that are owned by the individual [12] . On the other hand, guidelines have also been provided for professors on how to exploit and use CAA in medical education [13] . However, some researchers also discussed the disadvantages associated with the use of computer technology, such as the involvement of a high level of organization in general evaluation, including academic forces, support, staff, computer services, and managers [14] .

Therefore, considering the necessity of useful training in the skin diseases department, in this study, we decided to investigate the effect of the internship training course on the skill of diagnosing common skin diseases using the CAA method.

## Method

In this pre-experimental study, which was conducted with a pre-and post-testing one group design, interns of the dermatology department of Hazrat Rasool Akram Hospital, which is the only skin diseases training center of Iran University of Medical Sciences, were evaluated from October 2018 to March 2020. Finally, according to the sample size formula, 252 interns were examined.

In this study, the intervention was continuous and in the form of a training course, which included theory classes and clinical training in the dermatology ward and clinic, and also on duty. At the time of conducting the study, according to the current educational rules at Iran University of Medical Sciences, interns spent only a short period of 2 weeks, out of their 18-month internship period, in the dermatology department.

In order to conduct this study, the CAA was presented at the beginning of the two-week period in the form of a PowerPoint presentation consisting of typical images of 25 common skin diseases (along with a brief explanation of the patient's history and description of the symptoms associated with the lesions or the relating pathology images). A similar test, which included typical but different pictures of the same 25 common skin diseases in a random order, was demonstrated to the interns on the last day of each period, and the interns had to record the diagnosis of the displayed diseases in the answer sheet within a fixed time. The PowerPoints of these pre- and post-tests were checked and approved by three dermatology professors, several medical education department professors, and professors of statistics and epidemiology. Also, in this study, the possibility of student cheating was considered a confounding variable, and an attempt was made to control this variable by assigning an examiner for each exam and following the rules of formal university exams. Finally, the information obtained from holding these courses during the consecutive attendance of interns in the dermatology department, including test scores, age, sex, marital status, the month of internship, year of entering the university, being an international campus student, and month of completing the internship period, were collected and analyzed.

## Data Analysis

The obtained information was entered into SPSS-22 software. For describing the quantitative variables, mean, standard deviation, median, and range of changes were used, and qualitative variables were described as raw frequency and frequency percentage. Qualitative data were compared using

the chi-square test and quantitative data, including CAA evaluation scores before and after the training course, were compared using the Independent T-Test. Pearson's correlation coefficient was implemented to assess the correlations between quantitative variables, and Spearman's correlation coefficient was used to investigate the correlations between qualitative variables. The significance level was considered $\alpha<0.05$.

## RESULTS

The study of 252 medical students in internship showed that 99 (39.3%) were male and 153 (60.7%) were female. Among the studied subjects, 196 (77.8%) were single and 56 (22.2%) were married (Table 1). The average age of the interns participating in the study was 25.35 ± 2.0 years and they were in the age range of 23 to 40 years. According to Table 1, most of the people who participated in the study were from 2013 entries (53.2 percent) and the least number of subjects were from 2006 entries (0.4 percent), which shows that a higher number of recent university entries attended the dermatology internship. Also, most of the interns were in the 4th (8.7%) and 8th (8.7%) months, and the lowest frequency belonged to the interns that were in the 16th month (2%). Therefore, the interns who were in the final months of their internship had participated less in the dermatology course. Most of the students (87.3%) were non-campus students and the highest rate of participation in the dermatology internship period was in June (16.3%) and the least in April (2.4%). This was probably due to the fact that in 2020, the clinical internship period was closed due to the outbreak of the Covid-19 disease from March 2020 to April 2020 and the first half of April 2020. Also, in other years, the internship period was not held in the first half of April due to the Nowruz holiday. On the other hand, the highest rate of participation of interns was reported in 2019 (68.25%).

Table 1. Demographic and educational characteristics of studied participants

| Variable | | Quantity | Percentage |
|---|---|---|---|
| **Gender** | **Male** | 99 | 39.3 |
| | **Female** | 153 | 60.7 |
| **Marital status** | **Single** | 196 | 77.8 |
| | **Married** | 56 | 22.2 |
| **Year of university entrance** | **2006** | 1 | 0.4 |
| | **2010** | 17 | 6.7 |
| | **2011** | 22 | 8.7 |
| | **2012** | 64 | 25.4 |
| | **2013** | 134 | 53.2 |
| | **2014** | 14 | 5.6 |
| **Months of internship** | **1.00** | 17 | 6.7 |
| | **2.00** | 17 | 6.7 |
| | **3.00** | 20 | 7.9 |
| | **4.00** | 22 | 8.7 |
| | **5.00** | 13 | 5.2 |
| | **6.00** | 9 | 3.6 |
| | **7.00** | 11 | 4.4 |
| | **8.00** | 22 | 8.7 |
| | **9.00** | 20 | 7.9 |
| | **10.00** | 14 | 5.6 |
| | **11.00** | 14 | 5.6 |
| | **12.00** | 7 | 2.8 |
| | **13.00** | 18 | 7.1 |
| | **14.00** | 10 | 4.0 |
| | **15.00** | 8 | 3.2 |
| | **16.00** | 5 | 2.0 |
| | **17.00** | 9 | 3.6 |
| | **18.00** | 16 | 6.3 |
| **International campus student** | **No** | 220 | 87.3 |
| | **Yes** | 32 | 12.7 |
| **Month of training course** | **April** | 6 | 2.4 |
| | **May** | 28 | 11.1 |
| | **Jun** | 41 | 16.3 |
| | **July** | 25 | 9.9 |
| | **August** | 13 | 5.2 |
| | **September** | 15 | 6.0 |
| | **October** | 16 | 6.3 |
| | **November** | 21 | 8.3 |
| | **December** | 19 | 7.5 |
| | **January** | 21 | 8.3 |
| | **February** | 33 | 13.1 |
| | **March** | 14 | 5.6 |
| **Year of the training course** | **2018** | 31 | 12.3 |
| | **2019** | 172 | 68.3 |
| | **2020** | 49 | 19.4 |

The results of our study showed that the average score of interns before completing the course was 8.19±2.6 (minimum 2 and maximum 16) and after completing the course was 19.39±3.4 (minimum 11 and maximum 25), and the difference between them was significant ($P<0.001$). Also, the average difference between the scores before and after the

training course was 11.19±2.1, and the scores of all participants in the study increased after completing the training course, which ranged from 3 to 17 points. The frequency distribution of pre-and post-course scores and the changes in the scores followed the normal distribution.

Based on Table 2, the study of the pre-and post-test scores and the changes in scores between women and men participating in the study showed that there was no significant relationship between the gender of participants and the difference in pre- and post-course scores (P=0.494). Also, pre-and post-course scores in single people were higher than in married people (P<0.001 for both). However, there was no significant difference between single and married people in terms of mean pre-and post-course grade changes (P=0.092). Also, the pre-and post-course grades and the related changes were significantly lower in international campus students compared to other interns (P<0.001).

Table 2. Study of the relationship between pre-and post-course grades and grade changes with gender, marital status, and being an international campus student

| Variable | | | Mean ± SD | F | df | T | P-value* |
|---|---|---|---|---|---|---|---|
| Gender | pre-course grades | Male | 8.52±2.45 | 0.866 | 252 | 1.569 | 0.118 |
| | | Female | 7.99±2.71 | | | | |
| | post-course grades | Male | 19.58± 3.10 | 5.331 | 252 | 0.692 | 0.590 |
| | | Female | 19.28± 3.54 | | | | |
| | Grade changes | Male | 11.10±2.05 | 0.301 | 252 | -0.578 | 0.494 |
| | | Female | 11.25± 2.15 | | | | |
| Marital status | pre-course grades | Single | 8.5969±2.56721 | 2.133 | 252 | 4.760 | <0.001 |
| | | Married | 6.7857±2.30189 | | | | |
| | post-course grades | Single | 19.9184±3.25079 | 0.007 | 252 | 4.830 | <0.001 |
| | | Married | 17.5536±3.16182 | | | | |
| | Grade changes | Single | 11.3061±2.08491 | 0.039 | 252 | 1.689 | 0.092 |
| | | Married | 10.7679±2.16578 | | | | |
| International campus | pre-course grades | Yes | 8.3727±2.66504 | 7.888 | 252 | 2.876 | <0.001 |
| | | No | 6.9688±1.87487 | | | | |
| | post-course grades | Yes | 19.7818±3.32661 | 4.999 | 252 | 5.028 | <0.001 |
| | | No | 16.7188±2.33120 | | | | |
| | Grade changes | Yes | 11.3818±2.10449 | 1.756 | 252 | 3.963 | <0.001 |
| | | No | 9.8438±1.62856 | | | | |

* Independent sample T-test

In Table 3, using Pearson and Spearman tests, we examined the relationship between pre- and post-course grades and the changes in grades with the variables of the year of entering the university, the month of internship, being an international campus student, months of course completion, year of course completion, and the age of the participants. The results showed that there was no significant relationship between the year of entering the university with pre-course grades (P=0.11), post-course grades (P=0.19), and grade changes (P=0.344). Also, there was no significant relationship between the month of internship with pre-course grades (P=0.33), post-course grades (P=0.191), and grade changes (P=0.077). On the other hand, there was a significant relationship between being a campus student and pre-course grades (P=.005), post-course grades (P<0.001), and grade changes (P<0.001). Also, there was no significant relationship between the month of completing the internship with pre-course grades (P=0.265), post-course grades (P=0.519), and grade changes (P=0.312). On the other hand, the results of our study showed that there was a significant relationship between the age variable with pre-and post-course scores (P < 0.001), but the relationship between score changes and age was not significant (P = 0.119).

Table 3. Study of the relationship between pre-and post-course grades and grade changes with the age and educational variables of the participants

| Variable | | Year of entry | Months of internship | International campus student | Internship month | Internship year | Age |
|---|---|---|---|---|---|---|---|
| **Grade changes** | **Correlation Coefficient** | -.060* | .112* | -.266* | .081 | -.064* | -.099** |
| | **P-Value** | .344 | .077 | <0.001 | .198 | .312 | .119 |
| **pre-course grades** | **Correlation Coefficient** | .209* | -0.189* | -.175* | -.033 | .071* | -.282** |
| | **P-Value** | .11 | 0.33 | .005 | .601 | .265 | <0.001 |
| **post-course grades** | **Correlation Coefficient** | .149* | -0.83* | -.307* | .001 | .041* | -.290** |
| | **P-Value** | .19 | 0.191 | <0.001 | .993 | .519 | <0.001 |

*Spearman's correlation

**Pearson's correlation

## Discussion

The clinical training course is one of the most important and sensitive stages in medical education and improving the quality of this course is of particular importance [15, 16] . Despite the availability of some clinical evaluation methods, the evidence shows that usually, the evaluation of students is limited to subjective information, and no attention has been paid to the accurate assessment of their clinical skills. This is despite the fact that skill and practical work in medical education is crucially important due to the significant role of a medical doctor in promoting the health of society [17] . CAA is a relatively new method of evaluating students' learning with the help of computers, which can be used at every stage of the evaluation process, including the assessment of educational items [18, 19] .

Therefore, the objective of this study was to investigate the effect of the training course during the internship period on the diagnosis of common skin diseases by the interns. The results of our study showed that the average scores of interns after completing the course were higher compared to their pre-course scores (19.39±3.4 vs 8.19±2.6). These results show that the adequacy of training to increase the ability to diagnose common skin diseases by interns has been optimal. This result, which is equal to reaching half of the expected clinical education goals, was also reported by Davenport et al. in their research with the aim of evaluating the nursing education program at Columbia University. According to their study, a program that can achieve at least half of its goals is considered desirable in terms of education [20] . Therefore, in the present study, the increase of about 50% in the students' grades indicates the desirability of the current educational programs. In a systematic review of computer-based assessments in medical education, Al Amri et al. reported that computer-based assessments are widely used to assess and enhance learning opportunities in almost all areas of medical curricula, and have a wide impact on clinical skills, professional qualification, and practice. Also, it can be effective for evaluating theoretical and applied knowledge both individually and collectively[21] . In a study by Stephens et al., it was also shown that practice-oriented internships can be an important part of the modern curriculum in medical schools. In their study, which investigated this teaching method in the dermatology internship course of medical students, it was concluded that the practice-oriented teaching method is a valuable experience for medical students and can cause more interest for further study in the field of dermatology [7] . In a study by Heijden et al., in which general practitioners used a web-based system to consult dermatologists for the treatment of their patients, it was shown that the use of this web-based system leads to a 74% reduction in face-to-face referrals to specialists. Also, only 16% of the patients who were treated through this system needed to see a specialist in person [22] . In another study by Charman et al., which was conducted on 1000 patients with skin diseases, it was reported that the provision of triage services and examination of patients through teledermatology led to a 60% reduction in in-person referrals to specialized dermatology hospitals and specialists [23] . In general, reports indicate that medical students have a strong interest in using CAA and have a positive experience, which has led to its introduction for formative assessment in higher education [24] . Also, previous research regarding the review of medical students' opinions about web-based evaluation reported that a high percentage of students showed a positive attitude towards the use of this method. Additionally, in a medical college in Saudi Arabia, a six-step approach was implemented for developing a CAA for summative assessment, and it was reported that a higher percentage of students endorsed the CAA and suggested that conducting a CAA pilot would be helpful in familiarizing students with this new assessment tool [25] .

In addition, according to the findings of our study, the comparison of the scores before and after the course and their changes showed that the scores of international campus students were significantly lower than other interns. On the other hand, a significant relationship was observed between being an international campus student and the level of grades before and after the course and their changes. This difference between the students of the international campus and others can be seen due to the obvious differences in the ranks of the national entrance examination and probably the differences

related to the intelligence and learning capabilities of the campus students and other students. On the other hand, the results of our study showed that there was no significant relationship between the year of entering the university and the month of internship with the pre-and post-course grades and changes in the grades of the internship course. In other words, the students who were at the end of the internship period and the interns who had just started their internship period had no difference in terms of the mentioned grades. Teaching clinical skills is a complex process that is affected by many factors and variables such as a suitable educational environment, committed professors, student's interests, etc., and can change the scientific and theoretical knowledge of the students into practical knowledge by giving them opportunities; also, appropriate training and the presence of numerous clients can lead to acquiring professional skills including the above items to the extent of mastery [26, 27] . It may be possible to justify the low grades of the students with reasons such as insufficient training due to the lack of patients, lack of sufficient opportunity to practice practical skills or specialization of the field, or due to the short duration of the course.

During the spread of Covid-19, some changes were made in the training procedure of the interns. In the current study, an investigation was performed to assess the differences in the grades of the students before and after the pandemic. Our results showed that there was no significant relationship between the year of completing the internship (in 2018 and 2019, which were before the pandemic, and 2020, which was after) with pre- and post-course grades and grade changes. Therefore, it can be concluded that changing the educational method during the Corona period did not make a difference in the results of the interns' courses. Also, in this study, the examination of the relationship between the pre-and post-course grades and the changes in the grades with the duration of internship showed no significant relationship between any of the mentioned variables. Also, there was no significant relationship between pre-and post-course scores and changes in scores with the gender of studied students. On the other hand, pre-course and post-course scores in unmarried people were higher compared to married people. However, there were no significant differences between single and married people in terms of the mean pre-and post-course grade changes. On the other hand, the results of our study showed that there was a significant relationship between the age variable and the grades before and after the course. But the relationship between mean score changes and age was not significant. Therefore, it seems that in interns who are older and married, the grades of the courses are generally lower than others. This can be related to decreased motivation or incremented personal and family busyness in older and married interns. Therefore, in the study of educational adequacy, demographic factors such as age and marital status should be considered in addition to the components related to the educational program. In general, it seems that the use of a proper educational method along with a codified, systematic, and uniform evaluation method can lead to the optimal educational adequacy of the dermatology internship. The CAA assessment method can be a suitable option for evaluating medical students since it motivates and encourages learners to practice skills by providing opportunities for assessment, the possibility of examining a wide range of assessed knowledge, the use of a range of assessment methods (e.g. peer assessment, self-assessment), providing opportunities for immediate feedback, and increasing educational justice and standardized feedback [28, 29] . However, our study had limitations such as conducting the study only in one educational center, not following up the interns' knowledge until the end of the internship period, participation of interns from different stages, and not examining other indicators related to education such as choice treatment. Therefore, it is suggested to conduct a study with a larger sample size in a multi-centered manner and to exam other clinical skills such as proper treatment.

## CONCLUSION

The results of this study showed that there is no relationship between the month of completing the internship, the year of entering the university, and completing the course during the covid-19 pandemic with the changes in the grades of the interns after completing the dermatology internship course. Also, the results of this study showed that the pre-and post-course grades and their changes in international campus students were significantly lower compared to other students. Also, older age and being married caused a decrease in pre-course and post-course grades in interns.

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