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# Medical education assessment

## *Avaliação em educação médica*

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**Abstract:** One of the most critical steps for medical education is the assessment. The assessment can be divided into short-term memory, long-term memory, and retrieval memory. If the student acquires all these memories steps, the surgical skill will be mind incorporate for years. As a healthcare provider, the medical community needs to transform training and learning to a valid and reliable activity. Most of the medical evaluations are subjective; an objective assessment is difficult but most desirable. The authors described some objective surgical skill assessment based on OSAST, dexterity and global rating scale. Moreover, we discussed the formative and summative assessment roles to the medical learning process.

**Keywords**: Education, medical/methods; Evaluation/methods; General surgery/education; Learning; Training.

**RESUMO**: Um dos aspectos mais críticos na educação em medicina é a avaliação de novos conhecimentos e habilidades. Essa avaliação deve testar memórias curta, longa e de recuperação. Quando o aluno obtiver todas essa etapas, a memória perdurará por anos permitindo a realização de atividades cirúrgicas eficientes e seguras a longo prazo. A maioria das avaliações são subjetivas, embora difícil de se realizar a avaliação objetiva é modalidade de ensino ideal. Esse artigo descreveu algumas opções de avaliações objetiva como OSAST, destreza e escala de taxa global. Além disso, foi abordado os valores da avaliação somativa e formativa no processo de aprendizado do estudante de medicina.

**Descritores**: Educação médica/métodos; Avaliação/métodos, Cirurgia geral/educação, Ensino; Aprendizagem.

## INTRODUCTION

One of the most important steps for medical learning is the assessment. As a final goal, an appropriate assessment allows a better medical service for the community[1-3].

Surgical competence assessment evaluate technical skills, decision making and communication skills as well. The assessment can be done during the learning process (formative assessment) and at the end of the training (summative assessment). The former assessment will provide data that enables the faculty interference to improve learning. The summative process will show if the student achieves the competence[1-3].

Nowadays, competence is difficult to measure because most of surgical evaluations are subjective, lacks validity and reliability. In the medical learning process an objective evaluation is desirable. Only with an objective evaluation the clerkship is able to correct and train the students[4] (Table 1).

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**Table 1**. Examples of subjective and objective assessment in surgical training[5]

| Subjective | Objective |
|---|---|
| Operative log book | Checklists |
| Examination | Global rating scales |
| Complication data (morbidity and mortality) | Error score rating |
| Time expenditure by each task | Dexterity analysis |

Dexterity analysis - this analysis can be used for any manual skill evaluation. In surgery a device detects all the surgeon movements and up load in a computer system to measure the range motion. Low range motion more movement accuracy.

Reliability - The skill can be tested by two or more different student. The result must be similar (inter-rater reliability).

Because all safety and quality political changes for patient assistance, and the decrease of surgical rotation period due to knowledge overload, an effective and objective assessment is necessary to achieve competence

The aim of this article is to review surgical training assessment.

It is interesting to comment that these tools can be applied for education undergraduate students learning and for continued medical education (CME).

One of the most frequent assessment formats is OSCE- objective structures clinical examination. The Toronto group adapt this model for surgical skills evaluation: OSATS – objective structured assessment for technical skills[6,7,8].

Moreover other objective type of assessments, such as dexterity, global ratinf scale can be used in the association of OSATS to improve surgical training evaluation[8].

## ASSESSMENT METHODS

### OSATS

The objective structured assessment of technical skills is based on stations where the students perform a specific surgical ability is a fixed period of time . Depend on the aim of the evaluation this assessment can be divided in 6-8 different stations. Each station mimics a technical skill or part of a particular ability, in the case of complex abilities.

The advantages of this type of assessment are task flexibility, several models can be used: animal, simulators, cadaver, objective evaluation. The disadvantages are cost, schedule complexity, human resources (number of monitors and education and time expenditure) to apply this evaluation[4,8].

### Dexterity

A computer program can be used to evaluate human movement assessment and simulation.

Human movement assessment is a kinesiology tool to study human movements. This evaluation allows studying purposeful hand direction, depth perception, finger coordination, movement speed, dexterity and movement precision[8].

Some programs are available in the market (ADEP[9], ICSAD[10]). Despite their technical characteristics al the software aim is to measure surgeon accuracy.

Another interesting simulation model is virtual reality simulator. The 3-D software provides a “real world” simulation, but the available models are considered as a low-fidelity simulator. Some new softwares are in testing phase and included haptic properties (force and touch skills) to promote a more realistic model of assessment[4].

### Global Rating Scale

This scale is based on seven questions related to a particular surgical ability evaluated by a Likert scale (5-point scale)[11].

For an illustrative example see knots and suture assessment section and Table 2.

### Another methods to evaluate surgical skills

We will describe some assessment related to surgical skills.

#### *Ultra-violet / fluorescein analysis in surgical scrubbing and hand hygiene*

All the students will scrub their hand with a misture of surgical soap and fluorescine (BODE® Visirub dissolved in Sterillium, Schülke Optics, B. Braun Fluo-Rub®, and Ecolab Magic Blue®)[12].

The next step the student will expose their hands in a ultra-violet lamp and a digital photographic will be done. This photography will be digitalized and by an Image J Pro ®[13] software the no fluorescent parts of the hands will be measure. If we found an area greater than 5% of the total hand area a new training will be necessary[14].

#### *Knots and suture*

Global rating scale

The most used tool to evaluate knots and suture is the Global rating score. Although the authors claim objectivity some aspects continue to be considered subjective[11].

**Tabela 2. Global rating scale[11]**

| Rating | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Respect for tissue** | Frequently used unnecessary force on tissue or causal damage by inappropriate use of instruments | | Careful handling of tissue but occasionally caused inadvertent damage | | Consistently handled tissues appropriately with minimal damage |
| **Time and motion** | Many unnecessary moves | | Efficient time/motion but some unnecessary moves | | Clear economy of movement and maximum efficiency |
| **Instrumental handling** | Repeatedly makes tentative or awkward moves with instruments by innappropriate use of instruments | | Competent use of instruments but occasionally appeared stiff or awkard | | Fluid moves with instruments and no awkardness |
| **Knowledge of instruments** | Suture and knots with inadequate tension | | Competent suture, appropriate tension and, adequate knots | | Excellent suture, with adequate tension and knots |
| **Flow of operation** | Frequently stopped operating and seemed unsure of next move | | Demosntrated some forward planning with reasonable progression of procedure | | Obsviously planned course of operation with effortless flow from one move to the next |
| **Use of assistants** | Consistently placed assistants poorly or failed to use assistants | | Appropriate use of assistants most of the time | | Strategically used assistants to the best advantages at all time |
| **Knowledge of specific procedure** | Deficient knowledge. Needed specific instruction at most steps | | Knew all important steps of operation | | Demonstrated familiaritywith all aspects of operation |
| **Overall results** | Fail | Fail | Pass | Pass | Pass |

Pender et al.[15], showed an interesting tool to evaluate knots and suture skills. The paper studied 12 different knots and suture[15] (Table 3).

**Table 3.** Knots and suture training assessment

| Task | Category | Competence | Aim |
|---|---|---|---|
| Two handed, under tension, sugeon's knot | Accuracy, gap, slippage, breakage (suture) | Time ≤ 26 sec, no errors | Two consecutives repetitions (upper limit=80) |
| Two handed, under tension, slip knot | Accuracy, gap, slippage, breakage (suture) | Time ≤ 30 sec, no errors | Two consecutives repetitions (upper limit=80) |
| One handed, under tension, slip knot | Accuracy, gap, slippage, breakage (suture) | Time ≤ 30 sec, no errors | Two consecutives repetitions (upper limit=80) |
| Suture, simple, interrupted | Accuracy, gap, slippage, breakage (suture) | Time ≤ 36 sec, no errors | Two consecutives repetitions (upper limit=80) |
| Suture, Suture,interrupted, horizontal mattress | Accuracy, gap, slippage, breakage (suture) | Time ≤ 60 sec, no errors | Two consecutives repetitions (upper limit=80) |
| Suture, interrupted, vertical mattress | Accuracy, gap, slippage, breakage (suture) | Time ≤ 36 sec, no errors | Two consecutives repetitions (upper limit=80) |

Another method to assess knots and suture was proposed by Goova et al.[17] The authors assessed six different types of knots and suture. The evaluation was based on the following criteria:

- ✓ Proficiency training goal (number of consecutive procedure repetitions);
- ✓ error rate (accuracy, gap in the knot's sequence, slippage and breakage of the knots and suture);
- ✓ proficience score (time to perform the task with no errors)[16,17] (Table 4).

Errors - see Table 5.

**Table 4.** Knots and suture training assessment

| Task | Cutoff time (sec) | Proficiency score |
|---|---|---|
| Palm needle driver | 60 | 53 (7 sec), no errors |
| Two-handed knot, without tension | 60 | 50 (10 sec), no errors |
| One handed knot, without tension | 60 | 50 (13 sec), no errors |
| Two-handed knot, with tension,surgen's knot | 60 | 47 (15 sec), no errors |
| Two-handed knot, with tension, slip knot | 60 | 45 (15 sec), no errors) |
| One-handed knot, with tension, slip knot | 60 | 45 (15 sec), no errors |
| Simple interrupted suture | 120 | 102 ( 18 sec), no errors |
| Suture, Suture, interrupted, horizontal mattress | 120 | 89 (31 sec), no errors |
| Suture, interrupted, vertical mattress | 120 | 89 (31 sec), no errors |
| Simple running suture | 600 | 435 (165 sec), no errors |
| Subcuticular running suture | 600 | 396 (204 sec), no errors |
| Subcuticular interrupted suture | 120 | 87 (33 sec), no errors |

**Table 5.** Errors description related to knots and suture assessment

| Task | Error |
|---|---|
| Palm needle driver | No closure of needle drives (3 clicks),accuracy, instrument drop, non-palming |
| One and two-handed knots and suture | No closure of needle drives (3 clicks), accuracy, instrument drop, non-palming, knot gap (bigger than 3 mm) |

Each one of the table errors descriptions correspond to a minus one point in the equation.

However some errors demand a higher punctuation:

- ✓ Slippage bigger than 3 mm, (- 10 points);
- ✓ Total slippage or knot break (- 20 points);
- ✓ Protocol violation – fatal flaw.

According to the previous information, the assessment score can be calculated by the following equation[16,17]:

- ✓Cutoff time – completion time – 10X (sum of the errors);
- ✓The cutoff score are showed in the Table 4.

## RESEARCH IN EDUCATION

Many other surgical skills do not have an objective assessment. This type of assessment must be based on Myller's pyramid for declarative and procedural knowledge acquisition. Basically, the student has to know how this work and show it.

Moreover, there is a correlation between student self-confidence and competence[1,2,18]. According to Clanton et al.[18] the correlation was 0.88 for knot training in third year medical students.

The confidence evaluation questionnaire was based on the Likert scale and some suggestions for the confidence evaluation are disposable in the medical literature[18].

As an example we showed the following questionnaire extract from Clanton et al.[18], paper.

### Confidence questionnaire of surgical skills

Please rate your confidence to complete the following tasks on a scale of 1 to 6.

I feel confident that I can:

1. Tie 10 complete 2-handed square knots using proper surgical technique;

2. Tie 10 complete 1-handed square knots using proper surgical technique;
3. Tie a surgeon's knot using proper surgical technique;
4. Complete a 2-handed with appropriate tension;
5. Complete a 2-handed square knot without the knot breaking;
6. Complete a 2-handed square knot without the knot unraveling;
7. Complete a 2-handed square knot with appropriate speed and efficiency;
8. Tie a series of 4 instrument tied square knots using proper surgical technique;
9. Perform an instrument tied square knot with appropriate tension;
10. Perform an instrument tied square knot while everting the skin edges;
11. Perform an instrument tied square knot without the knot breaking;
12. Perform an instrument tied square knot without the knot unraveling;
13. Perform an instrument tied square knot with appropriate speed and efficiency;
14. Demonstrate proper needle loading onto needle driver;
15. Demonstrate a simple interrupted stitch using proper surgical technique;
16. Demonstrate a simple running stitch using proper surgical technique;
17. Demonstrate suturing technique without excessively damaging the tissue;
18. Suture a wound with a good cosmetic result.

**Covariates in learning assessment**

Another relevant issue to be considered in medical education is some factors that can interfere in the learning process.

Some of these the variables have been studied: gender, handiness, scholar background, previous experience, psychological traits.

Although, the covariate factors influence in the learning process, the increment of all those covariates can work as confounders factors[19-20].

For this reason, and according to literature data, the most relevant factors are: gender, handiness and previous experience related to the studied skill[7,19,20].

## CONCLUSION

The authors described some objective surgical skill assessment based on OSAST, dexterity and global rating scale. These tools were important to analyze the learning effectiveness regarding long-term memory and retrieval memory.

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