

# Evaluation Of Online Development Examinations Of Infectious Diseases And Clinical Microbiology (IDCM) Expertise Students

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## Research article

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## Abstract

**Background:** Formative examinations are required to monitor the development of research assistants in the field of Infectious Diseases and Clinical Microbiology. However, the preparation, conduct and evaluation of these exams also require especial features and experience. In this study, it is aimed to review the experiences obtained in the evaluation exams of research assistants conducted by the education commission (EMEK) in the field of IDCM specialization.

**Methods:** There are two online exams per year for research assistants in the IDGM field. In this study, the examinations between 2014-2018 were evaluated. The validity and reliability analyzes for each exam were performed and the difficulty and discrimination indexes of the questions were calculated. The topics with the least correct answers were determined.

**Results:** Over the years, an increase in the number of research assistants was observed. The internal consistency coefficient of the exams was the lowest of the cronbach alpha value of 0,69 and the highest of 0,92. The mean score of the exam was over 70. Some of the questions needed to be reviewed and corrected. Although clinically rare diseases and basic microbiology questions have been answered less frequently, the rate of responding to diseases that are frequently seen in the clinic was higher.

**Conclusion:** Online examinations facilitate broad-based measurement and evaluation at national level. With the increase of our online exam experience, we found that there are still parts to be improved.

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## Background

Education is defined as the process of creating desired behavioral change in the individual's behavior through his own life. The extent to which the knowledge provided by the training is achieved and the extent to which the development is achieved can only be learned by measurement and evaluation. The first aim of measurement and evaluation is to see what the learners gain in knowledge and competence levels and to monitor their individual development. The second aim is to monitor the effectiveness of the educational content and to organize the educational content according to the results, and to guide the students about their knowledge and competencies. (1)

During medical education, formative assessment and summative assessment are recommended. Formative evaluation is an intermittent assessment and evaluation while training is in progress. The aim is to determine the learning deficiencies of the learner (2-5).

Online formative assessments in medical education have been increasing in recent years with the aim of measuring the knowledge of research assistants according to a national norm, determining minimum national standards in the specialization training program, and measuring the quality of teaching under the training program. The appreciation of the online exams is due to its encouragement of self-learning in medical education. Self-learning students can assess their work themselves, identify their strengths and weaknesses. Students who participate in the formative examinations are more successful in the grades-based exams. (6-8)

Throughout the country, different disciplines such as Turkish Orthopedics and Traumatology Training Council (TOTEK), Turkish Chest Diseases Competency Board, Turkish Medical Oncology Association, and EMEK are doing assistant development exams. EMEK and Turkish Chest Disease Competency Board hold development exams online (9-11). Infectious Diseases Society of America (IDSA) conducts development examinations online (12). Formative evaluations made online in the literature are reported to increase internal motivation for learning, to improve knowledge and to contribute to determining individual learning needs. Online exams often use multiple choice exam methods (6,13).

In this study, it is aimed to evaluate the learning objectives and examinations, and to report the experience obtained in the research assistant exams of EMEK.

## Methods

## Exam Method

The date and time of the exam will be announced on the internet in the platforms where every research assistant can be informed and the applications are taken online. Research assistants taking IDCM education in Turkey are participating in this voluntary examination. The research assistants who are applying for the test attend the exam by logging into the system with their own passwords in the clinic where they receive their education. The examiners are appointed by the responsible institutions of education. Assistant examinations are held twice a year with six-month intervals.

The scope and distribution of the questions are determined according to TUKMOS curriculum subjects and the questions are prepared by EMEK executive board in the form of multiple choice test format (5 choices). All questions are reviewed by EMEK executive board and questions are validated. The exams which are made online from a central system and consist of 50 questions, have a 1 hour duration. Each question is 2 points, maximum exam score is 100 points. As this is an exam with formative purpose development, no passing grade has been determined. The exams are held at lunchtime. This timeframe appears to be a reasonable period that will not only disrupt the clinical work but also make the organization difficult.

## After Exam Feedback

Feedback is given to each center after the exam. The result of the examination is not given to any person other than the research assistant himself and the education supervisor of the institution he / she is studying. Through the examinations, it is aimed to evaluate the professional knowledge development of the expertise students according to years and to evaluate the educational institutions' deficiencies according to these results.

## Exam Statistics

The numerical data of the exams were obtained by reviewing retrospective data records. The data obtained were tabulated. Data were compiled as MS excel data.

## Reliability and Validity of Exams

Cronbach's alpha reliability coefficient was calculated statistically. Student's T test was used to compare the means for countable values, chi-square and Fisher's corrected chi-square tests were used to compare the qualitative values.  $P < 0.05$  was considered significant.

## Results

It was found that the number of research assistants who wanted to test themselves in EMEK exams increased gradually (Figure 1). In particular, the participation rate of the 1st year research assistants was found to be quite high (Figure 2). The distribution of the research assistants, the mean grade point of the exams and the cronbach's alpha values are presented in Table 1. The cronbach alpha value of the exams was found to be lowest at 0,69 and highest at 0,92 (Table 1). In each exam period as a result of the exam analysis the most and least correctly answered questions were found and presented in Table 2.

The discriminant rate of the exam questions was 16% in 400 questions. 84% of the questions had to be corrected before being added to the question bank (Table 3). The mean difficulty index of the exams was found to be at least 69 and at most 84.7, therefore it is determined to be in the easy question class. Table 3 presents the discrimination and mean difficulty index ratios of the questions according to the exams.

Table 4 presents the distribution of subjects with low correct answer rate (difficulty index: difficult question) in 400 questions in online exams in 2014-2018.

## Discussion

Medical specialization students are both educated in the clinic and serve in the provision of services. For this reason, it is very difficult for them to go to another center to take their exams. This process brings both time consuming and economic burdens. These requirements have been a starting point for online surveys and assessments (10). Because the students are located in different provinces, the problem of time and space is solved easily with the central online examination. It is ensured that the trainers evaluate this process by the central examination of the students receiving education at different faculties and different geographic regions at the same time. As a matter of fact, it is possible for the students of different educational institutions to evaluate themselves. In addition, it is ensured that research assistants in all educational institutions can see the shortcomings of students and their programs according to their questions. If technology can be used well, more communication, interaction and cooperation can be achieved with online exams. There are studies showing that the use of online evaluation has contributed positively to the learning and teaching process. There are publications reporting that students feel more comfortable in their online surveys and evaluations, their negative attitudes towards learning and measurement-evaluation have disappeared and their academic achievement has increased (14,15).

When the seniority of the students taking the exam is examined, it was observed that the first year research assistants participated in the exam in the most intense way and it was noticed that the number of research assistants who took the exam in the following years decreased according to seniority. This may be due to different reasons. This may be due to the fact that the first year assistants are more willing to test themselves and are in the clinic. Last-year assistants in the period of rotation or thesis preparation may be less motivated.

The online evaluation systems have many positive contributions to the education process. When appropriate infrastructure is provided to the web environment, it is accessible and applicable from anywhere. Students' achievements in exams can be seen instantly in the system (2). Online exams allow the creation of a question bank. The students who prepare the exam keep their knowledge up-to-date and follow the subjects they will prepare for the exam carefully. Exams are done through the network, thus paper and publication expenditures are also eliminated (2,16). It takes a long time for classical examinations to be conducted and evaluated by academics. Thanks to online exams, trainers also save time. In addition, faculty members can look at the response rates of the questions and focus on subjects in that students' knowledge is insufficient, so that these subjects can be better understood. Individualization of the exam, instant feedback, quick scoring, and no limitations in terms of time and place are the advantages of the online exam (2,17). As a matter of fact, EMEK exams were conducted with one hour duration and many research assistants were evaluated online.

An exam is expected to be reliable, valid, useful and contributing to education. The fact that the margin of error in the exam is low means that it is a very reliable test (5). The measurement method should be valid and reliable (18,19). Cronbach's alpha reliability coefficient is mostly used to measure the reliability of a test. The higher the coefficient, the higher the internal consistency. For reliable tests, this coefficient is expected to be 0.80 or higher. It has also been reported that 0.70 or more can be accepted for formative exams (20). When EMEK examinations are considered, it is seen that the best value in reliability is taken in the first exam and the most negative measurement is taken in May 2017 exam. The high margin of error in this period is attributed to both the reduction of motivation in the examiners and the technical disadvantages in the preparation of the questions and in the implementation of the online exam. However, the reliability coefficient of the EMEK research assistant development examinations, which were made for formative purposes, was found to be quite satisfactory (Table 1).

The discrimination index is an index used to separate those who do not have the characteristic to be measured by the test. Questions with high levels of discriminative features increase the reliability of the test. The discriminative feature of a question with a discriminant index of 0.40 or higher is defined as very high. The discriminativity of a question with index 0.30-0.39 is not complete, so it needs to be reviewed. The question with a 0.20-0.29 index should be corrected and developed, and should not be reused without any changes. 0.19 index of a question is low, the question must be removed

from the test and not transferred to the question bank (20). In an exam made for the evaluation of research assistants, the expected feature of the questions is to distinguish the student who does not know the subject matter (20). When we look at the most of the EMEK examinations, although the discrimination rate is sufficient in some questions, it is necessary to review many questions (Table 2). In the examinations, the question rate which can distinguish the student who does not know the subject with the relevant subject is found to be 16%. However, the percentage of questions that should not be used after reviewing is 43% in total. 41% of the exam questions should be reviewed and included in the question bank after making the necessary corrections. These data suggest that it is necessary to receive specific training for measurement and evaluation during question preparation.

In the analysis of exams, the investigation and interpretation of why the difficulty of the questions may have been caused is a gain of the evaluation (2,17,20). Table 4 presents the subjects in which the students have difficulty in answering correctly and have lack of knowledge. The remarkable result in this table is that less common or rare infections and basic medical science questions are answered less accurately. This will be the educational gain of the units with particular attention to these topics in the training process.

In the online applications, problems such as the emergence of unexpected technical problems, infrastructure and hardware dependence, security problems, students' use of different computers and especially requirement of having a computer are the limitations of online exams. No matter how good the network is, there may be some problems such as power failure or voltage change, lack of features of the computer being used. In addition, although online exams are strictly assigned to supervisors, cheating is much easier than classical exams. For this reason, the security of the system, (the user codes must not be created on the systems) communication security, difficulties in identification of the user and cheating affect the reliability of the online examination negatively (2,17).

It is the limitation of the EMEK examinations that the number of questions in categorized subject titles are not determined by taking into consideration the learning objectives of the IDCM.

## Conclusions

As a result, the EMEK research assistants examinations conducted twice a year contribute to the evaluation of the training of the research assistants, but the examinations have aspects to be developed. Online exams make it easy to measure. With the online exams to be made, it will be easier to monitor the learning progress of the research assistant by monitoring the cognitive development of each assistant and reviewing the training programs.

## List Of Abbreviations

**IDCM:** Infectious Diseases and Clinical Microbiology Society of Turkey

**EMEK:** IDCM's Education Commission

**TOTEK:** Turkish Orthopedics and Traumatology Training Council

**IDSA:** Infectious Diseases Society of America

**TUKMOS:** Medical Expertise Board Curriculum Creation and Standard Setting System of Turkey

## Declarations

**Ethics approval and consent to participate:** Ethical approval was not obtained because our study did not include human and animal experiments. Required permission has been obtained from IDCM.

**Consent for publication:** "Not applicable"

**Availability of data and materials:** I can confirm I have included a statement regarding data and material availability in the declaration section of my manuscript.

**Competing interests:** No competing financial interests exist.

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**Authors' contributions:**

TÖK, conducted and interpreted item analysis of data. Contributed significantly to the design and writing of the article. Read and endorsed the last article.

OK, designed the article and revised the study. Read and endorsed the last article.

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## Tables

**Table 1.** Distribution of research assistants who take EMEK exam according to years, their mean grade points and internal consistency values

The year of Education	2014 June	2015 June	2015 December	2016 June	2016 December	2017 May	2017 December	2018 September	Total*
1.year	1	3	15	26	60	61	84	71	321
2.year	9	16	24	16	27	29	25	23	169
3.year	23	16	24	19	37	28	35	17	199
4.year	12	11	19	22	19	19	15	3	120
5.year	19	22	23	18	19	8	4	3	116
Unspecified	16	-	-	-	1	-	1	60	78
Total	80	68	105	101	163	145	164	177	
Grade point mean	77	74	69	77	71	79	74	72.15	
Cronbach's Alpha coefficient	0,92	0,78	0.72	0,87	0,82	0,69	0,79	0,71	

\* The same person has entered the examination of different years throughout his assistantship

**Table 2.** The most and least correctly answered questions in EMEK exam according to years

<b>Year/Month</b>	<b>Most Correctly Answered Question Title</b>	<b>Least Correctly Answered Question Title</b>
2014/June	Antibiotic diarrhea	Staphylococcal Microbiology
2015/June	Description of pandemic	Hemorrhagic fever
2015/December	AIDS patient monitoring	Antibiotic susceptibility testing
2016/June	EBV infection	CMV retinitis
2016/December	Saprophyticus microbiology	Cat Scratch Disease Clinic
2017/May	Epidemiology of Leptospira	Group A streptococcal microbiology
2017/December	Asymptomatic bacteriuria	The question of hepatitis D
2018/September	Management of candidemia Live vaccines	Typhoid vaccine

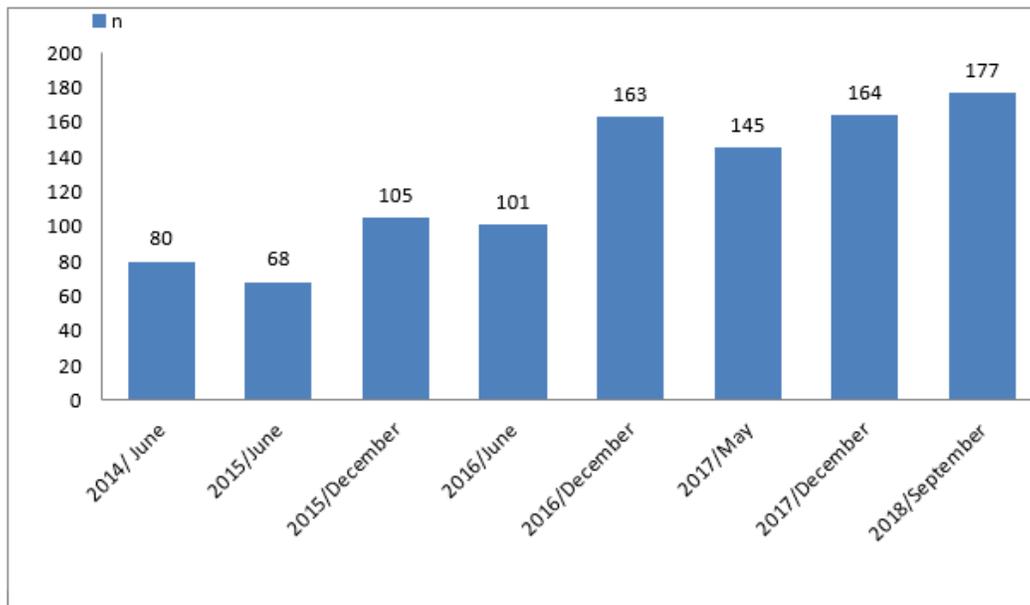
**Table 3.** Discrimination and mean difficulty index statistics of the questions according to the exams

QUESTION FEATURES	2014	2015	2015	2016	2016	2017	2017	2018	Total
		June	December	June	December	June	December	September	
	n=50	n=50	n=50	n=50	n=50	n=50	n=50	n=50	n=400
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Discriminative	7 (14%)	10 (20%)	6 (12%)	19 (38%)	8 (16%)	4 (8%)	6 (12%)	5 (10%)	65 (16%)
Not fully discriminative									
Must be reviewed	4 (8%)	7 (14%)	10 (20%)	10 (20%)	13 (26%)	10 (20%)	11 (22%)	15 (30%)	80 (20%)
Unable to discriminate, should be corrected and developed	9 (18%)	9 (18%)	8 (16%)	10 (20%)	13 (26%)	8 (16%)	16 (32%)	11 (22%)	84 (21%)
Unable to discriminate should be removed from the test	30 (60%)	24 (48%)	26 (32%)	11 (22%)	16 (32%)	28 (56%)	17 (34%)	19 (38%)	171 (43%)
<b>MEAN DIFFICULTY INDEX</b>	<b>84.73</b>	<b>73.73</b>	<b>69.47</b>	<b>72</b>	<b>71.53</b>	<b>78.59</b>	<b>74.50</b>	<b>72.46</b>	

**Table 4.** Scope of the questions that are difficult to answer

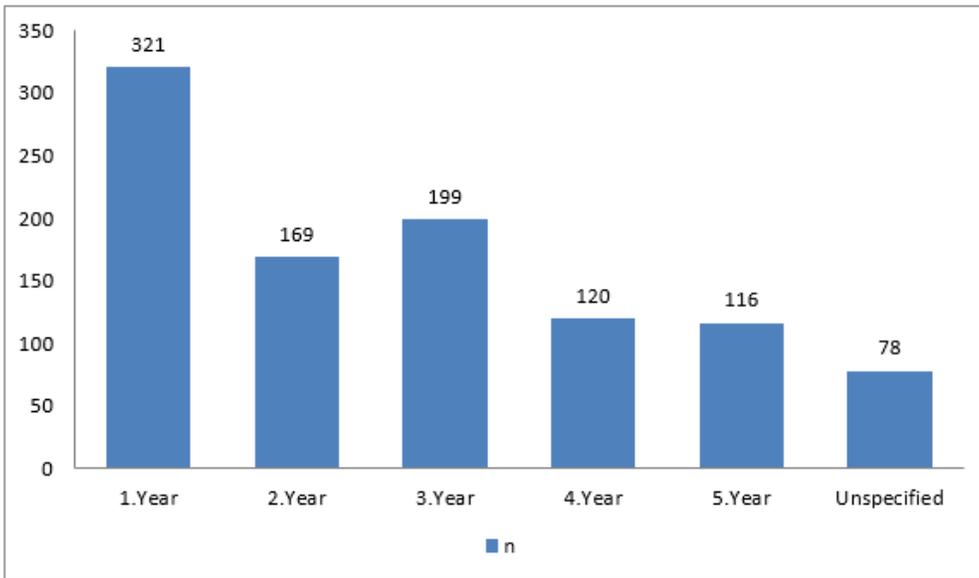
SUBJECT-QUESTION CONTENT	SCOPE
Acute pancreatitis	Clinic
Antibiotic resistance mechanisms	Clinical Microbiology-Pharmacology
General knowledge of antibiotics	Microbiology-Pharmacology
Arthropod-induced infections	Clinic
Special microbiological properties of bacteria	Bacteriology
Treatment of botulism	Clinic
Clinic of viral rash diseases	Clinic
Immunological response to infection	Immunology
Infective endocarditis	Clinic
Febrile neutropenia, organ transplantation	Clinic
Isolation methods specific to diseases	Hospital infections
Etiology of hospital-acquired pneumonia	Hospital infections
Drug fever properties	General infectious diseases
Implant surgical infections	Clinic
Cat scratch disease	Clinic
Diagnosis and treatment of chronic hepatitis	Clinic
Travel infections	Clinic
Typhoid vaccine	Clinic
Tuberculin skin test	Clinic
Laboratory findings of viral infections	Virology
Virus infrastructure	Virology

## Figures



**Figure 1**

Number of students taking EMEK exams over the years



**Figure 2**

The number of students taking exams according to their years being as an assistant