



## UvA-DARE (Digital Academic Repository)

### Designing for self-awareness

*supporting students' reflexive interactions based on photos*

ten Brink, M.; Witschge, T.; Bredeweg, B.; Schouten, B.

#### DOI

[10.1145/3527927.3532807](https://doi.org/10.1145/3527927.3532807)

#### Publication date

2022

#### Document Version

Final published version

#### Published in

C&C '22

#### License

CC BY-SA

[Link to publication](#)

#### Citation for published version (APA):

ten Brink, M., Witschge, T., Bredeweg, B., & Schouten, B. (2022). Designing for self-awareness: supporting students' reflexive interactions based on photos. In *C&C '22: Proceedings of the 14th Creativity and Cognition 2022 : June 20-23, 2022, Venice, Italy* (pp. 161-170). Association for Computing Machinery. <https://doi.org/10.1145/3527927.3532807>

#### General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

#### Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.



# Designing for self-awareness: supporting students' reflexive interactions based on photos

Marije ten Brink  
m.ten.brink@hva.nl

Amsterdam University of Applied Sciences, Eindhoven  
University of Technology  
the Netherlands

Bert Bredeweg

University of Amsterdam, Amsterdam University of  
Applied Sciences  
the Netherlands

Tamara Witschge

Amsterdam University of Applied Sciences  
the Netherlands  
t.a.c.witschge@hva.nl

Ben Schouten

Amsterdam University of Applied Sciences, Eindhoven  
University of Technology  
the Netherlands

## ABSTRACT

Educators in professional higher education experience difficulties addressing students' *self-awareness* in their courses. The topic is often dismissed by students as 'vague' or 'irrelevant'. This is detrimental for learning since knowing who you are and who you want to be is crucial: it guides behaviour and helps to feel balanced and in control. Support is needed to trigger students' self-awareness and to make this process less demanding. In this paper we present guidelines for interactive triggers supporting students in developing their self-awareness. We asked students to discuss self-made photos in small groups and offered them three paper prototypes of triggers to work with. Questionnaire results and analysis of students' discussions resulted in insights on how these triggers provoke distinct interaction and support self-awareness. Insights in advantages and disadvantages of the triggers can be used to design and implement innovative interactive systems that engage students in the process of developing self-awareness.

## CCS CONCEPTS

• **Applied computing** → **Interactive learning environments.**

## KEYWORDS

self-awareness, reflexivity, reflective learning, creativity, design, triggers, higher education

## ACM Reference Format:

Marije ten Brink, Tamara Witschge, Bert Bredeweg, and Ben Schouten. 2022. Designing for self-awareness: supporting students' reflexive interactions based on photos. In *Creativity and Cognition (C&C '22)*, June 20–23, 2022, Venice, Italy. ACM, New York, NY, USA, 10 pages. <https://doi.org/10.1145/3527927.3532807>



This work is licensed under a Creative Commons Attribution-Share Alike International 4.0 License.

C&C '22, June 20–23, 2022, Venice, Italy

© 2022 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-9327-0/22/06.

<https://doi.org/10.1145/3527927.3532807>

## 1 INTRODUCTION

Capable students in professional higher education act as reflective practitioners [27]. By evaluating and re-evaluating own professional thinking and behaviour, *self-awareness* is established [10, 18]. The relevance of self-awareness for students is recognised in a wide range of professional domains. For example, it is important for healthcare professionals to critically reflect on their opinion about the dignity of life, for economists to question their view on profit maximisation in relation to trust in the economic system, and for engineers to consider their stance on the sustainability of their solutions. Capable students understand their accountability as professionals in societies of the future.

Facilitating the development of self-awareness can be hard for educators. Previous studies suggest that it is helpful to create a social context allowing students to engage in reflexive interaction with peers [7, 24, 25, 28]. Still, students often lack grip on reflexive assignments addressing self-awareness and dismiss them as 'vague' or 'irrelevant' [13, 19]. This may obscure their difficulties with the level of abstraction, finding words and the creativity needed to express personal and reflexive thoughts. Research indicates the need for *facilitator triggers* [9], to support students in a task that might be more demanding than they think. Research inspired by the methodology *Photovoice* [15, 34–36] shows that photos made by students themselves act as facilitator triggers for reflexive processes. However, extra triggers are needed to support students in reflecting on 'ineffable' meaning and interpretation of self-made photos [29]. Knowledge about how to design such triggers is lacking.

Instead of trying to measure how the *level of self-awareness* is affected by the triggers, we aimed to examine how a helpful *process leading to self-awareness* is facilitated, because:

- (1) Developing self-awareness is a long term affair, therefore measuring development over the course of one assignment is difficult [12].
- (2) Self-awareness unfolds in a social, collaborative context. Students help each other to identify, evaluate and challenge aspects that determine self-awareness, hindering measurement of individual progress.

We defined the research question: **How to design triggers for reflexive interactions with self-made photos, to support a process leading to self-awareness for students in professional higher education?** Fifteen bachelor students at a university of

applied sciences in the Netherlands engaged in an assignment focusing on self-awareness. We designed paper prototypes of three different triggers for them to work with: 1) **Photo profile**, 2) **Photo story** and 3) **Photo position**. A questionnaire and an analysis of students' discussions allowed us to compare the effects and present an overview of the advantages and disadvantages of the three triggers for a process leading to self-awareness.

## 2 THEORY AND RELATED WORK

In this section, founding theories are introduced and their relation to this research is explained.

### 2.1 Reflexivity and self-awareness

In literature, a distinction is made between the concepts of reflection and reflexivity [1]. Understanding the distinction may be helpful to position the concept of self-awareness. Human reflection is defined as the action of a subject (a person) towards an object, e.g. a mathematician reflecting on an abstract problem. Reflexivity, on the other hand, is defined as the mental ability of humans to consider themselves in relation to their social contexts and vice versa. Reflexivity 'bends back' thoughts and utterances upon the self and is therefore directed from subject to object and back to the subject. The practice of reflexivity requires an active, emotionally involved person (with emotions being the commentaries upon concerns) and it is a heterogeneous process, i.e. no similar responses occur in situations that are objectively similar.

Although the two concepts undoubtedly overlap, the reflexive process of 'bending back' thoughts and emotions upon oneself and one's intentions, requires examining of own values, beliefs and opinions, i.e. self-awareness. It is therefore reflexivity, more than reflection, that constitutes the theoretical frame of this research.

### 2.2 Reflexivity and conversation

Reflexivity is practised through internal conversation. Moreover, previous research states that 'we do not merely have conversations with ourselves, but we are these conversations' [33]. Humans use language to make sense of their world, their actions and their lives, but also become who they are thanks to the internal conversations they have with themselves as well as with 'generalised others' – a concept coined by philosopher and social theorist G. H. Mead [17]. By internally conversing with generalised others, individuals interpret their own actions in relation to the actions of other members of society and are able to organise their behaviour in relation to the larger whole of which they are part. Therefore, reflexivity is essentially a social phenomenon that finds its origin in communication. The individual is the locus of thought, but the meanings of his/her thoughts are public and common to all humans who speak the language. The meaning is in the open, it is articulated with language in social discourse. To understand reflexivity as the process of moving from subject to object and back to the subject, internal conversation has to be considered in continuity with external conversation. By focusing on facilitating and examining these external conversations, as we do in this research, we follow the line of thought of Mead [17] stating that one does not need to enter the mind (which is impossible) to find out what one thinks. Instead, one should rather focus on the visible and audible human output

and consider the 'minding' as a phase within the organisation of a publicly observable act expressed in language [33].

### 2.3 Supporting reflexivity and self-awareness

**2.3.1 Facilitating collaboration.** 'There is no private language' according to philosopher Wittgenstein. Language is approached in the larger context of cooperation in the group, taking place by means of signals and gestures. Meaning appears within that process [17] and self-awareness is being developed. 'We must be others if we are to be ourselves' [6]. Therefore, to support reflexivity and self-awareness for students it is crucial to facilitate a social and collaborative learning process. Previous research on collaborative learning suggests positive learning results when turn-taking is facilitated leading to equity of participation of group members [8, 11]. Literature on 'Inquiry-based discussion' [5] and 'Quality talk' [21] indicates the importance for students of discussing and articulating curricular contents in their own words. Also, for collaborative learning to be effective, a combination of language and action in joint activities is required.

The Collaborative Learning Mechanisms (CLM) framework [8] was used for our research design. The CLM framework distinguishes two mechanisms indicating Collaborative Discussion and Action: 1) Making and accepting suggestions (introducing and identifying knowledge and ideas): and 2) Negotiating (evaluating and challenging new knowledge for joint consideration). 'Negotiating' is considered a higher level of learning result. Also, a mechanism for Coordinating Collaborative Discussion and Action is distinguished: Maintaining joint attention and awareness, mainly by thinking-out-loud or by verbal shadowing: a process of listening to and repeating others [23]. Aspects referring to action are e.g. pointing to and moving or removing objects on a shared tabletop.

**2.3.2 Using Photovoice in education.** To facilitate a joint activity and support collaborative learning on the topic of self-awareness, the method of *Photovoice in education* [15, 29] was used. Originally, Photovoice is a form of participatory action research [35], focusing on *giving voice* to marginalised people by having them document their lives with self-made photos for presentation to policymakers. In education, the focus is on the reflexive learning process that takes place when self-made photos are discussed and interpreted among students. Photos contain 'ineffable' knowledge exceeding a plain description of what is depicted in the photo (the *signifier*) [26]). It is suggested that discussing this ineffable knowledge provokes reflexivity in a natural and undemanding way, suitable for bachelor students [29]. At the same time, a closer investigation of how to support students in moving from internal to external conversation and articulating meaning and interpretations is lacking. It is the aim of this research to fill this gap.

To guide our thinking about course content and assignments for the students to reflect and interact with self-made photos, the Interpretation Framework [29] served as the foundation. The framework consists of *frames* or 'hypotheses about connections among photos' [14] suggested by students when working with self-made photos. Examples of frames are 1) *Human behaviour*: referring to (interaction with) the other, 2) *Culture*: referring to a wider context of influence and 3) *Identity*: referring to the self.

**2.3.3 Supporting articulation.** Theories from different research domains were selected to inspire our thinking about the design of materials supporting the articulation of meanings and interpretations. From the field of design and branding the Product Personality Scale [20] was selected: a set of 20 personality characteristics used to describe a product. For example, the appearance of a product may forward 'cheerful', 'modest' or 'untidy'. Similar, students may describe their photos with this set and be supported in verbalising meanings and interpretations, leading to self-awareness.

From the domain of System Thinking and Human and Machine Cognition, inspiration was found in the DSRP-theory. Four organisational principles, i.e. Distinction, Systems, Relations and Perspectives facilitate concept development and articulation of abstract ideas [3, 4]. Also, theories were selected underlying the construction of Concept Maps as a means to graphically organise and represent concepts as systems of groups, contrasts and relationships. Concept mapping is described as a powerful and engaging learning- and evaluation tool, capable of assessing both valid and invalid ideas [22]. Materials inspired by DSRP and Concept mapping may support students to not only distinguish and organise what is communicated in their photos but also what is not, leading towards developing self-awareness.

Finally, the close relationship between reflexivity and narration was taken as inspiration for the supporting materials used in this research. Narration is what directs the internal conversation with 'oneself as another' and with 'the other as oneself'. Even if one narrates one's self, the other remains present as an 'inner witness' of this narrative [32]. Also, humans exist as a set of memories and as a process in which these memories are used in a narrative to deal with a dynamic environment [31]. By creating narratives from self-made photos students may be supported to develop self-awareness.

### 3 THE DESIGN OF THE TRIGGERS

From the selected theory and related work we defined user requirements for the triggers. The trigger should:

- (1) Provoke collaborative learning. We defined a procedure enforcing turn-taking: [8, 11] and thinking-out-loud [8]. The design of the trigger itself should allow for joint action and easy access and manipulation.
- (2) Facilitate the interpretation- and reflexive process when working with self-made photos.

With six experts in the field of design and education, we explored ideas for possible triggers to support self-awareness while working with self-made photos. All six are experienced educators and have an MSc or PhD degree. Four of them are experienced designers. In brainstorming sessions of approximately one hour, we discussed the requirements mentioned above and created a simulation of the classroom setting. We asked the experts to speculate about what would be needed to support students in developing self-awareness, based on dummy photos representing self-made photos of students. Based on their input and on the discussed theory we propose three design ideas for triggers (Table 1):

#### 3.1 Photo profile

Expert 4 suggested: "When working with self-made photos, interesting insights about who you are can come up. You think about

yourself in a specific way, but others recognise something in your photo(s): details, framing, etc, that they consider significant for you as the maker. This may come as a surprise to you. Discussing these perceptions can be insightful. It is a way of bringing up latent knowledge."

Combining this input with the discussed Product Personality Scale [20], we propose **Photo profile**. Through Photo profile, students are supported to profile (i.e. characterise) their photo(s) in terms of appearance or atmosphere. The relation to developing self-awareness is direct: from a) profiling characteristics of a photo to b) profiling qualities of the maker.

Photo profile consists of a workboard in easy-to-use A3 format with 20 Product Personalities, translated into Dutch and expressed on labels. The speech bubble shape of the labels suggests that the chosen characteristic is expressed by/through the photo. Extra, blank labels allow for manipulation of the trigger by writing alternative characteristics. Students are asked to lay down one or more of their photos on the shared table and place pre-designed or self-written labels on top – as the illustration on the top of the workboard suggests (Figure 1).

#### 3.2 Photo story

A suggestion was provided by expert 2: "By clustering photos, students can tell a story about themselves. This may bring up interesting insights about a person. I remember this type of assignment from art school. It can be very insightful or even confronting." Expert 6 stated: "Photos tell a visual story. It can start with recognising a visual pattern. Three photos together can tell a nuanced story about a specific quality of someone's identity."

Relating this input to theory on the process of storytelling as a means to construct knowledge about the self [31, 32], we propose **Photo story**, supporting students to tell a story using three of their photos. We took the 'Rule of Three'-approach, common in the field of design, as a practical approach for the design of the trigger. Three is considered the optimal number of elements to construct stories and interactions that surprise and satisfy [16]. A '3-point narrative arc' typically consists of 1) the dilemma, 2) the climax and 3) the resolution. The relation to developing self-awareness is indirect: from a) (three) photos to b) a 3-point narrative arc to c) what the story and the photos tell about the qualities of the maker.

Photo story consist of an easy-to-use A3 format workboard with an indication of three photos and their suggested roles in the narrative arc. Students are asked to use this structure as a foundation for their story and lay down three of their photos on the shared table.

#### 3.3 Photo position

Expert 2 suggested: "Self-reflection is a difficult task for young people. Simple structures can help them to orientate themselves, for example by using a single axis. How would you position your photo, and therefore yourself, on the axis? Why? Did you once experience being at the far left/right?" Expert 1 added: "Self-awareness is about awareness of the effects of your acting on others: who will be included, who is excluded? And about other underlying contrasting forces in our society, such as capitalism versus socialism and differences in religion and culture."

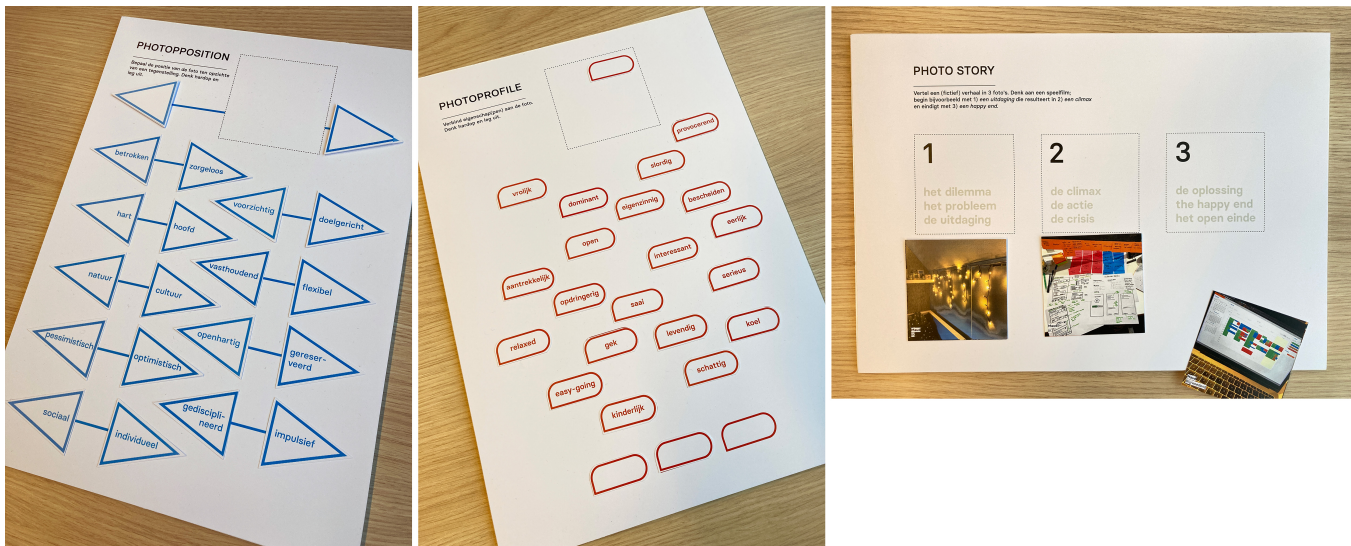


Figure 1: From left to right: Photo position, Photo profile and Photo story.

Relating this input to theories of system thinking and concept mapping, we propose **Photo position**. Through Photo position students are supported to position their photo(s) in between two opposing concepts. Selecting labels to form an axis and positioning photo(s) on the axis can be considered a form of concept mapping [22]. The relation to self-awareness is indirect: from a) the meaning of a photos to b) opposing concepts to c) positioning a photo on the axis to d) what the concepts and the position of the photo tell about the qualities of the maker.

Photo position consists of an A3 format workboard with nine pre-defined label pairs on both sides of an axis. The shape of the labels refers to arrows pointing in opposite directions to emphasise contrast. The label pairs are defined as general, opposing concepts, such as social versus individual, heart versus brain and pessimistic versus optimistic (translated into Dutch). Empty labels allow for the writing of alternative concepts. Students are asked to position their photos on the table in between two opposing labels – as the illustration on the workboard suggests.

We hypothesise that all three triggers support reflexive interactions leading to self-awareness, in their own distinct way (Table 1). We used the two mechanisms of Collaborative learning: ‘Making and accepting suggestions’ and ‘Negotiating’ [8] as a lens to determine differences, which we will discuss in section ‘The study’.

### 3.4 Additional materials: photos and note sheet

The digital photos of the students were collected, printed out on 200 gr. paper and cut to their final size of 9 x 9 cm. To support students in documenting results during the session, a note sheet with three text boxes was designed to make notes each round (Figure 2).

## 4 THE STUDY

In this section, the set-up of the study is explained, as well as the methods used for data analysis.

### 4.1 Participants and embedding in the course

Fifteen bachelor students (3rd year or above) of a university of applied sciences in The Netherlands participated in a course focusing on self-assessment of their professional development, as part of their regular study program. They were asked to investigate personal qualities and determine how to apply them professionally. The course is mandatory and took place in the winter of 2021/2022. The first author of this paper took the role of the educator. Following the steps of Photovoice in Education [29], we informed the students and invited them to make four photos of three topics that may help them to think about who they are and who they want to become (12 photos total), inspired by frames of the Interpretation Framework [29]. The topics were: ‘This makes me happy/furious’, ‘This is important to me’ and ‘This is me’ (Table 2).

Two weeks later the students were invited to the university to share and discuss their photos. The aim of the session was to identify three or more personal qualities that scaffold their roles as starting professionals. This requires self-awareness. After the session, within a period of approximately three weeks, the students completed the course with a short assessment document describing their individual professional development based on the defined qualities. Delivering this document in good order and discussing it in a short online individual assessment with the educator afterwards resulted in passing the course. Analysing the content of the document and the online assessment was outside the scope of this research. The focus was on the session in class, which we will discuss next.

### 4.2 Mixed methods research design

To answer the research question, mixed methods were applied. First, a *repeated-measures* user study was conducted to be able to compare the three designs of the triggers. The fifteen students were divided into five groups of three. Due to last moment illness, one student switched groups, resulting in one group of two, one



**Table 1: Conceptual differences between the three triggers**

	Interpretation process	Relation to developing self-awareness
Photo profile	Naming a characteristic of the photo itself	Direct: from characteristics of photo to qualities of maker
Photo story	Creating a story line connecting three photos	Indirect: from photos via story to qualities of maker
Photo position	Defining opposing concepts related to the photo and deciding upon position of photo in between	Indirect: from photo to opposing concepts to position to qualities of maker

**Table 2: Assignment topics and reference to the Interpretation framework [29]**

Topic	Frame
This makes me furious or happy	<i>Human behaviour</i> : referring to (interaction with) the other
This is important to me	<i>Culture</i> : referring to a wider context of influence
This is me	<i>Identity</i> : referring to the self

**Table 3: Triggers offered in counterbalanced order**

	1st round	2nd round	3rd round
Group A	Photo profile	Photo story	Photo position
Group B	Photo story	Photo position	Photo profile
Group C	Photo position	Photo profile	Photo story
Group D	Photo profile	Photo position	Photo story
Group E	Photo position	Photo story	Photo profile

of four and three of three students. The groups were positioned with their photos around a table. A fixed procedure was followed, including turn-taking: conducive for equity of participation [8, 11], and enforcing thinking-out-loud [8]. Each group was offered the three triggers in a counterbalanced sequence to minimise order effects (Table 3). Per round, the students were asked one by one to present their photos by means of the trigger or to comment on their peers. The sessions were recorded, with the written consent of the students, with a GoPro camera and an audio-recorder (Figure 2).

Second, we offered students a questionnaire with eight questions, investigating students' preferences for one of the three triggers in terms of 1) ease-of-use and engagement (three questions) and 2) support for self-awareness (two x two questions about the two mechanisms of the CLM-framework). Students were asked to answer the seven questions by checking one of the options: 'Photo story', 'Photo position' or 'Photo profile'. An open text field with 'Why?', included in each question, invited students to motivate their choice. The eighth question was optional and consisted of an open text field for concluding remarks. Students filled out the questionnaire right after the session in approximately ten minutes.

### 4.3 Data analysis

The mixed methods approach resulted in two sources of data:

- (1) The answers to the questionnaire. We used SPSS and Microsoft Excel.
- (2) The recordings of the sessions. Spreadsheet software was used to transcribe the discussions of the students.

To understand how the three triggers contribute to *reflexive interactions with self-made photos to support a process leading to self-awareness*, we looked at dependent measures in two categories:

- (1) Student's preference for one of the triggers, in terms of:
  - perceived ease-of-use and engagement
  - perceived support for self-awareness:
    - a. through 'Making and accepting suggestions', i.e.: choosing and defining labels and personal qualities
    - b. through 'Negotiating', i.e.: evaluating and challenging suggestions for labels and personal qualities.
 The questionnaire data were the primary source of analysis. We computed average measures of the total group of fifteen students and used the individual comments in the open text fields to add context to the results.
- (2) Interactions provoked by each trigger, in terms of:
  - Talking time, total per group in seconds. More talking time suggests enhanced reflective interactions [30]
  - 'Making and accepting suggestions' and 'Negotiating', the two mechanisms of Collaborative Discussion and Action [8]
  - Other interactions or activities, suggesting remarkable differences between the three triggers
 The recordings of the sessions were the primary source of analysis. The data in the open text fields were used to enrich and refine the findings.

## 5 RESULTS

The mixed-methods approach allowed us to supply a nuanced account of specific reflexive interactions and conversations provoked by the three triggers, leading to self-awareness, which will be discussed next.

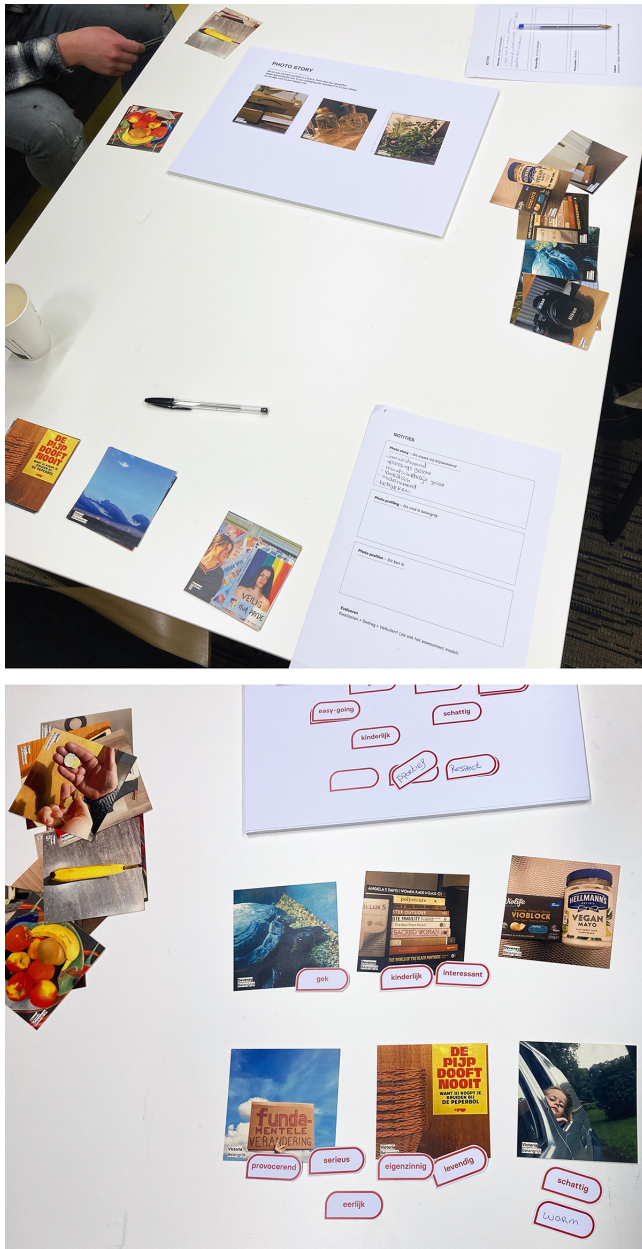


Figure 2: Students working with Photo story including note sheets (above) and with Photo profile (below).

### 5.1 Perceived ease-of-use

The majority of the students (87%) checked 'Photo story' as the trigger they perceived the hardest to work with. Participant 6 (pp6) noted that 'Coming up with a story is hard' and 'This requires more creativity' (pp10), indicating the difficulty of the creative task of storytelling in general. Most students referred in their note to the difficulty of storytelling with photos: pp9: 'It is hard to link photos together and come up with a story'. Other students added the time factor; pp13 wrote: 'It was nice to think of a story, however to do

that spontaneously was challenging.' Pp2: 'You feel there is not a lot of time to come up with a story'.

The least demanding trigger to work with, according to a small majority of the students, is Photo profile: 53% of the students chose this option. Comments of students tell us that they perceive the Photo profiling task as fast and not too difficult: 'Linking a word to a photo is very fast' (pp7) and 'It is easy to connect a characteristic to a photo' (pp6). Also, they recognised the straightforward, direct relation between the characteristics of the photo and the qualities of the maker. Pp9: 'Because it is about a characteristic that you have chosen yourself and already thought about when making the photo'.

Then, the students were asked which trigger they perceived as most surprising. A majority of 73% checked 'Photo story'. Some students indicated they just did not expect such an assignment: 'I've never heard of it, but it's funny' (pp8) and 'unexpected assignment' (pp1). Most students surprised themselves in being able to succeed in an assignment they perceive as difficult: 'Seconds before making this assignment I thought I couldn't tell anything at all. However, I was able to come up with a story pretty quick' (pp2) and 'It was easier than I anticipated' (pp9). Finally, some students indicated being surprised about the insights they gained from using Photo story: 'Interesting results' (pp1), 'It is interesting to find connections that do not seem to be there at first sight' (pp3) and 'Surprisingly, a story can be made from incoherent photos' (pp10).

### 5.2 Perceived support for self-awareness

Four items in the questionnaire asked students about the perceived support of the triggers for the development of self-awareness. We questioned the support for 'Making and accepting suggestions' in two items (Which trigger helped you most/least to **define** personal values, beliefs, emotions and opinions?) and the support for 'Negotiating' in the remaining two items (Which trigger helped you most/least to **evaluate** and **challenge** personal values etc.?). Overall the responses to these four questions were not significant or less significant than the previous three.

The preferred trigger to support 'Making and accepting suggestions' remains undecided. The same counts for the trigger perceived as least helpful for this. One student checked all options for the former and three students checked none for the latter, strengthening the suggestion that there is not one specific trigger most or least helpful for Making and accepting suggestions, according to the students. Pp4: They all worked; I extracted relevant personal values from all three'.

Photo profile is chosen by a modest majority of the students (53%) as most helpful trigger to support 'Negotiating', and Photo story as the least helpful by 53% of the students. One student checked none of the options for the latter indicating 'I'd say there is no least helpful trigger' (pp13).

### 5.3 Interactions provoked by the triggers

5.3.1 *Talking time.* Photo profile supported talking about photos most: 127 sec on average per session, compared to 103 sec for Photo position and 79 sec for Photo story.

5.3.2 *Mechanisms of Collaborative Discussion and Action.* The results suggest that Photo profile supports above all 'Making and

accepting suggestions'. First of all: it was observed that suggesting characteristics of photos and translating them into personal qualities happened fast and easy in almost all cases. This prompted peers to propose new characteristics and qualities, which then were accepted. Also, a situation was witnessed in which peers suggested characteristics of a photo even before the maker of the photo explained the reason for making, reinforcing our previous finding about the ease-of-use of Photo profile. At the same time, we observed little evidence of 'negotiating', in which suggestions were critically evaluated and challenged.

It was observed that Photo position supports 'Negotiating' and comments were found from students reinforcing these observations. First of all, students expressed a broader sense of self-awareness by not only discussing personal qualities but also including personal drawbacks. Pp 10 stated: 'The opposites also make you think about disadvantages of your qualities'. And pp11 noted: 'With this trigger you are able to explain where you are on a spectrum, reflecting that it is not black or white', referring to a more nuanced view on your own qualities. Thinking about opposites and positioning on a scale involves negotiation with yourself. As pp5 noted: 'I hadn't thought of an opposite myself. I only came up with one characteristic for the photo. Now I was forced to carefully think it through.' And pp10: 'By weighing your photos between two opposites you develop a better picture of your qualities'. Also, we observed negotiation between the student and their peers. Peers suggested alternative label pairs and helped to define the right opposite term of a concept. For example with the concept 'open': pp10 connected the label pair 'open' (as in 'open-hearted') versus 'reserved' (as in: 'keep one's distance') to one of his/her photos. With help of peers, the student ended up with 'open' (as in 'open-minded') versus 'conservative', giving a different but more accurate definition of characteristics expressed in the photo.

Finally, we argue that Photo story supports 'negotiating' in its own distinct way. First of all, we witnessed that the content of the story leads to suggestions for qualities of the narrator without the help of pre-defined labels. This requires searching for and negotiating the right term. For example, the story of pp7 about a desired side-job as a bartender in the future, resulted in 'versatile' as the best fitting quality, after the rejection of suggestions like 'enterprising' and 'ambitious'. Secondly, we observed that qualities of the narrator suggested by peers refer to the way the narrator was able to come up with a creative, interesting story, for example, 'Inventive' for pp10, 'imaginative' and 'creative' for pp8, 'playful', 'ingenious' and 'quick thinker' for pp1. These suggestions often came as a surprise to the narrator and resulted in discussing and negotiating which term fitted the narrator best. Although supportive of negotiating unexpected narrator qualities, Photo story might also have drawbacks, such as distracting from the main assignment. Pp2 and pp10 rated Photo story as least helpful for self-awareness and argued: 'Maybe because we talked more about the creativity of making up a story than about personal qualities' (pp2) and 'I thought this was more of a creative assignment that was not necessarily about myself' (pp10). Also, the focus on a story in which three photos are combined instead of explaining individual photos can create a feeling of incompleteness or randomness. Pp15 stated: 'Because of the story I don't know if I was able to tell everything'. Pp6 concluded in short: 'It was too random'.

We conclude with a remarkable positive side-effect of Photo story: its ability to provoke humour and laughs almost every time a story was told. We suggest that Photo story allows students to show a more idiosyncratic, quirky and unorthodox part of themselves. Being involved in humour and laughing is, as research suggests, conducive for learning and engaging in general.

**5.3.3 Activities with photos.** The three triggers were designed to forward specific interactions: placing labels on top of a photo (Photo profile), placing three photos in a row (Photo story) and positioning a photo in between two opposing concepts (Photo position). In addition, we observed students creating clusters of photos from different makers to be able to share one label when using Photo profile, overlapping more than one photo. With Photo story the basic structure of placing three photos in a row was followed by all. However, we witnessed students adding more space between photos to suggest a longer time period being spanned and rotating photos to create an alternative view on reality. With Photo position we observed students using the length of the axis as a means to discuss their position. Sometimes the labels with the opposing concepts were positioned close to the right and left of the photo, indicating that a photo expressed both perspectives equally. Often, the axis was widened, to allow space for the photo to be positioned somewhat or extremely to one side of the axis. Also, other students joined in with their photos, widening the axis even more to allow for more space for more photos. The horizontal structure of the axis was maintained throughout all sessions.

## 5.4 Other results

The decision to offer three triggers in one session was to accomplish a repeated-measures design and not primarily to support educational processes. However, we suggest that combining triggers may have helped students to reach their learning goal of identifying three or more personal qualities that scaffold their roles as starting professionals. We witnessed students engaging in discussion and interaction with each other and with the triggers, gathering diverse results throughout the sessions. It might explain that not one trigger convincingly dominated in the answers to the questions about perceived support for self-awareness in terms of 'Making and accepting suggestions' and the modest domination of one trigger as support for self-awareness in terms of 'Negotiating'. Also, some students explicitly checked all or none of the answer options for these questions, indicating they find it hard to choose one trigger over the other.

Some students experienced gaining insights twice. Pp5 stated: 'I ended up with more or less the same results as with the previous trigger' and pp15: 'This was the final round; much was already stated', indicating that not many new insights were gathered in the third round. At the same time, it did not result in a loss of interest in the assignments or bland routine behaviour. Instead, students behaved attentively and engaged up until the end.

## 6 DISCUSSION

The differences in preferences for the three triggers and the interactions they provoke could have implications for thinking about reflexivity and designing triggers to support self-awareness, summarised in Table 5.



**Table 4: Interactions provoked by the three triggers**

	Talking time	Mechanisms	Remarkable	Activities with photos
Photo profile	127 sec	Making and accepting suggestions	Provokes immediate suggestions	Clustering, sharing labels
Photo story	79 sec	Negotiating	Provokes humour and laughs	Sequential arranging
Photo position	103 sec	Negotiating	Provokes nuanced view including drawbacks	Widening/narrowing axis

Theoretical implications for thinking about reflexivity are three-fold. First, this research may contribute to theories on reflexivity (e.g. [1]) and educational sciences in general, with insights on conducive social conditions for reflexive expressions of students. By approaching external conversations as the continuity of internal conversation [17], insights were gained on how reflexive processes can be promoted and directed by examining visible and audible human output.

Also, this research suggests insights that may advance theories on Photovoice in education [15, 29] from the perspective of students. We argue that with this conceptual knowledge of supporting materials and procedures, Photovoice in education may be developed further as a usable and comprehensive method to support reflexivity in students.

Finally, the diversity in responses of students when engaged in reflexive assignments with self-made photos confirms, yet also showcases, the statement that reflexivity is a heterogeneous process, in which no similar responses occur in objectively similar situations. Even when students present photos depicting similar objects or scenes, the process of interpretation and giving meaning is unique for every student.

Also, practical implications can be defined from this research, which are presented per trigger underneath:

In terms of ease of use, it is suggested that students prefer to work with Photo profile. This is supported by findings that Photo profile rendered the longest talking time. It is suggested that the design concept of Photo profile, in which characteristics of a photo are directly related to qualities of the maker, supports students best in terms of engagement. We consider this an important learning advantage, since developing self-awareness can be hard for students and engaging in it is not a given fact. At the same time, this direct relationship between characteristics and qualities may also prevent students from taking the extra step of truly ‘bending back’ thoughts on themselves and articulating abstractions. Photo profile supports primarily the mechanism of ‘Making and accepting suggestions’. Less evidence was found of support for ‘Negotiating’, which is considered a higher level of learning result.

Conversely, the significant results in the questionnaire suggest Photo story as the most difficult trigger to use. Responses of students may indicate that the reason for the perceived difficulty is the required creativity to come up with a story on the spot. This is confirmed by previous research, describing creativity as a complex meta-cognitive task [2]. Although perceived as difficult, Photo story was scored convincingly as the most surprising of the three by students. Comments reveal that students often mean to say that

they positively surprised *themselves* in dealing with the challenge Photo story offers, and value the unexpected creativity and humour it brings about. We consider this an important learning advantage. It may also have supported ‘negotiating’ about how this ‘dealing with the challenge’ can be translated into qualities of the narrator. However, the finding that Photo story may distract from the assignment and may create a feeling of incompleteness or randomness, suggests that Photo story works well as an ‘activator’, but may not work well on its own to support self-awareness. This is confirmed by the responses in the questionnaire, indicating Photo story as the least helpful of the three.

Finally, Photo position did not show up significantly in the results as most or as least helpful for self-awareness, nor as most easy, most difficult or most surprising. However, from students’ comments in the questionnaire and interactions in the sessions, we argue that of all three triggers, Photo position potentially is best qualified to support self-awareness. The complexity of defining *two* opposing concepts related to a photo – instead of naming *one* characteristic in the case of Photo profile – potentially helps students best in abstract thinking and negotiating concepts, adjusting their meaning to fit the photo and the maker. Also, working with opposites and positioning a photo on a scale in between, turned out to provoke students in becoming aware not only of their qualities but also of drawbacks. This is beneficial for taking a stance and positioning oneself. However this was recognised by students, the moderate preference of the students for Photo position suggests that its beneficial complexity, which may have profoundly supported self-awareness, may not have been fully understood. Where Photo story supports a broader sense of self-awareness by including unexpected, quirky and creative aspects of students’ personalities, we suggest that Photo position helps students to define a more realistic image of themselves. The advantages and disadvantages of the three triggers are outlined in Table 5.

Conceptualising triggers to support self-awareness may also be affected by our suggestion that offering the three triggers in one session contributed to a positive overall learning experience. Engaged and attentive students were observed up until the end, including the few students that indicated to have gained the same insights twice, suggesting that for these students the third round served as a consolidation of insights found earlier. We invite designers, researchers and educators to implement the triggers in their courses in a way that fits the educational context and goals.

**Table 5: Suggested advantages and disadvantages of the three triggers**

	Suggested advantages	Suggested disadvantages
Photo profile	Ease of use Supports talk	Results may lack depth and abstraction
Photo story	Reveals creative qualities Reveals unexpected, quirky qualities Supports humour	Perceived difficult Distracting Incomplete
Photo position	Supports abstract thinking Reveals realistic self-image, incl. drawbacks Supports self-positioning	Beneficial complexity may not have been fully understood

## 6.1 Limitations

Because we worked with five groups of students and not with six, we could not perfectly counterbalance the offering of three triggers in our research design. Therefore the effect of order cannot be completely ruled out. Also, the sample size of fifteen students can be considered small. We aimed to increase the validity of the results by using the quantitative measures mainly to indicate a tendency and explained this tendency with the qualitative responses of the students and our observations. Also, we argue that the type of research we conducted: investigating specific types of and variety in interactions related to a specific learning goal (self-awareness) per trigger, is less prone to small sample sizes.

## 6.2 Future work

Paper prototypes were used for this research to be able to quickly identify distinct interactions provoked by three different designs of triggers. However, creating a digital interactive environment for Photo profile, Photo story and Photo position can have important benefits for future learning scenarios, such as working together remotely. This is beneficial in a pandemic sensitive society as well as for learning scenarios crossing cultural and geographical borders. We envision that learning results from reflexive assignments addressing self-awareness increase when students from different parts of the world, with different cultures and upbringing, are involved. Future research could investigate how such a digital environment could work. Next to features such as uploading self-made photos, selecting pre-defined labels or writing your own, we recommend that the mentioned activities: clustering of photos, sharing labels, spatial options for sequential arranging and widening/narrowing axis (Table 4), could form the interactive backbone of a shared digital environment. Also, the immediate association with contextual information about chosen or created labels via web technologies may add value to the system design. We hope the design and research community feels encouraged to pick up this challenge.

In terms of students' performance and content, we recommend examining in more depth what is needed from the students in assignments addressing self-awareness. Related to the provoked interactions by the triggers, skills were uncovered such as: finding words, creativity, abstract thinking and self-positioning. Also, the two mechanisms we used for our analysis: 'Making and accepting suggestions' and 'Negotiating', may imply a difference in the level of learning result and a dependency on the mentioned skills. Future

research may investigate how levels and skills can be integrated into an evaluation tool for students and educators alike.

## 7 CONCLUSION

With the results presented in this research, we contribute to the discussion on how to involve students in professional higher education in becoming self-aware. Reflexive assignments addressing self-awareness are often dismissed by students as 'vague' or 'irrelevant', which prevents them to strive for maximum learning results. By offering them designs that act as facilitator trigger (Fogg), we acknowledge the suggestion that students may lack the ability to deal with the complexity and abstraction of such assignments and need support for a task that is more difficult, and important, than they think.

In this research, we suggested ways to provide support from a design perspective. With three different designs of triggers we were able to define distinct interactions provoked by each trigger and evaluate how, through which mechanisms and activities, a process leading to self-awareness is supported. With design guidelines and advantages and disadvantages of the proposed triggers, we hope to have inspired designers, researchers and educators to try out the triggers in various educational contexts and to share the results. Also, we hope to have inspired the design of digital interactive systems, to support the development of self-awareness in situations when working together remotely is preferred.

## REFERENCES

- [1] Margaret S. Archer. 2010. *Conversations About Reflexivity*. Routledge.
- [2] B.S. (Ed.) Bloom, M.D. Engelhart, E.J. Furst, W.H. Hill, and D.R. Krathwohl. 1956. *Taxonomy of Educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. David McKay, New York.
- [3] Derek Cabrera. 2008. Distinctions, Systems, Relationships, Perspectives: The simple rules of complex conceptual systems. *52nd Annual Conference of the International Society for the System Sciences 1* (2008), 1–31.
- [4] Derek Cabrera and Laura Colosi. 2008. Distinctions, systems, relationships, and perspectives (DSRP): A theory of thinking and of things. *Evaluation and Program Planning* 31 (2008), 311–334. <https://doi.org/10.1016/j.evalprogplan.2008.04.001>
- [5] James S Chisholm and Amanda J Godley. [n.d.]. Learning About Language Through Inquiry-Based Discussion: Three Bidialectal High School Students' Talk About Dialect Variation, Identity, and Power. *Journal of Literacy Research* 43, 4 ([n. d.]), 430–468. <https://doi.org/10.1177/1086296X11424200>
- [6] C. Cooley. 1964. *Human Nature and the Social Order*. Schocken Books, New York.
- [7] Thi Diem, Hang Khong, Eisuke Saito, and Robyn M Gillies. 2017. Key issues in productive classroom talk and interventions. *Educational Review* 71, 3 (2017), 334–349. <https://doi.org/10.1080/00131911.2017.1410105>
- [8] Rowanne Fleck, Yvonne Rogers, Nicola Yuill, Paul Marshall, Amanda Carr, Jochen Rick, and Victoria Bonnett. 2009. Actions Speak Loudly with Words: Unpacking Collaboration Around the Table. In *ITS'09 - ACM International Conference on Interactive Tabletops and Surfaces*. 189–196.

- [9] BJ Fogg. 2009. A Behavior Model for Persuasive Design. In *Persuasive '09*.
- [10] Paulo Freire and M.B Ramos. 1970. Chapter 2 from Pedagogy of the Oppressed. Seabury Press, New York, 186. arXiv:arXiv:1011.1669v3 <http://search.ebscohost.com/login.aspx?direct=true&db=edspmu&AN=edspmu.S1935856209200011&site=eds-live>
- [11] Giulia Gelmini, Alessandro Cappelletti, Fabio Pianesi, Franca Rossi, Zancanaro Enforcing, and Massimo Zancanaro. 2004. Enforcing Cooperative Storytelling: First Studies. In *International Conference on Advanced Learning Technologies*. <https://telearn.archives-ouvertes.fr/hal-00190119>
- [12] Tim Jay, Ben Willis, Peter Thomas, Roberta Taylor, Nick Moore, Cathy Burnett, Guy Merchant, and Anna Stevens. 2017. *Dialogic Teaching Evaluation report and executive summary Independent evaluators*. Technical Report. Education Endowment Foundation. [www.educationendowmentfoundation.org.uk](http://www.educationendowmentfoundation.org.uk)
- [13] Geert F. Kinkhorst. 2010. Didactische ontwerp-regels voor reflectie-onderwijs. *Onderwijsinnovatie* (2010), 17–25. [https://www.ou.nl/Docs/TijdschriftOI/OI\\_2010maart\\_PRAKTISCHARTIKEL\\_didactischeontwerpregels.pdf](https://www.ou.nl/Docs/TijdschriftOI/OI_2010maart_PRAKTISCHARTIKEL_didactischeontwerpregels.pdf)
- [14] Gary Klein, Brian Moon, and Robert R. Hoffman. 2006. Making sense of sense-making 2: A macrocognitive model. *IEEE Intelligent Systems* 21, 5 (2006), 88–92. <https://doi.org/10.1109/MIS.2006.100>
- [15] Amanda O Latz. 2017. *Photovoice Research in Education and Beyond: A practical guide from theory to exhibition*. Routledge Taylor & Francis Group, New York and London. <https://www-taylorfrancis-com.ezp01.library.qut.edu.au/books/e/9781315724089>
- [16] Ellen Lupton. 2007. Rule of Threes. In *Design is Storytelling*. Cooper Hewitt, Smithsonian Design Museum, New York, 38–41.
- [17] George H. Mead. 1934. *Mind, Self and Society From the Standpoint of a Social Behaviorist*. The University of Chicago Press, Chicago and London.
- [18] Jack Mezirow. 1990. *Fostering Critical Reflection in Adulthood*. John Wiley & Sons Inc. 416 pages.
- [19] Kariene Mittendorff. 2014. Leren Reflecteren. In *Het onzekere voor het zekere. Kwetsbaarheid als kracht in loopbaandialogen.*, F Meijers, M Kuijpers, K Mittendorff, and G Wijers (Eds.). Garant, Antwerpen; Apeldoorn. <http://www.mittendorffonderwijsadvies.nl/wp-content/uploads/2011/10/Leren-Reflecteren-Mittendorff-2014.pdf>
- [20] Ruth Mugge and Jan P L Schoormans. 2009. The development and testing of a product personality scale. *Design Studies* 30, 30 (2009), 287–302. <https://doi.org/10.1016/j.destud.2008.10.002>
- [21] P. Karen Murphy, Jeffrey A. Greene, Carla M. Firetto, Brendan D. Hendrick, Mengyi Li, Cristin Montalbano, and Liwei Wei. 2018. Quality Talk: Developing Students' Discourse to Promote High-level Comprehension. *American Educational Research Journal* 55, 5 (2018), 1113–1160. <https://doi.org/10.3102/0002831218771303>
- [22] J D Novak and a J Cañas. 2008. *The Theory Underlying Concept Maps and How to Construct and Use Them*. Technical Report. IHMC - Institute for Kuman and Machine Cognition. 1–36 pages. <https://doi.org/TechnicalReportIHMCMapTools2006-01Rev2008-01>
- [23] David Pinelle, Carl Gutwin, and Saul Greenberg. 2003. Task analysis for groupware usability evaluation: Modeling shared-workspace tasks with the mechanics of collaboration. *ACM Transactions on Computer-Human Interaction* 10, 4 (2003), 281–311. <https://doi.org/10.1145/966930.966932>
- [24] Michael Prilla. 2014. User and Group Behavior in Computer Support for Collaborative Reflection in Practice: An Explorative Data Analysis. In *COOP 2014*. Springer, 293–309. <https://dl.eusset.eu/bitstream/20.500.12015/2754/1/00539.pdf>
- [25] Michael Prilla, Alexander Nolte, Oliver Blunk, Dennis Liedtke, and Bettina Renner. 2015. Analyzing Collaborative Reflection Support: A Content Analysis Approach. In *ECSCW 2015: Proceedings of the 14th European Conference on Computer Supported Cooperative Work*. Springer International Publishing, Oslo, Norway, 123–142. <https://dl.eusset.eu/bitstream/20.500.12015/3107/1/10PrillaNolteBlinkLeidtkeRenner2015.pdf>
- [26] Ferdinand de (Ferdinand Mongin) Saussure. 1961. *Course in general linguistics: transl. from French by W. Baskin*. London.
- [27] Donald Schön. 1983. *The Reflective Practitioner: how professional think in action*. Temple Smith, London.
- [28] Marije ten Brink, Bert Bredeweg, and Ben Schouten. 2021. Students' Attitude Towards Technology Enhanced Photovoice to Support Critical Reflection. In *Lecture Notes in Networks and Systems: Methodologies and Intelligent Systems for Technology Enhanced Learning, 11th Conference*, Vol. 326. Springer, 32–41. [https://doi.org/10.1007/978-3-030-86618-1\\_4](https://doi.org/10.1007/978-3-030-86618-1_4)
- [29] Marije ten Brink, Frank Nack, and Ben Schouten. 2021. Framing students' reflective interactions based on photos. In *Proceedings of the DRS Learn X Design 2021: 6th International Conference for Design Education Researchers*. Design Research Society, 232–244. [https://doi.org/10.21606/drs\\_lxd2021.02.185](https://doi.org/10.21606/drs_lxd2021.02.185)
- [30] Tina Pingting Tsai, Jyhjong Lin, Caiying Chen, and Jhaowei Yen. 2020. Using Inquiry-based Quality Talks to Enhance the Effectiveness of ePUB3-based Flipped Classes. In *ICIET2020 – 8th International Conference on Information and Education Technology*. 6–11. <https://doi.org/10.1145/3395245.3395250>
- [31] Barend van Heusden. 2009. Semiotic cognition and the logic of culture. *Pragmatics & Cognition* 17, 3 (2009), 611–627. <https://doi.org/10.1075/pc.17.3.07van>
- [32] Frédéric Vandenberghe. 2005. The Archers. A Tale of Folk (Final episode?). *European Journal of Social Theory* (2005), 227–237.
- [33] Frédéric Vandenberghe. 2010. Pragmatist and hermeneutic reflections on the internal conversations that we are. In *Conversations about reflexivity*, Margaret S. Archer (Ed.). Routledge, London and New York.
- [34] Caroline Wang. 1999. Photovoice: A Participatory Action Research Strategy Applied to Woman's Health. *Journal of Women's Health* 8, 2 (1999), 185–192.
- [35] Caroline Wang and Mary Ann Burris. 1994. Empowerment through Photo Novella: Portraits of Participation. *Health Education and Behavior* 21, 2 (1994), 171–186. <https://doi.org/10.1177/109019819402100204>
- [36] Caroline Wang and Mary Ann Burris. 1997. Photovoice: Concept, Methodology, and Use for Participatory Needs Assessment. *Health Education and Behavior* 24, 3 (1997), 369–387. <https://doi.org/10.1177/109019819702400309>