

Formative Assessments as an Instrument to Improve Students' Learning Outcomes – A Case Study in the Course 'Conservation of Photographs'

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Introduction

In educational evaluation, two primary forms of assessment are commonly distinguished: Formative assessment (FA) and summative assessment (SA). Both are designed to provide evidence of students' knowledge, skills, and competencies (Dolin et al. 2018, p. 62). However, they differ fundamentally in their purpose and use (Horst et al. 2015, p. 410). FA is intended to support and enhance students' ongoing learning processes, whereas SA aims to evaluate learning achievement at a specific point in time, most often at the conclusion of a course (Dolin et al. 2018, p. 61–62). Evidence for SA is typically collected through graded examinations, which may take various forms, such as written or oral exams, reports, portfolios, among others (Dolin et al. 2018, p. 61–62). While SA is generally governed by formal institutional and legal frameworks, such formalization typically does not apply to FA. Consequently, decisions regarding its application rest entirely with teachers (Horst et al. 2015, p. 409).

Courses assessed exclusively through SA may provide limited opportunities for students to reflect on their learning and make improvements during the course. In response to this challenge, the present project sought to implement FA as a means of supplementing students' learning in a course normally assessed solely through a final written report. FA provides information that guides students' knowledge acquisition and development and has the potential to recognize progress (Horst et al. 2015, p. 411). Thus, three FA activities were designed and

implemented twice each to gain insight into students' knowledge across six teaching topics. The evidence generated through these activities informed instructional decisions and identified necessary steps to support students' learning development (Dolin et al. 2018, p. 56).

Course Background

This project was implemented within the course *Conservation of Photographs* at the Royal Danish Academy – Institute of Conservation (RDA-IC). The course is a third-year mandatory module in the Bachelor's program in Graphics Conservation, worth 15 ECTS, and is conducted over a nine-week consecutive block. In the current iteration, the class consisted of a small group of ten students.

The course aims to provide students with a foundation in the history, techniques, materials' deterioration, and identification of photographs. In addition, students are expected to develop competences to define well informed conservation solutions for photographic materials and collections.

The course structure consists of approximately 15% lectures, 25% supervised practical work, 9% unsupervised practical work, 24% written work, and 27% self-study. It was organized by nine weekly modules, with each module focusing on a specific material typology and/or conservation challenge. Most modules follow a structure in which a lecture is followed by a workshop/lab class.

The course assessment is based on an individual written report, submitted at the end of the term. The assessment type was defined prior to my appointment at the RDA-IC. I, however, defined the content of the report, which consisted of a compilation of the reports produced during the various workshop sessions throughout the course. The report requires students to reflect on the case studies they worked on and to document, describe, and critically analyze the photographic materials, techniques, conservation issues, and treatments they conducted.

As the course coordinator and main lecturer for the first time, I had the opportunity to restructure the content of the course. Throughout this process, I sought to synchronize as much as possible, the curriculum, the teaching and learning activities, and assessment strategy to enhance the learning outcomes of the students.

Justification for the Project

After performing a congruence analysis of the course, I concluded that relying solely on a final SA was insufficient to adequately support students' learning processes. While the final written report provides a grade reflecting the quality of the submitted work, it does not actively guide learning during the course (Dolin et al. 2018, p. 58). In the absence of structured opportunities for intermediate feedback, there is a risk that misunderstandings or superficial engagement with the course content persist until the final assessment.

Furthermore, based on prior teaching experience in the conservation of photographs, I have observed that students frequently feel overwhelmed by the wide range of photographic processes introduced in the course. This complexity can result in uncertainty and difficulties in meaningfully integrating new knowledge. These observations reinforced the need for more systematic and continuous support to help students navigate and assimilate the course content.

To address these issues, FA activities were introduced throughout the course. The primary aim of these non-graded assessments was to provide students with ongoing guidance, clarify misunderstandings, and highlight key concepts (Dolin et al. 2018, p. 70). When used constructively, FA can provide targeted feedback that contributes to improvements in learning outcomes and, ultimately, to the quality of the SA (Dolin et al. 2018, p. 59). Given that the final report integrates work developed across multiple modules, the FA activities were expected to positively influence students' performance in the SA. Moreover, actively involving students in the assessment process has been shown to enhance engagement and motivation, helping students in taking greater ownership of their learning (Black & Wiliam 2009, p. 8–9).

In addition to supporting students' learning, FA provides valuable opportunities for teachers to adapt teaching methods and course content in response to students' needs in real time (Dolin et al. 2018, p. 58). In this way, FA functions as a structured, iterative process of feedback and feedforward, contributing to the ongoing development of both students' learning and teaching practice (McManus 2008, 5).

Finally, the implementation of FA has the potential to enhance course congruence by strengthening the alignment between curriculum objectives, learning activities, and assessment methods. Such alignment contributes to a more coherent and effective learning environment.

Structure and Implementation of the FA

The project focused on evaluating the effectiveness of three different FA methods in supporting students' learning:

1) Questionnaire + discussion (type 1)

An online anonymous questionnaire was prepared in Google Forms, primarily consisting of direct questions (multiple-choice or short answer). After students completed the questionnaire, the results were observed and discussed collectively.

2) Pair discussion + oral presentation + discussion (type 2)

Different themes were assigned to pairs of students. Each pair discussed their theme and presented it orally to the whole class. A teacher-mediated discussion followed each presentation to consolidate understanding.

3) Group production of a scheme + oral presentation + discussion (type 3)

Different themes were assigned to groups of approximately three students. Each group collaboratively created a visual diagram or flowchart. A teacher-mediated discussion followed each group presentation to review and deepen understanding.

FAs were conducted six times across the nine weekly modules. Excluding the first week (which is organized in a different way) and two guest-taught modules (in which no assessment was included), each FA type was used twice. The FA types followed a fixed sequential order (1, 2, 3, 1, 2, 3) and were not aligned with specific weekly content (Fig. 1).

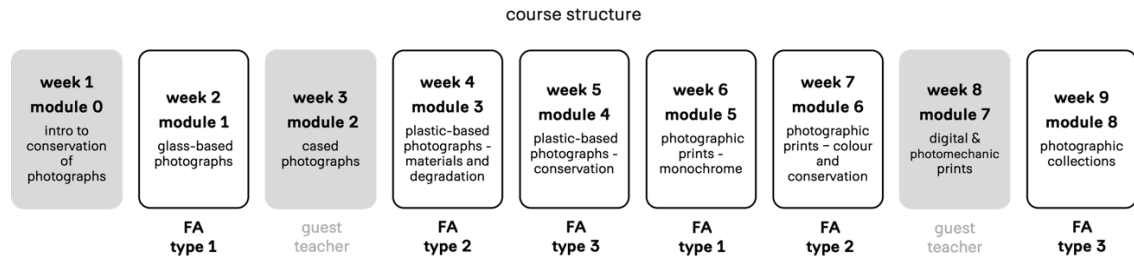


Fig. 1. Course structure with mapping of the implemented formative assessment (FA) types.

The FAs were conducted at the end of each module, typically at the beginning of the following week, and focused exclusively on the topics covered in that module. Each FA session lasted on average 45 minutes, and students were briefed on the objectives and structure of the assessment beforehand.

Except for one session (corresponding to a module of higher complexity), students completed the FAs without access to their notes, lecture slides, or other literature, to more accurately evaluate the knowledge retained from the previous week.

During the FA sessions, my role was to observe students' performance and monitor their level of knowledge. Based on the collected evidence, I mediated constructive discussions, clarified misunderstandings, and reinforced key concepts. I also guided students' independent study by suggesting further exploration of specific topics through targeted literature. In turn, students were able to clarify confusing concepts, self-assess, and validate their knowledge, enabling them to direct their learning more effectively (Fig. 2).

On the last day of the course, students were invited to provide feedback regarding their experience with the FA. An online anonymous questionnaire was conducted in class using Google forms. They answered a total of 6 questions focusing on: i) overall usefulness, ii) impact on learning, iii) relevance to the final assessment, iv) comparison with modules without FA, v) time vs benefit, vi) preferred assessment format, vii) suggestions for improvements (Appendix 1). After filling out the questionnaire, the students were asked to share their experience and suggestions orally.

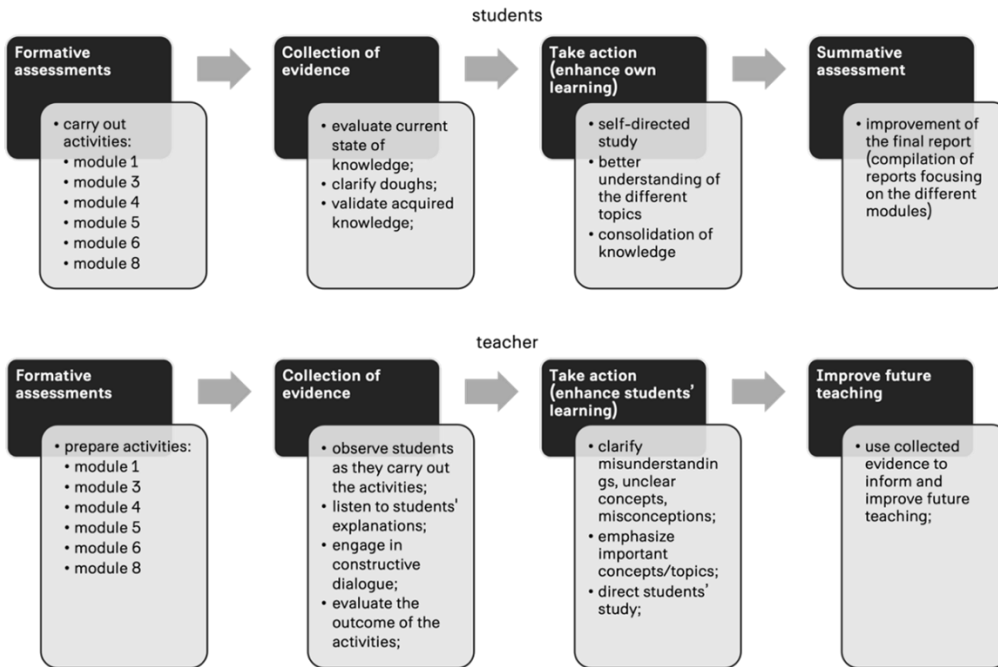


Fig. 2. Role and actions of students and teacher in formative assessment.

Feedback from Students

From the ten students, seven answered the questionnaire (70% of the class) (Appendix 2). Based on their answers to the questionnaire (Fig. 3) and the following oral discussion, it is possible to state that students found the FA useful to consolidate the knowledge from lectures and practical classes.

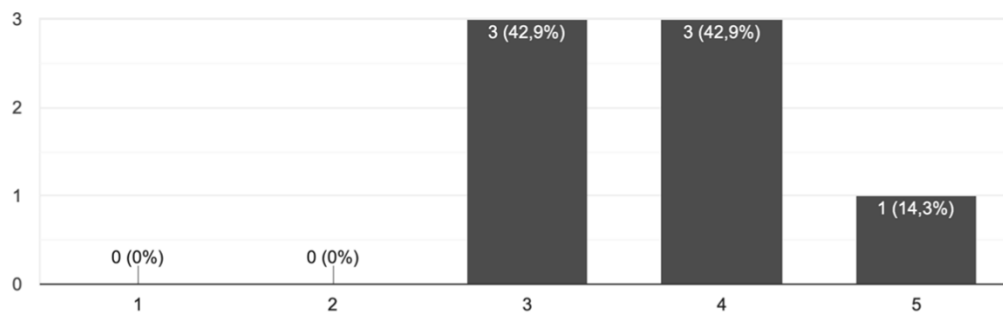


Fig. 3. Overall usefulness of the formative assessment (scale: from 1 - not at all, to 5 - to a great extent).

During the oral feedback, it became clear that most students agreed that FA improved their learning outcome by making a recap and allowing

them to recall the topics from the previous module. They found it especially important in a course with so much new content every week. Some students also noted that it helped to understand the most important takeaways from the lectures. One of the students said that the FA was effective at pointing out which areas required more self-study.

Regarding the relevance of the FA in supporting the preparation of the final report, student opinions were more varied (Fig. 4).

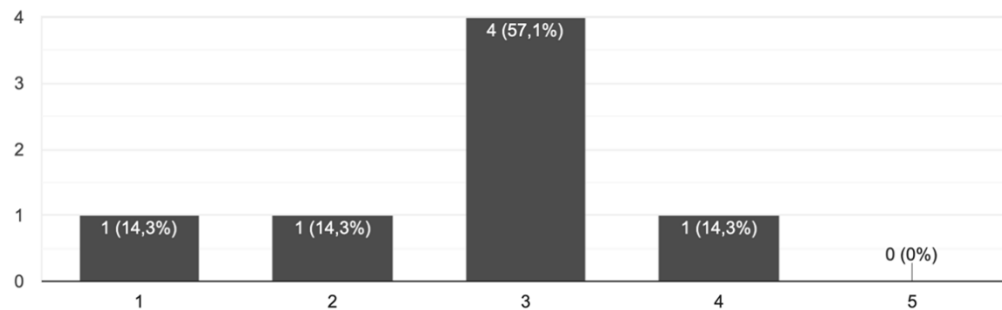


Fig. 4. Support provided by the formative assessment in the preparation of the final report (scale: from 1 - not at all, to 5 - to a great extend).

During the oral feedback, some students explained that FA activities were primarily effective in improving their understanding of the topics, rather than directly enhancing their performance on the final report. One student noted that by emphasizing the key elements of each module, the FAs helped them identify what to focus on in the report. Another student remarked that it is difficult to measure the direct impact of FA on the SA, but suggested that it could be greater than expected, as the FA gradually build students' knowledge, potentially influencing the quality of the final report.

Students were asked whether they perceived FA activities as providing added value to their learning compared with sessions that did not include such activities, regardless of the instructor responsible for the module. As two modules were taught by guest instructors and did not incorporate FA, these sessions served as a natural point of comparison. Most students reported that FA provided an additional benefit to their learning when compared with sessions that did not include FA (Fig. 5).

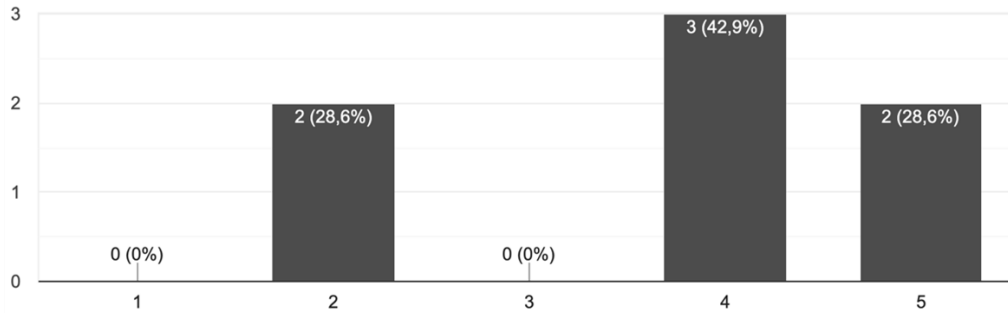


Fig. 5. Benefit to the learning of having modules comprising formative assessment activities compared to those not having it (scale: from 1 - not at all, to 5 - to a great extend).

In general, it can be said that most students considered it was worthwhile spending time on FA (Fig. 6). This was clearly reinforced by the students during the oral feedback session.

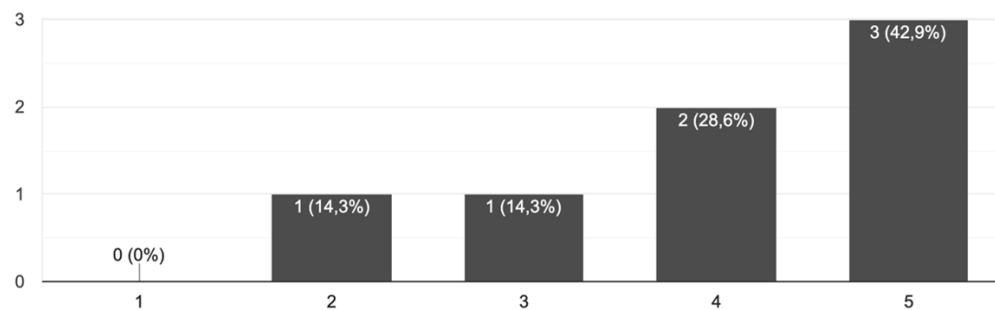


Fig. 6. Value of time spent on formative assessment (scale: from 1 - not at all, to 5 - to a great extend).

Regarding the FA types, some students did not show a clear preference, but most students preferred type 1 (questionnaire + discussion) (Fig. 7). Most agreed that the questionnaire is more effective in tracking their current state of understanding and knowledge gaps. At the same time, this FA being binary ('right or wrong' type), allowed them to feel validated when they gave a right answer.

In contrast, none of the students expressed a particular appreciation for FA Type 3 (group production of a scheme + oral presentation + discussion) (Fig. 6). They explained that this was primarily because they spent a significant amount of time creating an aesthetically "good-looking" scheme, which shifted their focus away from the content of the module.

In what concerns FA type 2 (pair discussion + oral presentation + discussion), the answers varied (Fig. 6). Some students stated that the discussion with pairs was constructive and improved their understanding about the topic, while other said they lacked validation of their one knowledge. Also, some found it became less evident what were the major takeaways from the module with this FA type.

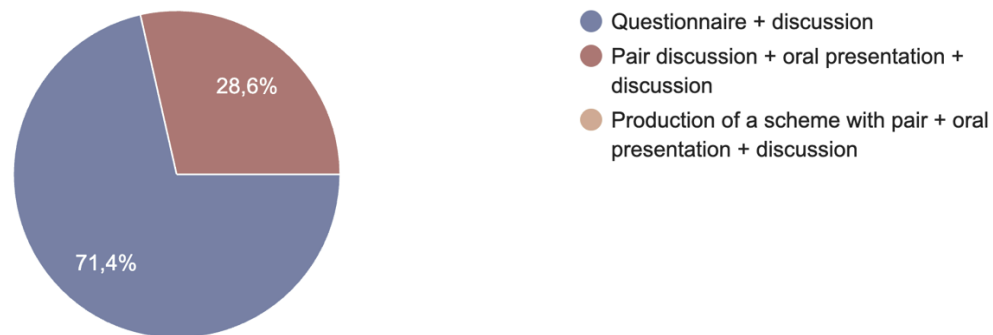


Fig. 7. Preferred assessment format.

Some students noted that, while the questionnaire guided their responses through specific questions, the other FA types, with open discussion topics, were more abstract and harder to address, as they relied solely on their own or their peers' memory.

Own Reflections of the Present and for the Future

In general, I consider that the FA improved the students' learning outcomes. As intended, the assessments provided continuous support, helping students navigate the course content more effectively. Based on the experience with this project, I will undoubtedly maintain FAs in the next edition of the course. Nevertheless, the FA sessions can be further optimized to enhance their effectiveness.

Before implementing the FAs, I assumed that type 1 (questionnaire + discussion) could be less engaging, as it is more self-centered and lacks peer interaction. However, it proved to be highly effective in validating students' understanding and identifying knowledge gaps, offering a personalized response to each student (Black & William 2009, p. 11). As a teacher, it was also easier to perceive what students did or did not remember and understand. During the subsequent

discussion, I could easily focus on clarifying misconceptions and reinforcing weak areas. In the same way, this FA type provided more objective feedback for improving my lectures in the future.

Type 2 (pair discussion + oral presentation + discussion) also added value to students' learning. This format promoted peer discussion, allowing students to support each other and build knowledge collaboratively (Dolin et al. 2018, p. 60). Although I could not follow every discussion fully due to a language barrier, I was positively surprised by the quality of the oral presentations. These presentations helped students systematize their knowledge and develop communication skills, adding an additional layer of learning.

In contrast, type 3 (group production of a scheme + oral presentation + discussion) was less effective. The schemes were often incomplete, and the oral presentations were frequently dominated by explanations of the diagram's design rather than the module content. As students themselves noted, much of their attention was spent on the visual design, detracting from the learning focus. I also observed that some groups divided tasks and worked individually rather than collaborating, which limited the benefits of peer learning.

In future iterations of the course, I will discard FA type 3 and focus on improving the efficiency of types 1 and 2. For FA type 2, I plan to structure discussions in a way that addresses issues raised by students, such as unclear takeaways and insufficient validation of understanding. I also intend to match the FA type to the content of each module rather than following a fixed sequence.

Clarifying the intended learning outcomes for each module could further support students in understanding what they are expected to know and do, whether any action is needed, and what steps to take next (McManus 2008, 4). Additionally, better alignment between FA and SA, for example designing a SA that reflects the formative activities, could strengthen learning outcomes (Dolin et al. 2018, p. 72).

Overall, I believe that the FAs added congruence to the course, better aligning the curriculum, learning activities, and assessment, and creating a more coherent and effective learning environment.

References

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Appendix 1 - Conducted Formative Assessments

Formative Assessment 1 - Glass-based photographs

* Indica uma pergunta obrigatória

1. What is a glass-based photograph? *one short sentence* *

2. Which **monochromatic glass-based photographs** do you know? *

3. Are glass-based photographs **always negative**? *

Marcar apenas uma oval.

yes

no

4. Which one of the following is **both a negative and a positive**? *

Marcar apenas uma oval.

albumen plate

wet collodion plate

gelatine plate

5. What is the major **limitation** of a wet collodion? *

Marcar apenas uma oval.

- it is not very sharp
 it needs a very long exposure time
 it has to be exposed and processed while wet

6. Which one has a **shorter exposure time**? *

Marcar apenas uma oval.

- albumen plates
 wet-collodion plate
 gelatine plate

7. Which characteristics can you use to distinguish between a **wet collodion** and **gelatine plate**? *

Marcar tudo o que for aplicável.

- tone
 format
 thickness of glass
 date
 degradations
 content of the image

8. Which glass-based **colour** process achieved a great success? *

9. What are the main degradations usually found in the **base (glass)** of these materials? *

10. What are the main degradations usually found in the **emulsion** of these materials? *

11. What should you consider when **rehousing** and **storing** glass-based photographs? *

Marcar tudo o que for aplicável.

- use PAT tested materials
- use paper with alkali buffer
- store the materials at T~18°C and RH~30-40%
- if possible store materials at very low T and RH

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FORMATIVE ASSESSMENT 2

Plastic-based photographs

Materials, Identification, and Preventive Conservation

G1, G4

- Briefly explain the main fragilities of the 3 types of plastic-based materials

G2

- Describe a workflow to identify/distinguish the 3 types of plastic-based materials

G3, G5

- Explain what can you do to extend the lifespan of all 3 types of plastic-based materials



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FORMATIVE ASSESSMENT 3

Plastic-based photographs - Conservation & Restoration

- Work in groups of 3 or 4 on the weeks theme and develop a visual diagram/scheme - ca. 15 min
- Presentation of the diagram to the class - ca. 15 min



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Formative Assessment 4 - Monochromatic prints (Material & Identification)

* Indica uma pergunta obrigatória

1. What is a **photographic print**? *

2. Which are the 2 main **types of photographic paper**? *

3. How is the image obtained in a **printing-out-paper (POP)**? *1 short sentence* *

4. How is the image obtained in a **developing-out-paper (DOP)**? *1 short sentence* *

5. Mark the sentences that are **wrong**: *

Marcar tudo o que for aplicável.

- POP have photolytic silver
- DOP have photolytic silver
- filamentary silver is less prone to degradation than photolytic silver
- DOP tend to fade faster than POP
- toned silver prints tend to be more prone to degradation
- toning is a purely aesthetic treatment

6. How many layers has an albumen print? *

Marcar apenas uma oval.

- 1
 2
 3

7. How many layers has a salted paper print? *

Marcar apenas uma oval.

- 1
 2
 3

8. How many layers has a DOP? *

Marcar apenas uma oval.

- 1
 2
 3

9. How many **layers** can you see? *



Marcar apenas uma oval.

- 1
- 2
- 3

10. Which monochromatic **non-silver prints** do you know? *

11. Do you **agree** with this sentence?: *In general, monochromatic non-silver prints* *
are more stable than silver prints.

Marcar tudo o que for aplicável.

- yes
- no

12. What do you have to look for when identifying photographic prints? *only choose * the 3 options you consider more important*

Marcar tudo o que for aplicável.

- paper fiber visible
- surface sheen
- layer structure
- tone
- degradation signs
- texture
- image content
- paper fibers invisible

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FORMATIVE ASSESSMENT 5

Colour prints - Material & Identification Conservation & Restoration of photographic prints

G1

- Briefly explain the **colour pigment** processes you learned about. What are the **main fragilities** of these processes?

G2

- Briefly explain **dye imbibition** (dye transfer) and **dye coupling** processes (chromogenic). What are the **main fragilities** of these processes?

G3, G5

- Briefly explain dye **destruction** (silver dye bleach) and **dye diffusion** processes (instant). What are the **main fragilities** of these processes?

G4, G5

- What are the **main differences** in the treatment of **monochromatic vs colour prints**?

FORMATIVE ASSESSMENT 6

Conservation of photographic collections

- Work in groups of 3 or 4 on the weeks theme and develop a visual diagram/scheme - **ca. 15 min**
- Presentation of the diagram to the class - **ca. 15 min**



Appendix 2 - Results from the Questionnaire about the Formative Assessments (Feedback from Students)

Feedback on the 'formative assessments'

7 respostas

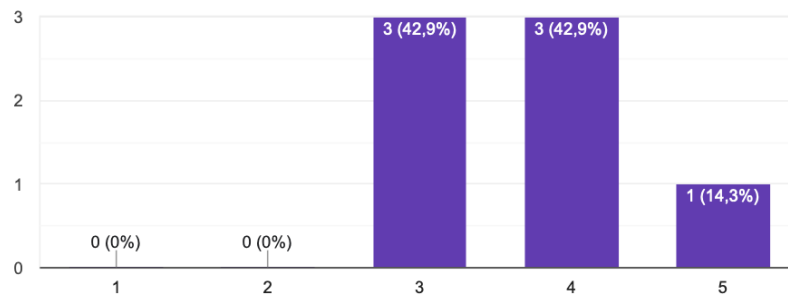
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1. Overall usefulness

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On a scale from 1–5, to what extent did the formative assessments helped you consolidate the knowledge from lectures and practical classes?

7 respostas



2. Impact on learning

In one or two sentences, explain why the formative assessments did or did not help your learning.

7 respostas

It really helped to be reminded of the most important/key takeaways from the lectures.

It was simply quite short. I found that a simple right and wrong quiz was best at highlighting the gaps of my knowledge, but discussing the same thing just made me exhausting

It always helps to recall and recap things you learned the week prior. I always prefer when there is a quick recap of previous lectures/ topics because then I will remember more of it

I liked the questionnaire + discussion and pair discussion + oral presentation + discussion, but the production of a scheme with pair + oral presentation + discussion did not help as much as the other two.

it was a good way to try and jog the memory and put all the lectures into perspective, but sometimes the format of the assessment took over from recounting the theory.

Jeg har været syg så den ville nok have hjulpet mere hvis jeg havde været der til det hele

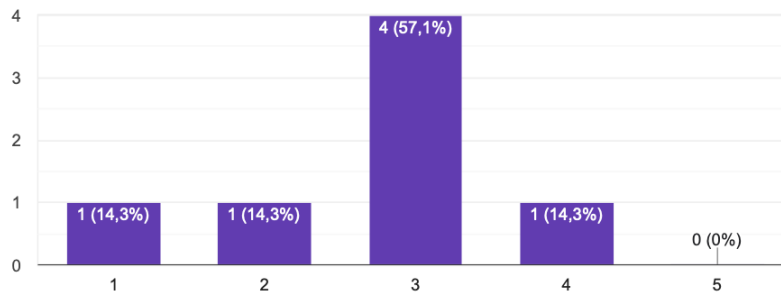
It was a good way to sum up the things learned in class and makes you aware of which areas you need to go back and read more about

3. Relevance to the final assessment



To what extent did the formative assessments support you in preparing your final report?

7 respostas

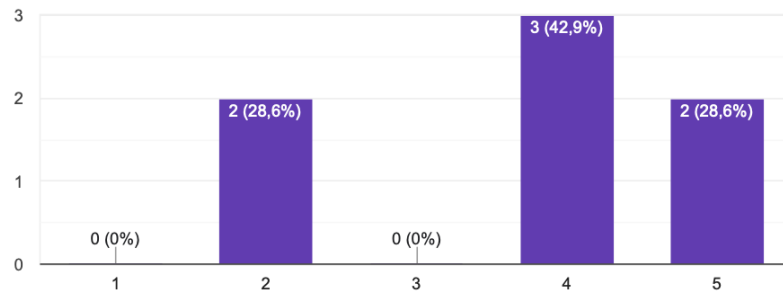


4. Comparison with modules without formative assessment



Regardless of who taught the session, do you feel the formative assessments provided an additional benefit to your learning compared to sessions that did not include them (those with guest teachers)?

7 respuestas

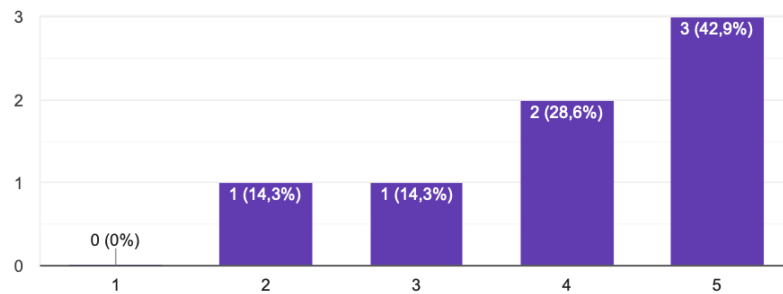


5. Time vs. benefit



On a scale from 1–5, how worthwhile was the time spent on formative assessments?

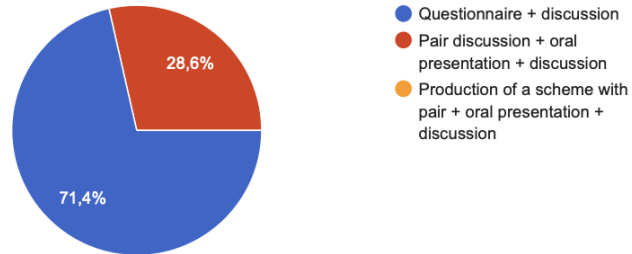
7 respuestas



6. Preferred assessment format

i) Which formative assessment format did you find most useful?

7 respostas

**6. Preferred assessment format**

ii) Briefly describe why.

7 respostas

It was helpful to discuss the content with others.

Its easier to see the knowledge you lack this way, and feeling truly right about an answer is also good for the brain, where a wishy-washy discussion doesnt make one more sure of oneself

I do think getting a questionnaire and talking about it after help me better personally than the pair workings. In a questionnaire the questions also help me recall stuff and it make me realize I do remember things. In the group formative assements there was not always that much to go on and if you are blanking then there is nothing to kickstart the memory.

The production of a scheme with pair + oral presentation + discussionones became much more about the visual and less about the important stuff

due to the questionnaire being individual it seemed more like a test to see what i could remember from lectures and not what the group remembered as a whole, which i think made it more effective

Det gav en bedre ide om hvad der er vigtigt

I think all three were good



7. Improvements

What would you suggest to improve the effectiveness of the formative assessments?

7 respostas

The schematic/diagram were not always helpful, a bit of time was often spent just deciding how it should look.

Maybe it's just me who doesn't see the difference they make, and it may be my subjective experience. I just didn't see much point in it, other than probably being a mandatory thing to do for the paedagogical course.

I prefer the questionnaires, so for me it would be best to just change them all to that. And maybe having a few very open questions so the student can't guess the answer.

More of the first two and more of the discussions

i felt that having to create schemes and visuals sometimes took over from the point of the assessment, and we perhaps spend a bit more time trying to make nice visuals which took focus away from going over the theory. i think that a combination of questionnaire + discussion and pair discussion + oral presentation + discussion would work fine.

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None

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