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### *Using reflection triggers while learning in an online course*

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#### **Abstract**

This paper reports about a controlled experiment on the effects of three types of reflection triggers in an online course. 54 volunteers, distributed in 5 groups, used these structured opportunities for reflection during learning. Results show that reflection triggers were extensively employed by the test persons and were perceived as quite useful to reflection and learning. Test persons in the experimental groups reported significantly more reflective tools and more intensive reflection than those in the control group. In contrast, no positive effects on learner performance and retention could be established. This paradox elicits different possible explanations which are discussed in the light of the common pedagogical claim that more thoughtful approaches to learning should be promoted.

#### **Structured practitioner notes**

*What is already known about this topic*

- For many years, both teachers, researchers and prominent authors (Schön, Bateson, Kolb...) have been stressing the importance of reflection for learning, both in regular classrooms and in eLearning settings.
- Reflection can aim at enhancing the effectiveness of learning and/or promoting meta-cognition or akin notions like “learning to learn” or “self-regulation”, all considered as essential skills for knowledge workers.
- Today’s electronic learning environments expand opportunities to reinforce reflection by triggering learners about the content at hand and about own ways of internalizing it.

*What this paper adds*

- Although a wide variety of reflection triggers can be observed in the literature, there is only little and scattered research evidence available about the assumed effects and usage. This paper addresses this lack of empirical by surveying three concrete and structured reflection affordances.
- Although reflection may take place before, during and after action, its training is currently often associated to post-practice reflective tools like portfolio or learning diary. This paper brings in the forefront a different type of tool that targets reflection in action.
- This paper relates its findings to similar experiments, learning theories and open questions in order to offer a context for the discussion about compact and cost-effective ways to stimulate reflection while learning.

*Implications for practice and/or policy*

- Some institutions are experimenting with efforts to teach more than how to pass exams: they are looking for ways to grow their students' meta-cognition (for instance by having students estimate their knowledge, separately from taking the actual test). This study explores the provision of reflection triggers as one possibility to make learning processes and learning habits (good or bad) more visible and more discussed.
- Teachers might feel they lack enough time to exercise meta-cognition. However, the reflection triggers suggested in this article might amount to very short periods of time. This cost-effective approach might allow not to "sacrifice" content or burdening educators.
- The article invites the teacher to evaluate against his audience and learning goals the relevance of giving a face value to reflection instead of assuming that this reflection will occur. Would he decide to use reflection triggers, the article offers ideas for innovative crisscrossing between cognitive and meta-cognitive landscapes in online formal learning settings. It also elaborates on the observed limitations of the approach.

### **Introduction**

Meta-analysis (Hattie, 2008; Marzano, 1998) or literature reviews (Watkins, 2001) repeatedly pinpoint reflective practice as a highly influential factor of learning, if not the most influential one (Wang, Haertel, & Walberg, 1990). It is generally acknowledged that stimulating reflective skills will prepare knowledge workers to cope with requests for new knowledge acquisition and ongoing personal development in the information society (Rychen & Salganik, 2003; European Commission, 2006). Today's electronic learning environments offer new opportunities for reinforcing reflection, especially in a self-instruction context, that is situations wherein learners cannot rely upon an instructor to directly inform and stimulate their thinking about learning contents and processes. This paper describes a controlled comparative experiment about the use of "reflection triggers" in such a mode of learning.

### **Reflection triggers**

A "reflection trigger" (RT) refers to a deliberate prompting approach that offers learners a structured opportunity to examine and evaluate their own learning (Verpoorten, Westera, & Specht, 2010). Whereas the promotion of reflection is often associated with portfolios or similar post-practice methods, RT are nested in the study material and offered during learning activities. Examples would be tools for the visualization of learning progress, the qualification and comparison of aspects of the learning experience, the judgment on self-efficacy or understanding, the justification of study decisions, the provision of questions about the content, the pedagogical intention and the nature of learning as it develops. In all cases, RT are supposed to induce regular tingling for evaluating one's own learning and nurturing internal feedback. In the temporal flow of learning, their contiguity to student's doings commit RT to reflection-in-action more than to reflection-on-action, though Schön's (1983) famous distinction is relative: even a reflection that takes place "in action" bears on a pre-existing context but, in the case of RT, the interval is a matter of seconds.

The concise reflection they call for further characterizes RT. To support condensed reflective processes, RT operate through miniature Web applications (sometimes called "widgets") performing a single task, displaying a very clear and appropriate graphical style and providing a single interaction point for direct visualization or provision of a given kind of data (Verpoorten, Westera, & Specht, 2011). The application of such compact opportunities for reflection touches on a principle question though: is the very idea of a "short" reflection a contradiction or can embedded reflection on learning be brief and valuable at the same time? Beyond theory, there is a practical stake in this question: teachers as well as learners may be reluctant to reflective approaches, since these are supposed to go at the expense of studying

course contents. It is a major challenge to establish reflective learning practices without swamping the time available. Devoting attention to short reflection triggers unfolding within tasks also conveys research opportunities to get closer to the flow of self-regulating activities undertaken by students as they engage with learning and monitor it (Butler & Winne, 1995). Lastly, giving a trial to such instantaneous RT opens up questions about new patterns wherein instruction becomes explicitly interwoven with personal reflection and support of internal feedback about the task at hand (Kulhavy, 1977).

### **Research questions**

Two main questions guide the experiment: a) will RT embedded in a study task engage learners in active reflection?, b) will this reflection positively affect the performance? Two secondary research questions are tackled: a) will multiple RT have a greater effect than one single RT?, b) will there be any observable difference of effects between the types of RT used? Lastly, the study collects learners' perception and appreciation of RT and confronts these qualitative outcomes with performance data.

### **Methodology**

In a comparative study an online course was delivered at 5 different conditions. The intervention variables were the exposure to reflection triggers (different numbers, different types). The dependent variables were performance, time spent on the course and participants' perceptions of RT.

#### *The online course*

The two-hour online course "Web usability principles" was created for the occasion on the eLearning platform Moodle. It provided reading material on 20 pages that participants could freely navigate. A final test closed the learning sequence and assessed the content mastery reached by the learner.

#### *Three types of reflection triggers*

The study exposed participants to RT selected among the inventory proposed by Verpoorten et al. (2010). This work classifies reflective techniques into separate categories according to 3 types of actions requested from the learners to enact reflection: type 1) receiving information, type 2) giving information (responding), type 3) verbalizing information. Consistently with its comparative purpose, the study used one RT selected in each category. In the introductory section of the course, the offered RT were explained and described as "support to reflection and appreciation of one's position within the learning process". Their use was stated as compulsory. For tracking purpose, students had to deliberately activate the RT. When learners were about to leave a page without having used RT, a reminder pop-up enacted.

#### **RT 1 - Compare with yardstick**

This RT offers learners an opportunity to compare aspects of their learning experience to some external yardstick (teacher, peer, expert, classroom average, oneself in similar circumstances, compliance ratio, etc.). A yardstick provides a larger context to an individual performance (Glahn, Specht, & Koper, 2007; Glahn, 2009). The course offers two instances of this reflection trigger. At course level, each learner can compare the number of actions he performed so far with a static yardstick: the number of actions performed by a previous group of peers (Figure 1). At page level, learners can compare their level of mastery of a content page to the average mastery level of the peer group. Such real-time mirroring of personal tracked data is assumed to encourage a more thoughtful monitoring and calibration at both levels.

<INSERT FIGURE 1>

RT 2 – Rate your mastery of this page

This is a type 2 RT (“giving information/ responding”). It induces the reflective experience by asking learners to give a quick insight into their behaviours or performances through the use of a rating scale. On each page visit or revisit participants rate their perceived mastery level of the page content by selecting the appropriate number of stars (Figure 2a). For each level a standardized explanation was given. In case of multiple visits the history (Figure 2b) of this self-reported measure is available and steadily builds a progress track.

<INSERT FIGURE 2>

RT 3 – Write on the content

This RT is of type 3 (“verbalizing information”): it aims for inducing a reflective experience by asking the learners to produce a mental or written discourse about certain aspects of their learning. The online course offers the RT as a comment box available on each page. Whenever learners leave the page, they first have to enter their annotations.

### **Sample and schedule**

Invitations to participate were displayed in 4 Linked’in discussion groups and spread in institutions from the authors’ institutional network. Early 2010, 92 test persons applied and filled in the background questionnaires (explained below). Volunteers were distributed over the 5 conditions differing from each other by the number and/or type of RT. A large proportion of volunteers (50% of the registered people) was allotted to Group 1 (no RT) and Group 2 (all RT), because between these groups the strongest differences were expected. All subjects received the Web address of the course version matching their treatment. They had one month to complete it and take the final test. From the overall sample, 28 subjects never entered the courses and 10 quitted the course before completing the final test. Group 5 - the “comment box only” condition - suffered from a high proportion of drop-outs (questioned in the “Discussion” section). Despite its inadequate size, the group was included anyway because of the importance of qualitative data. The attrition rate is stable across the other groups. Table 1 gives a compact view of the treatments and their usable samples.

<INSERT TABLE 1>

### **Measure instruments**

Data sources for this study are scores to the questionnaires, the tests and the logs analyses.

#### *Background questionnaire*

Reflective skills and akin notion like meta-cognitive capacity are critical with regard to reflection triggers. Two weeks before the experiment started, 3 instruments were used to obtain learners characteristics regarding these skills:

1. the MAAS (Mindful Attention Awareness Scale): this 15-item self-report instrument provides a measure of receptive awareness of and attention to present-moment events and experience (Brown & Ryan, 2003);
2. the NFC (Need For Cognition scale): this 18-item self-report instrument reflects the need to structure relevant situations in meaningful, integrated ways and a need to understand and make reasonable the experiential world (Cacioppo & Petty, 1982);

3. the MAI (Meta-cognitive Awareness Inventory): this 52-item self-report instrument is used to measure meta-cognitive awareness, covering knowledge of cognition and regulation of cognition on various scales (Schraw & Dennison, 1994).

Self-reported level of mastery in the domain and familiarity with ICT were also collected in the background questionnaire.

#### *Short and long-term performance*

A test taken straight after the study session measured learners' achievement. This performance test a) was on-demand and taken when the student felt that he had achieved the highest possible level of content mastery, b) could be taken only once, c) had a time limit so that the reflection takes place while covering the material and not at the moment of the test, d) could be anticipated by the participants through examples of test questions, e) combined 5 "verbatim", 5 "comprehension inference" and 1 final integrative "knowledge inference" questions, the last two types of question requesting deep understanding of the material (Chi, De Leeuw, Chiu, & Lavancher, 1994), f) blocked access to the electronic material once launched.

Additionally, participants answered a similar test for capturing retention six weeks after the first test. By this time, they no longer could access the course.

#### *Behavioural metrics*

Log files of online sessions leveraged different usage patterns: a) total time spent on course, b) number of pages (re-)visited, c) use of reflection triggers, d) time spent on the final test.

#### *Feedback from learners*

A second online survey, taken right after the final test, provided participants' feedback on RT. The questionnaire comprised:

1. judgments on the intensity and the levers of reflection in the course, measured by the "Reflective Thinking" scale of the COLLES questionnaire (Taylor & Maor, 2000) that generates a measure of students' perceptions about a course;
2. opinions on the RT: weak and strong points, contribution to learning, learners' intentions of reuse.

## **Results**

The presentation of the results is mapped onto the structure of the above section "Measure instruments". An alpha level of .05 is used for all statistical tests.

#### *Background questionnaire*

To ensure equivalence between groups at baseline, one-way ANOVAs were performed on the 3 meta-cognitive skills questionnaires. The statistical test exhibited samples equivalence: MAI:  $F(4, 49) = 0.65, p = .62, \eta^2 = .027$ , MAAS:  $F(4, 49) = 0.16, p = .95, \eta^2 = .137$ , NFC:  $F(4, 49) = 0.53, p = .70, \eta^2 = .0003$ . The measures of initial self-reported familiarity with eLearning and self-reported knowledge about the domain also indicated comparable groups. Besides this even distribution, the background questionnaire revealed the high meta-cognitive agility of the sample. Only 4 volunteers with a lower profile enrolled in the experiment, allowing an enrichment of the observations by providing some contrast regarding usage and perceptions of the RT.

#### *Short and long-term performance*

The average score of the control group at the final test is 14.9/20 ( $SD = 2.0$ ). It looks substantially higher than means in other conditions (in order and with standard deviations in

parentheses): 12.2 (2.4), 12.3 (4.5), 12.0 (2.3), 12.0 (2.7). However, a one-way ANOVA indicates that difference between treatments are not statistically significant,  $F(4, 49) = 1.62$ ,  $p = .18$ ,  $\eta_p^2 = .11$ .

Analysis of the mean score to the retention test offers similar results. The control group scored higher in average: 3.2 ( $SD = 1.6$ ) compared to means obtained for the other conditions (in order and with standard deviations in parentheses): 2.9 (1.5), 2.7 (1.6), 2.3 (1.8), 2.9 (1.8). However, a one-way ANOVA communicates that difference between treatments are not statistically significant,  $F(4, 49) = 0.31$ ,  $p = .86$ ,  $\eta_p^2 = .11$ .

### *Behavioural metrics*

The technical integration with the Moodle platform was designed in such a way that all interactions with the RT were recorded in Moodle's regular "Activity reports/All logs" facility. This data treatment leveraged the following observations:

- RT were used as requested to a very large extent;
- RT do not influence the time spent on the study phase, ANOVA:  $F(4, 49) = 0.29$ ,  $p = .87$ ,  $\eta_p^2 = .023$ .
- RT do not impact the time spent on the test, ANOVA:  $F(4, 49) = 0.31$ ,  $p = .86$ ,  $\eta_p^2 = .008$ .
- loops between low self-ratings of mastery and further access to insufficiently mastered pages do not show up from global data. The attention to learning brought by the RT does not translate into concrete monitoring actions.

### *Feedback from learners*

The relevance of RT can be evaluated from two different perspectives. One is that of an observer who confronts RT with student's achievement (cf. the above section). Hereafter are given evaluations of RT from the learner's perspective.

### *Perceived intensity of reflection*

To what extent do learners report any reflection during the course, no matter what this reflection was exactly about and how it might be triggered? Calculations based on the "Reflective Thinking" Likert scale (5 levels: Almost Never / Seldom / Sometimes / Often / Almost Always) of the COLLES questionnaire (Taylor & Maor, 2000) reveal that relative frequencies for the items "*I often reflect*" or "*I almost always reflect*" are significantly lower in the control group than in the aggregated treatment groups,  $\chi^2(4, N = 54) = 11.444$ ,  $p = .022$ . Significant differences are confirmed by separate chi-square tests. In sum, 3 treatment groups out of 4 (exception is RT3, group 5) report significantly higher intensities of reflection in comparison with the control group.

### *Contribution to learning*

In the post-questionnaire participants evaluated each RT they used (103 opinions). 54% of the collected answers assess RT as contributors to learning.

### *Intention of reuse*

When asked whether they would make further use of the RT in another learning context, 27% answered "yes", 28% "no" and 45% "it depends". Only RT 3 obtains a clear "yes" answer (50%) among participants who used it. RT of type 1 receive the lowest "yes" ratings (16%).

### *Pros and cons*

The two corpuses of positive (83) and negative (80) comments on RT were content analyzed in order to obtain categories that systematically summarize and reflect the data (Table 2).

<INSERT TABLE 2>

Positive comments specify strong points of RT (enhancement of reflection or monitoring, new opportunities for comparison with others). The most often expressed criticism concerns usability aspects of the RT or insufficient connection with instructional aspects. An asterisk indicates a category of comments that exhibits an uneven distribution of the percentages. The group that contributes for more than a majority of the comments is shown, along with its relative weight. (Despite the limited number of comments, at least in some categories, these differences are given because they might prompt further enquiries about specific effects of certain RT).

#### Awareness of opportunities for reflection

Data relating to awareness of reflection affordances comes from the request: “We offered, in this online course, opportunities for reflection. Give as many of them you have noticed”. Clearly, in treatment groups the awareness of available reflection opportunities is much higher: all treatment groups report between 42 and 50% more RT than the control group. But the number of opportunities is not exclusively attributed to the presence of RT. Participants rightly reported alternative opportunities for reflection like “control questions”, “examples”, “instructions before the start”, “warning before taking the test”, “text accessible”. Deprived of structured RT, the control group nevertheless pinpointed reflection opportunities in the course, though not to a large extent. In contrast, subjects in group 2 (all RT conditions) assimilated in a large proportion (70%) the opportunities for reflection to the offered RT that seem, in this case, to give a face value to reflection.

### **Discussion**

The results show a differentiated picture.

#### *Primary research questions*

With regard to the first primary question “will RT embedded in a study task engage learners in active reflection?”, the large usage of the reflection affordances and the self-reported measures of claimed intensity of reflection point at a positive answer. However, if this reflection truly took place, it is not traceable from the data. Also, it turns out that the mandatory use of recurrent but very compact episodes of reflection did not produce significant effect on performance and retention (second primary research question). To evaluate this result, 4 different explanations are now suggested, that future research will help to disentangle.

#### Questioning RT

One might propose: this kind of RT does not work. Compared to other ways of triggering reflection, and especially heavier reflective techniques (self-explanation, meta-cognitive modeling, introspective dialogues with an instructor or a peer, etc.), these featherweight techniques do not measure up. At best, the study results disqualify RT as pointless, at worst as counterproductive to the performance.

#### Questioning learners

To preserve the RT, it is also possible to blame the learners by claiming that they underestimated the amount of effort needed to adequately apply the reflective introductions. This diligent but shallow use of the RT would explain their lack of impact on performance. The data suggests here possible nuances between high performers with a high level of prior

meta-cognitive agility who discount reflection affordances and low-performers who seem to overlook them and fail to connect them well to the tasks. In all cases, the use of RT does not directly hook with cognitive operations in the service of performance. They remain foreign to the internalization efforts (at least those oriented towards the test) of the participants while they were designed as levers of deeper learning (Marton, Dall'Alba, & Beaty, 1993).

#### Questioning the course

Authors (Bannert, Hildebrand, & Mengelkamp, 2009; Hoffman & Spataru, 2008) suggested that amplifying reflection in non complex tasks is useless. In such cases, reflection affordances would be unnecessary because individuals perceive simplicity in the learning task and/or in the content provided. In our study, the contents of the course were certainly not straightforward: the performance tests showed that none of the test persons achieved high levels of mastery. The length of the course, about 2 hr long, may also be questionable. Such a period may be too short for various types of RT to produce any differentiated effect on performance (Papadopoulos, Demetriadis, Stamelos, & Tsoukalas, 2009; van den Boom, Paas, van Merriënboer, & van Gog, 2004).

#### Questioning the notion of performance

The current study confined the measure of the learning performance to domain-specific knowledge. (The mere notion of performance is questionable with volunteers for an experiment. Motivation to take the course can range from a wish to get a first insight into the topic to a desire to achieve a high score at the final test. When there is “enough learning” in the eye of a student remains a delicate question). An extended version of performance, including meta-learning achievements, might give a different picture of RT. The qualitative data points in that direction: a majority of users perceived RT as useful to reflection and learning. (Influence of social desirability and Hawthorne effects might be suspected here. However, several qualitative questions converge across groups to produce a rather neat contrast between the subjective view and the absent or sometimes adverse effect on performance). It means that these reflective artifacts which have no impact on performance were valued anyway, in relation to learning, by the largest part of the students (see similar discrepancies in Chiazzese et al. (2006) and in Thompson (2009)).

(Three months after the end of the experiment, participants received a follow-up questionnaire asking them to select, based on their experience of RT, among 10 plausible explanations, the one who best explained the absence of positive effect of the RT on the performance. Analysis shows a broad dispersion of the 35 received answers among the 10 explanations: a) RT offered episodes of reflection too small to be influential: 9%, b) RT were too repetitive and caused an over-prompting effect: 6%, c) RT were used superficially by participants: 11%, d) RT were useless for meta-cognitively agile participants: 3%, e) RT were useless for too easy task and content: 11%, f) RT trained reflective habits impossible to install in a 2-hour course: 17%, g) RT increased the cognitive load: 3%, h) RT created confusion in the course between a performance and a learning orientation: 11%, i) RT broke the learning flow: 23%, j) RT trained skills that the test could not capture: 6%. The relative contribution of a single group to any of these percentages never exceeds 40%).

#### *Secondary research questions*

The type and the number of offered reflection triggers do not make any difference regarding performance and regarding the “reflective flavor” they instill in the course. This suggests that if RT are effective, then any reflection trigger would do.



The logs analysis exhibits that this instant reflection is not time-consuming. The qualitative data backs this observation: time needed for reflection is seldom mentioned as a hindrance. The short time needed to enact reflection affordances may have accounted for their rather high level of use. But this possible strength may easily turn into a weakness since the impact of such quick insights couldn't be traced in students' performance. (It can also be noticed that the comment box, viz. the most time-consuming RT when properly completed, was offered in the group where the highest level of level of drop-outs was observed). If this study provides some indications that RT might stimulate students' reflection in a cost-effective manner, the return that may be expected from such compact opportunities is still to be investigated.

### **Recommendations for future research**

Further work needs first to be done to establish whether structured cost-effective ways to encourage effective reflection while learning can legitimately develop as a specific topic of investigation. To address this bottom-line question, it is recommended that future research:

- characterizes reflection triggers against (or in-between) implicit reflective processes active in learning and explicit post-practice deliberative techniques. Here, convergence of RT with the field of "Experience sampling method" (Intille, Kukla, & Ma, 2002) might be investigated since they share three qualities: appraisal of experiences in natural settings, in real-time (or close to the occurrence of the experience being reported), and on repeated time occasions. Intermediate categories between featherweight and heavier reflection triggers (or samplers) are also worth considering in subsequent works;
- qualifies the induced reflection and return that may be expected from different types of RT in contrasted situations. The study of possible effects should not be confined to performance but embrace other dimensions like the development of the self-as-a-learner, gains in instructional meta-cognitive knowledge (Elen & Lowyck, 1998), sense of control or ownership of leaning. These dimensions, touching upon the meaning of the learning situation could particularly be investigated with low achievers, for whom reflection is less natural or too heavy;
- applies the RT (whatever their nature) on longer learning periods. Yet, the tight crisscrossing organized by RT between cognitive and meta-cognitive processes is no usual instructional design. The influence of low familiarity with and short exposure to such an intertwined approach to learning is questionable. Refined estimations of the time needed for a reflective tool to produce an effect and to settle new habits of enhanced thoughtfulness (Johnson & Sherlock, 2008) are worth raising for research on reflection triggers.

It is also suggested that research on explicit reflection affordances interspersed with learning inspect its relationships to a) cognitive load theory (Sweller, 1994): in what circumstances does a RT convey intrinsic, germane or extraneous load? And for whom?, and b) to flow theory (Csikszentmihalyi, 1990): is there any possible value for a "flow breaker" as RT? for whom is it helpful or disruptive?

The potential of the reflection triggers to make learning more visible (table 2), as suggested by some participants, is also an intriguing issue (Hattie, 2008) which may be usefully explored in further research.

### **Conclusion**

How to encourage valuable reflection by learners, in a cost-effective manner, in the moment of learning? This study explored the provision of reflection triggers as one possibility. This option contrasts with post-practice deliberative techniques like portfolio or learning diaries

(Moon, 1999) and with the use of dialogue or collaborative activities as levers for reflection (Brockbank & McGill, 1998). The introduction of RT also outline a type of reflection in context which seems to differ from the prevalent definitions considering reflection as a mental activity in which individuals explore their experiences in order to lead to a new understanding and appreciation (Boud, Keogh, & Walker, 1985). Reflection looks here more as a means by which learners can build and evolve a mental model of the learning process they are committed to and of their position inside this process (Seel, Al-Diban, & Blumschein, 2002). In its first approach, the study presented here offers indications that: 1) in a quasi formal learning context, RT were used as requested. 2) the use of RT induced the feeling of an higher intensity of reflection. 3) RT did not enhance exam performance and were even adverse in some conditions 4) despite this lack of effect on performance, a fair proportion of participants qualified RT as contributors to learning 5) the use of RT did not significantly extend the time spend on the course. 6) RT instilled a higher awareness of the reflective approach applied to the course irrespective of the type and the number of RT.

At this point of the inquiry, it remains uneasy to provide sound principles regarding RT. A practitioner who would consider using such reflection affordances in a formal learning activity system should first evaluate against his audience and learning goals the relevance of giving a face value to reflection instead of assuming that this reflection will occur. Overall, the findings of this study need to be considered with caution due to the small size of the sample. Observations and outcomes are useful as pilot research to inform the design of a full-fledged experiment that employs a larger sample and a refined methodology.

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## LIST OF FIGURES AND TABLES

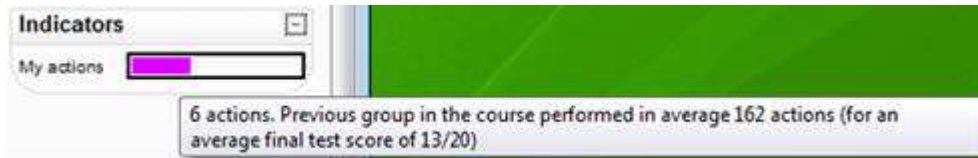


Figure 1: The reflection trigger (type 1) confronts personal tracked data to a yardstick



Figure 2: The reflection trigger (type 2) calls for a rating of mastery

Table 1: Overview of the 5 treatments, with offered reflection trigger(s)

Treatments	Reflection trigger(s) offered			Usable sample
	Compare with yardstick (RT1)	Rate your mastery of this page (RT2)	Write on the content (RT3)	
Group 1 (control): no reflection trigger	–	–	–	n = 10
Group 2 - all reflection triggers provided	<b>X</b>	<b>X</b>	<b>X</b>	n = 16
Group 3 – Triggers type 1 provided	<b>X</b>	–	–	n = 11
Group 4 – Trigger type 2 provided	–	<b>X</b>	–	n = 11
Group 5 – Trigger type 3 provided	–	–	<b>X</b>	n = 6

Table 2: Frequencies for categories of positive and negative comments on reflection triggers

Positive Answer category	Frequency	Negative Answer category	Frequency
RT provide opportunities for comparison with others*	24% (G3:89%)	Criticism on RT usability*	28.5% (G4:52%)
RT enhance reflection*	20.5% (G4:66%)	Criticism on RT didactics	25%
RT enhance monitoring	17%	Criticism on RT semantics	19%
RT are usable	8%	RT are compulsory*	10% (G5:66%)
RT make learning visible*	6% (G5: 76%)	RT are useless	6%
RT enhance attention	6%	RT are distractors	4%
RT enhance mental modelling of the learning situation	6%	RT take time	4%
RT are good for motivation	5%	RT allow a shallow use	2.5%
RT are good for personalisation	2.5%	RT seem silly	1%
RT are good for active commitment to the task	2.5%		
RT are good for learning to learn	2.5%		
	100%		100%