

Evaluation of the creditability of forensic tests through competency tests

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Abstract

The paper aims to evaluate a round of Competence Tests with qualitative results (non-destructive tests) in the field of classical forensics. The purpose of organizing the competency test rounds is to evaluate the performance of the forensic laboratories.

The performance of the laboratories is estimated by the statistical evaluation of the results obtained by each participant. In this particular case, the assignment of the values of the competence test objects (CTO) was carried out by the group of experts, and the Competence Test Scheme (CTS) was of the simultaneous participation type; also, the group of experts established the performance evaluation criteria. The results obtained by the participants were satisfactory.

Keywords: competency tests, forensics, qualitative results

1. Introduction

The credibility of the laboratories that perform tests is obtained/maintained by periodic evaluations by recognized specialized bodies (Accreditation Bodies) of the implementation of specific procedures, as well as by verifying the results obtained for the examined samples [1]; [2]; [3]. One of the requirements provided by the regulations in force for obtaining/maintaining the accreditation of a testing laboratory is the regular participation, with satisfactory results, in rounds of competency tests (distribution of homogeneous and stable materials - objects to be tested - to the participants, who submit them to the procedures of test, and the results obtained are evaluated statistically).

The evaluations aim to:

- Identifying problems and initiating improvement actions
- Establishing the effectiveness and comparability of the test or measurement methods
- Providing more confidence to the clients of the laboratories
- Identifying the differences between laboratories
- Training of the participating laboratories
- Validation of statements related to uncertainty.

A special situation is represented by forensic laboratories; they are part of legal laboratories (the results obtained can constitute evidence in court) for which proof of credibility is mandatory. In the particular case of forensic laboratories, samples can be subjected to destructive tests (for example a biological sample), in which the result is quantifiable (percentages) or non-destructive (examination of documents, objects used during crimes, etc.) in which the result it is represented by ensuring compliance with a benchmark (comparing the disputed document with the original document).

2. Materials and methods

The objects of the Competence Tests were produced in specialized laboratories, by competent personnel, in each field of the scheme's tests.

For the evaluated attempts, two samples were created on digital support (images), called "reference" and "litigation". In the case of such proficiency tests, stability and homogeneity are not subject to specific tests; CTOs are not perishable nor can they present inhomogeneities [4].

In Table no. 1, the tests subject to evaluation and the objective of the examination are presented.

Table no. 1. Tests subject to evaluation and the objective of the examination

No. crt.	Test (examination)	The objective of the examination
1	Handwriting examination	Are the disputed writing and the reference writing executed by the same scriptor?
2	Signature examination	Are the disputed signature and the reference signature executed by the same scriptor?
3	Examination of stamp impressions	Were the two stamp impressions created with the same stamp?
4	Identification of firearms by the traces left on the tubes and projectiles	Are the two cartridge tubes fired from the same gun?
5	Examining and comparing security graphics	Is the disputed document genuine?
6	Examination and comparison of DOVID elements (holograms)	Is the disputed document genuine?
7	Examining traces and papillary impressions	Do the contested fingerprint and the reference fingerprint belong to the same person (hand, finger)?

Sources: own contribution

For this scheme of Competence Tests, were established a priori possible values of measurands of nominal type scaled: positive, negative, most likely positive, most likely negative, uncertain.

The assigned values for the 7 attempts were established by the consensus of the experts (experts independent of those who produced the objects of the competence tests). The experts' opinions were unanimous. For attempts no. 1, 2, 3, 4 and 7 the assigned values were "Positive (YES)", and for tests no. 5 and 6 the assigned values were "Negative (NO)"

Each of the evaluated trials are carried out according to validated procedures, which contain, in general, the following stages: separate examination of the disputed and reference evidence, comparative examination of the disputed and reference evidence, establishing/formulating the result of the examination.

Participating laboratories use equipment specific to examinations for tests.

In table no. 2 shows the main equipment used for these tests.

Table no. 2. Equipment used

No. crt.	Test (examination)	The objective of the examination
1	Handwriting examination	- examination with simple optical instruments [7]
2	Signature examination	
3	Examination of stamp impressions	
4	Identification of firearms by the traces left on the tubes and projectiles	- examination with simple optical instruments - examination with complex optical instruments (spectral video comparator) [7] - use of dedicated software [5]
5	Examining and comparing security graphics	- examination with simple optical instruments[7]
6	Examination and comparison of DOVID elements (holograms)	- examination with complex optical instruments (stereomicroscope) [7] - examination with the help of spectral analysis equipment[7] - use of dedicated software [5]
7	Examining traces and papillary impressions	- examination with simple optical instruments[7] - examination with complex optical instruments (stereomicroscope) [7] - the use of dedicated software [6]

Sources: own contribution

The performance evaluation criteria are:

- the value transmitted by the laboratory agrees with the assigned value = 4 points;
- the value transmitted by the laboratory agrees, most likely, with the assigned value = 3 points;
- the participant's answer qualifies the measured value as uncertain = 2 points;
- the value transmitted by the laboratory does not agree, most likely, with the assigned value = 1 point;
- the value transmitted by the laboratory does not agree with the assigned value = 0 points

Performance evaluation:

Satisfactory (s) minimum 3 points

Uncertain (d) 2 points

Unsatisfactory (ns) below 2 points.

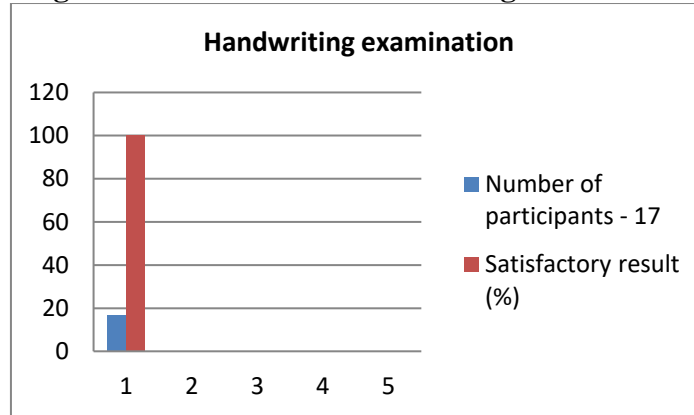
3. Results and interpretations

A number of 17 laboratories from Romania and the Republic of Moldova signed up to this scheme; only a part of the laboratories participated in some tests, depending on the profile of each one

Handwriting examination

Number of participants 17
Assigned value Positive (YES)
Participant answers 17 Positive (YES)
Results 17 results Satisfactory (s)

Fig. no. 1- The chart of handwriting examination

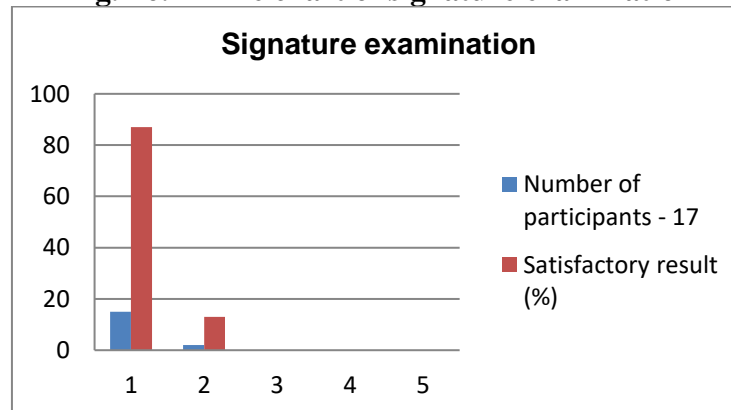


Sources: own contribution

Signature examination

Number of participants 17
Assigned value Positive (YES)
Participant answers 15 Positive (YES); 2 AML
Results 17 results Satisfactory (s)

Fig. no. 2- The chart of signature examination

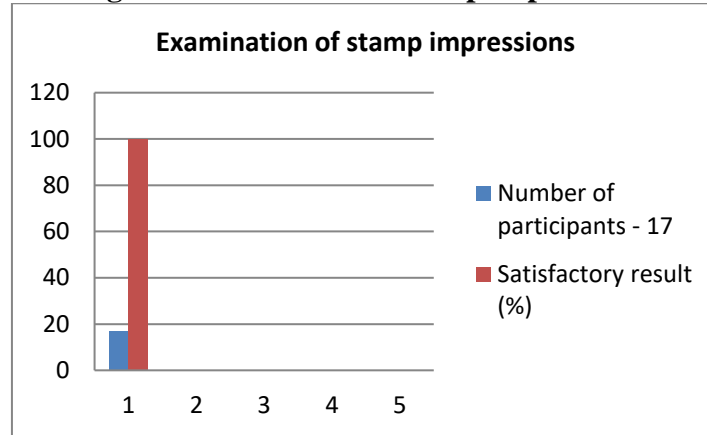


Sources: own contribution

Examination of stamp impressions

Number of participants 17
Assigned value Positive (YES)
Participant answers 17 Positive (YES)
Results 17 results Satisfactory (s)

Fig. no. 3- The chart of stamp impressions

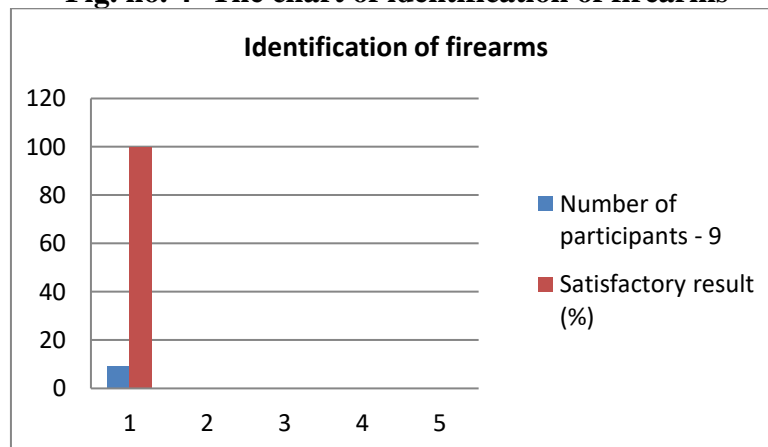


Sources: own contribution

Identification of firearms, according to the traces left on the tubes and projectiles

Number of participants 9
 Assigned value Positive (YES)
 Participant answers 9 Positive (YES)
 Results 9 results Satisfactory (s)

Fig. no. 4- The chart of identification of firearms

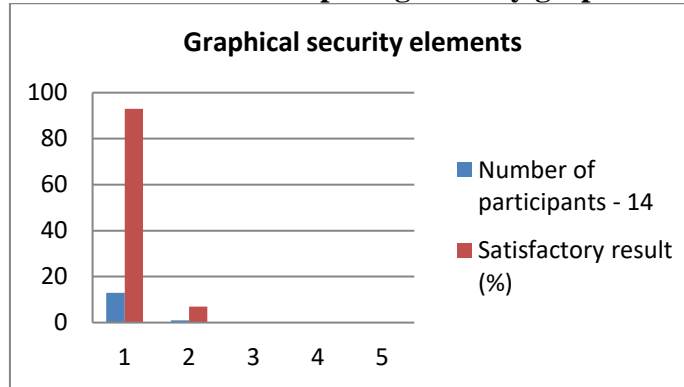


Sources: own contribution

Examining and comparing security graphic elements

Number of participants 14
 Assigned value Negative (NO)
 Participant answers 13 Negative (NO); 1 AML
 Results 14 results Satisfactory (s)

Fig. no. 5- The chart of comparing security graphic elements

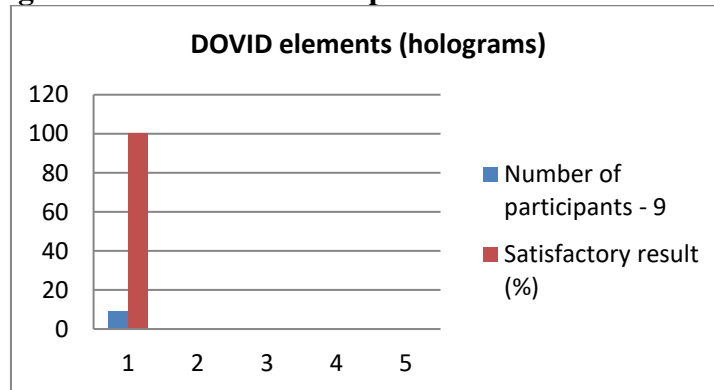


Sources: own contribution

Examination and comparison of DOVID elements (holograms)

Number of participants	9
Assigned value	Negative (NO)
Participant answers	9
Results	9 results
	Satisfactory (s)

Fig. no. 6- The chart of comparison of DOVID elements

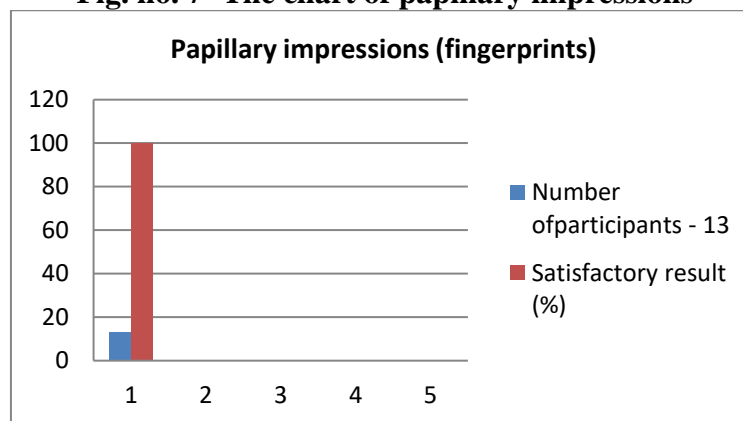


Sources: own contribution

Examining traces and papillary impressions

Number of participants	13
Assigned value	Positive (YES)
Participant answers	13
Results	13 results
	Satisfactory (s)

Fig. no. 7- The chart of papillary impressions



Sources: own contribution

4. Conclusions

The objects to be tested were made according to the needs of the examination and corresponded to the profile of the tests in the participating forensic laboratories.

The procedures for the transmission of the objects to be tested, as well as the reception, evaluation and communication of the results were respected and led to the obtaining of conclusive results regarding the effectiveness of the round of competency tests.

All laboratories obtained satisfactory results, which demonstrates their practical experience in examining specific materials by non-destructive methods.

5. Bibliographic References

- [1] SR EN ISO 17043:2010 General requirements for proficiency tests
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- [4] ISO Guide 35:2017- Reference materials- Guidance for characterization and assessment of homogeneity and stability
- [5] Best Practice Manual for the Forensic Examination of Handwriting ENFSI-BPM-FHX-01 version 02- June 2018
- [6] BPM for Fingerprint Examination ENFSI-BPM-FHX-01 version 01– November 2015
- [7] Specific work procedures in forensic laboratories in Romania