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Motivational beliefs, student effort, and feedback behaviour in computer-based formative assessment

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ABSTRACT

Feedback can only be effective when students seek feedback and process it. This study examines the relations between students' motivational beliefs, effort invested in a computer-based formative assessment, and feedback behaviour. Feedback behaviour is represented by whether a student seeks feedback and the time a student spends studying the feedback. The motivational beliefs examined in this study are success expectancy and task-value beliefs. Results show that the effort invested in the formative assessment was predicted by task-value beliefs, but not by success expectancy beliefs. Furthermore, feedback seeking was predicted by success expectancy as well as task-value beliefs, while feedback study time was not. In addition, feedback seeking was predicted by student effort invested in the formative assessment.

1. Introduction

Assessments are often used to formulate judgements about performance in order to select, classify or certify. These purposes are referred to as the summative function of assessment. Assessments can also be aimed at contributing to student learning, which is referred to as the formative function of assessment. The formative function of assessment is realized by communicating information on student performance, in the form of feedback, to teachers and/or students to stimulate and enhance teaching and learning processes. Feedback comes in many shapes and sizes. A distinction is often made between the following types of feedback: 1) knowledge of results (KR), where the student is merely informed whether or not an answer is correct, 2) knowledge of correct response (KCR), and 3) elaborated feedback (EF), where more information is provided (Shute, 2008).

Previous research has shown that KCR and EF are more likely to lead to improved learning outcomes than KR (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Van der Kleij, Timmers, & Eggen, 2011). However, simply adding KCR or EF feedback to computer-based formative assessments (CBFA) does not guarantee that students seek and process the feedback (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003; Timmers & Veldkamp, 2011). Foremost, students need to be willing to invest time and effort in seeking and processing feedback. Many factors influence this willingness. These factors can be categorized as characteristics of the feedback intervention itself (e.g. type of feedback), characteristics of the task and setting (e.g. test length), and student characteristics (e.g. motivational beliefs) (Narciss & Huth, 2004; Timmers & Veldkamp, 2011).

The present study examines the relations between students' motivational beliefs, effort invested in a CBFA and feedback behaviour. An advantage of using a computer in formative assessment is the possibility to record feedback behaviour by logging feedback study times and whether or not students seek feedback by linking to feedback pages. The motivational beliefs examined in this study are success expectancy and task-value beliefs.

2. Theoretical framework

Formative assessment is a term that is conceptualized in various way (Bennett, 2011; Yorke, 2003). However, it is generally agreed that its main purpose is to contribute to student learning by providing feedback. In this study, feedback as part of formative assessment is defined as

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information regarding student performance on a test-like event that is provided by an agent (e.g. teacher, computer) to teachers and/or learners with the purpose of stimulating and enhancing teaching and learning processes (cf. Hattie & Timperley, 2007; Sadler, 1989). This information can pertain to actual levels of performance as well as desired levels of performance. Additionally, it can include hints and means for reducing the gap between the actual and desired levels of performance or understanding (Hattie & Timperley, 2007; Sadler, 1989).

Mindful processing of feedback is considered crucial for feedback to result in improved learning outcomes (Bangert-Drowns et al., 1991). Students have to play an active and self-regulating role in seeking and constructing meaning from feedback information (Nicol & McFarlane-Dick, 2006). But of course, students then need to be willing to invest time and effort in a formative assessment as well as seeking and processing feedback. Such willingness can be promoted, but not guaranteed.

Models proposed for feedback seeking mostly focus on employees in organizations (Park, Schmidt, Scheu, & DeShon, 2007; VandeWalle, Ganesan, Challagalla, & Brown, 2000) and (interactive) computer-based learning environments (Aleven et al., 2003). Previous research shows that students are more likely to seek computer-mediated feedback than person-mediated feedback (Karabenick & Knapp, 1988; Kluger & Adler, 1993), probably because feedback seeking in computer environments often remains unnoticed by others. As such, the cost of exposing one's uncertainty and need for help, so called *self-presentation cost*, does not come into play (Aleven et al., 2003).

Bangert-Drowns et al. (1991) describe the process of receiving feedback in a test-like event in a five-stage model. Within this model, motivational beliefs are positioned as both affecting and being affected by feedback seeking and processing. The model starts with describing cognitive (degree of prior relevant knowledge) and motivational aspects (degree of self-efficacy, degree of interest, and kind of goal orientation) of the learners initial state (stage 1). The initial state is assumed to influence the effort students invest in the subsequent stages of the model or cycle. When a test-like event, in this case a CBFA, is administered, items activate the process of addressing relevant prior knowledge (stage 2). Subsequently, the test takers construct a response (stage 3). In this model, the option of on-demand help or feedback during stage 2 and 3 has not been taken into account. Instead, learners are provided with feedback information after they have constructed a response (stage 3). The next stage is the evaluation of results (stage 4). When the purpose of a test-like event is knowledge acquisition the cycle is successfully completed when adjustments are made to the degree of prior knowledge (stage 5). Test-like events are assumed to influence motivational aspects of the initial stage, e.g. degree of interest, for future (comparable) test-like events. As such, test-like events can also be used for the purpose of influencing motivational aspects of the initial stage. This could, for example, be relevant when students under- or overestimate their own abilities. A test-like event could then be used to monitor (limitations of) certain abilities and, as a consequence, could lead to adjustments of students' degree of self-efficacy or interest in the task or topic. The adjustments made in reaction to the test-like event (stage 5), or differences between stage 1 and 5, can be viewed as learning outcomes of the test-like event.

Previous research shows that student time and effort invested in a test-like event, or learning task, as well as seeking and processing feedback can be promoted or inhibited by various variables for the various stages mentioned by Bangert-Drowns et al. (1991). For example, if feedback is available when learners are requested to address prior knowledge and formulate responses (stage 2 and 3), students might copy feedback answers and, as such, short-circuit the searching–response–evaluation–adjustment process (Bangert-Drowns et al., 1991). Furthermore, possibilities for evaluation (stage 4) are limited if learners are provided with KR only (Hattie & Timperley, 2007). In addition, a positive attitude towards the test-like event can promote feedback study time (stage 4) (Van der Kleij, Eggen, Timmers, & Veldkamp, 2012). Previous research shows that feedback study time is also influenced by the correctness of the response and response certitude (stage 4) (Mory, 2004). Correct answers on items for which students were confident that they answered them correctly (low discrepancy) yield the shortest feedback time. Incorrect answers on items for which students were confident that they answered correctly (high discrepancy) yield the longest feedback study time.

According to the expectancy-value-theory of Eccles and Wigfield (2002), student willingness to invest time and effort in a task is explained by success expectancy and task-value beliefs, that is, so called motivational beliefs. Success expectancy beliefs refer to students' judgements about their capabilities to complete certain academic tasks. Beliefs about the importance of, interest in, and value of the task are referred to as task-value beliefs. Furthermore, motivational beliefs are viewed to be task-specific as they vary for different activities (Crombach, Boekaerts, & Voeten, 2003). Students' task-specific motivational beliefs result from initial judgements about a task based on previous experiences with similar tasks and content. Crombach et al. (2003) distinguish between two kinds of task-specific judgements: Judgements about the task before and judgements about the task after completing a learning task, appraisals and attributions, respectively.

3. Aims of the present study

The present study examines the relations between students' motivational beliefs, effort invested in a CBFA and feedback behaviour. A schematic overview of the relations examined is presented in Fig. 1. In terms of the five-stage model described by Bangert-Drowns et al. (1991), this study focuses on the relation between the learners initial state (task-value beliefs and success expectancy), addressing

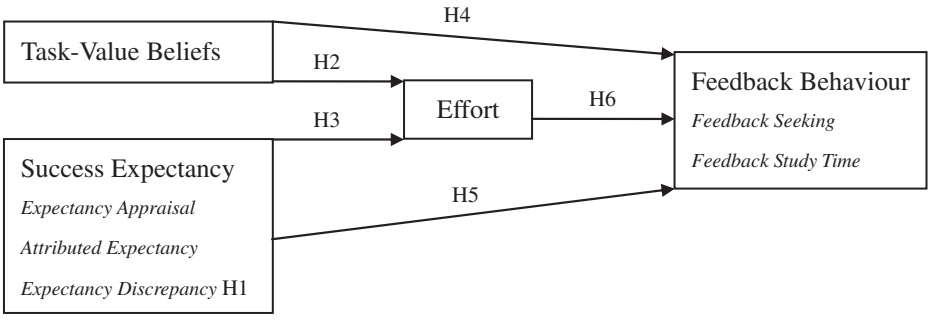

Fig. 1. A schematic representation of the six hypotheses tested in this paper.

relevant prior knowledge and constructing a response (effort students invest in a test-like event), and evaluation (feedback behaviour). The test-like event in this study is a CBFA on information literacy. Previous research shows that students have shortcomings in information literacy and at the same time tend to overestimate their information literacy (Ivanitskaya, O'Boyle, & Casey, 2006; Kuhlemeier & Hemker, 2005; Maughan, 2001). As such, the purpose of the CBFA is twofold, namely 1) knowledge acquisition, and 2) increase the degree of interest in the topic.

Given the tendency of students to overestimate their information literacy, students are expected to experience the CBFA as more difficult than expected in advance (H1). This assumption is related to 'success expectancy' and referred to as 'expectancy discrepancy'.

Based on the expectancy-value theory of Eccles and Wigfield (2002), Effort invested in a CBFA is assumed to be predicted by Task-Value Beliefs (H2) and Success Expectancy (H3). Pintrich (1999) found that both success expectancy and task-value beliefs predict the employment of follow-up activities, such as seeking and processing feedback, in learning processes. Therefore, it is expected that Feedback Behaviour is predicted by Task-Value Beliefs (H4) and Success Expectancy (H5). Furthermore, the relation between Effort invested in a test-like event and Feedback Behaviour is explored, as it has not been studied extensively. Effort can be viewed as an indirect measure of motivation (Crombach et al., 2003). Therefore, a positive relation is expected between Effort and Feedback Behaviour (H6).

4. Methodology

4.1. Research population and procedure

First-year bachelors of Health ($N = 151$) were requested to assess their own knowledge and understanding related to information literacy with a 20-item CBFA. The vast majority of bachelors of Health is female and their age ranges between 17 and 19 as the CBFA was embedded in a regular four-year training. Information literacy refers to the ability to identify information needs, locate corresponding information sources, extract and organize relevant information from each source, and synthesize information from a variety of sources (Walraven, Brand-Gruwel, & Boshuizen, 2008). Questions on task-value beliefs, success expectancy and effort invested in the CBFA were integrated in the CBFA system. The questions related to task-value beliefs and expectancy appraisal were presented before the items of the CBFA. Students were shown two exemplary items of the CBFA beforehand to get an impression of the task. Questions related to attributed expectancy and effort were presented after all items of the CBFA had been completed and before the KR page was presented. In addition, students were asked to estimate the number of correct answers just before the first item and directly after answering the last item of the CBFA to measure expectancy discrepancy.

The CBFA was programmed during one of a series of lessons of a research skills training programme for first-year bachelors of Health. No consequences were linked to skipping the lesson, as attending lessons is recommended to students but not compulsory. In general, all first-year bachelors of Health ($N = 190$) were recommended to attend lessons of the research skills programme. The students ($N = 151$) that attended the lesson in which the CBFA was programmed were divided over six separate and proctored sessions of ninety minutes. The surveillant started the sessions with a brief verbal instruction about the CBFA and handed out a written instruction. Students were told the outcomes of the CBFA would be discussed in the forthcoming lecture. Furthermore, after completing the CBFA students were requested to stay at least for the first forty-five minutes. They were encouraged to use the remaining time to work on an assignment for the next lesson of the research skills training programme. Most students finished the test within forty-five minutes. All students ($N = 151$) that attended one of the sessions completed the formative assessment. Only 141 completed the entire questionnaire on task-specific motivational beliefs.

4.2. Questionnaire on task-value beliefs, success expectancy and effort

Crombach et al. (2003) developed a measurement instrument to study student's task-specific motivational beliefs when faced with specific curricular tasks, the online-motivation questionnaire (OMQ). The OMQ identifies cognitive judgements students make to determine the amount of effort they intend to spend on a task. The original version of the OMQ consists of seven dimensions. Only the dimensions concerning task-value beliefs, success expectancy (attributions and appraisals) and effort were selected for this study. All items of the OMQ are 4-point Likert-scales.

The questionnaire used in this study, included dimensions referred to as task-value beliefs, expectancy appraisal, attributed expectancy, and effort. Effort is an indirect measure of task-specific motivational beliefs as it is considered a result of motivational beliefs. In addition, students were asked to indicate how many items they expected to (have) answer(ed) correct. This question was asked twice, both 1) preceding the CBFA and the first part of the questionnaire, and 2) directly after completing the CBFA and before the second part of the questionnaire. The answers to this question give an impression of the discrepancy between expectancy appraisal and attributed expectancy. As such, success expectancy encompassed the following three dimensions: expectancy appraisal, attributed expectancy and expectancy discrepancy.

4.3. A computer-based formative assessment on information literacy

In computer-based environments, a distinction can be made between on-demand help or feedback before KR is provided on a task (e.g. Kluger & Adler, 1993; Narciss, Körndle, Reimann, & Müller, 2004) and additional feedback after KR is provided (e.g. Karabenick & Knapp, 1988; Mory, 1994). In a test-like event which provides multiple tries or on-demand help or feedback before KR is provide on a task, hints or worked-out examples without KCR are preferred. The exclusion of KCR prevents the undesirable effects of pre-search availability (Narciss & Huth, 2004). This study limits itself to a context in which additional feedback is available for students after they have been provided with KR on a CBFA.

The CBFA presented students with 20 multiple-choice items on information literacy. The items were selected from an existing pool of items developed by information professionals working at university libraries. The lecturers involved in the research skills training programme selected the items based on estimated relevance. Furthermore, the final selection of items covered the various aspects of information literacy, such as source selection, the application of search strategies, and referencing. By including KCR and EF, students were given

an opportunity to engage in knowledge acquisition activities. The CBFA used in this study provided students with a KR page after the student completed all items of the CBFA. The KR page presented information whether items were answered correct or incorrect. The KR page is automatically generated and includes hyperlinks to pop-up pages with additional feedback per item. The additional feedback included KCR and an explanation of the various concepts used in the stem and answering categories (EF). In order to continue after opening an additional feedback page, this pop-up page first needs to be closed. The CBFA registered feedback behaviour by logging 1) whether students linked to additional feedback pages, and 2) the time between a pop-up pages with additional feedback was opened and closed.

4.4. Data analyses

The dependent variable feedback behaviour per student is represented by feedback seeking, and feedback study time. Feedback seeking was measured by the proportion of additional feedback pages opened per student. Feedback study time was measured per item by logging the time between opening and closing an additional feedback page. Measures per item were added to calculate total feedback study time per student. Although multitasking during the CBFA was discouraged by surveillance, it could not be excluded completely. To compensate for extreme values of feedback study time, the logarithm of total feedback study time was used.

An adapted version of the OMQ was used to measure task-value beliefs, expectancy appraisal, attributed expectancy, and effort. The questions about the number of items students expected to have answered correctly, were added to the questionnaire. The expected number of correctly answered items, out of twenty, was divided by five to create a metric in accordance with the 4-point Likert-scales of the OMQ. To confirm the various dimensions in the questionnaire, a varimax rotated principal component analysis was used.

For the various constructed subscales found in the principal component analysis unweight means were calculated (within a range of 1–4). Furthermore, a variable was added for expectancy discrepancy. This variable provides an indication of the extent to which students experienced the CBFA to be more or less difficult than expected in advance. This variable was calculated by subtracting the student estimation about the expected number of correctly answered items made directly before completing the CBFA and the estimation made directly after completing the CBFA. This variable pertains to Hypothesis 1.

A linear regression analysis, using PASW statistic 18, tested whether effort was predicted by task-value beliefs (H2) and the three dimensions of success expectancy (H3). Subsequently feedback seeking and total feedback study time were regressed on task-value beliefs (H4) and the three dimensions of success expectancy (H5) using PASW statistic 18 probit-analysis (Liao, 1994) and linear regression analysis, respectively. Finally, probit and linear regression analysis were used to explore the relation between effort and feedback behaviour (H6), feedback seeking and total feedback study time, respectively.

5. Results

5.1. Feedback behaviour

Out of 151 students, 113 opened a total number of 871 additional feedback pages. As such, 75% of the students consulted additional feedback. On average this group of students opened 7.7 (SD = 4.10) additional feedback pages.

For those students that opened additional feedback pages, the average feedback study time per item was 17.2 s (SD = 10.8). The average total feedback study time was 137.5 s (SD = 129.8) per student.

5.2. Principal component analysis of task-specific motivation

The principal component analysis with varimax rotation presented in Table 1 shows four dimensions of students' task-specific motivation. Based on the Eigenvalues and the changes in explained variance, the analysis with four components was preferred over other

Table 1
Principal component loadings for Effort, Expectancy Appraisal, Attributed Expectancy, Effort, and Task-Value Beliefs after varimax rotation.

Dimensions	1	2	3	4
Effort				
How much effort did you spend completing the task?	**.44**	.03	−.40	.11
How much time did you spend answering the items?	**.62**	−.13	−.08	.27
How much effort did you spend to reach a high test score?	**.69**	.06	−.17	.00
I did (not do) well, because I (do not) like this kind of tasks	**.74**	.11	.23	−.02
I did (not do) well, because I (did not) tried my best	**.80**	.00	−.20	.01
I did (not do) well, because the task was (not) pleasant	**.69**	−.00	.12	.18
Expectancy Appraisal				
How well do you expect to perform on this task?	.18	**.73**	.10	.08
How good are you in tasks which call on information literacy?	.03	**.70**	.09	−.09
What is your opinion on this kind of tasks generally?	−.08	**.77**	−.10	−.23
How many of the 20 items do you expect to answer correct?[a]	−.08	**.79**	.16	.13
Attributed Expectancy				
How many of the 20 items do you think you answered correct?[a]	−.04	.39	**.58**	.21
How difficult do you perceive this task to be?	−.21	−.13	**.74**	−.02
I did (not do) well, because I'm not good at this kind of tasks	.30	.28	**.51**	−.33
I did (not do) well, because I almost knew nothing about it	−.10	.00	**.70**	−.21
I did (not do) well, because I found the task to be difficult	.11	.20	**.57**	−.02
Task-Value Beliefs				
I consider the task to be valuable	.07	−.05	−.21	**.79**
How important is it for you to perform well on this kind of tasks?	.22	.02	.02	**.80**

[a] Used to measure expectancy discrepancy.

solutions. The four components explained 55.9% of total variance. A fifth component explained an additional 6% of variance but was difficult to interpret. One item (I did well on the test, because I was lucky) was removed based on the results of the analyses as this question had a low factor loading on all four components.

Table 1 shows a 6-item scale for Effort (Cronbach's $\alpha = .77$). For Expectancy Appraisal a 4-item scale ($\alpha = .75$) was encountered. The third aspect is a 5-item scale referred to as Attributed Expectancy ($\alpha = .67$). The fourth aspect is referred to as Task-Value Beliefs and contains only 2 items. These items showed a Spearman correlation coefficient of .47 ($p < .01$).

5.3. Descriptive statistics

Descriptive statistics for Task-Value Beliefs, the three dimensions of success expectancy and Effort are presented in Table 2. The means for Task-Value Beliefs, Expectancy Appraisals, Attributed Expectancy and Effort represents population average of unweight means per student. The mean for expectancy discrepancy is the average discrepancy between a students' estimate of expected number of items of the CBFA answered correct (within a range of 0–20) before and after completing the CBFA. The descriptive statistics for expectancy discrepancy show that on average students' estimates before and after completing the CBFA differed 3.54 points. This confirms that students, on average, experienced the CBFA to be more difficult than expected in advance (H1 is confirmed).

5.4. Predictors of effort

Effort was regressed on Task-Value Beliefs, and the three dimensions of success expectancy using linear analyses ($N = 141$). Results showed a positive relation between Task-Value Beliefs and Effort (H2 is confirmed). That is, the regression coefficient β was equal to .27 with a significance probability $p = .02$. No significant relations were found between the three dimensions of success expectancy and Effort (H3 is confirmed).

5.5. Predictors of feedback behaviour

Feedback seeking was regressed on Task-Value Beliefs and the three dimensions of success expectancy using probit analyses ($N = 113$). Results showed a positive relation between feedback seeking and Task-Value Beliefs (H4 is confirmed for feedback seeking). That is, the regression coefficient β was equal to .14 with a significance probability $p = .02$. Significant relations were also found for feedback seeking and Expectancy Appraisals ($\beta = .30$, $p = .01$), Expectancy Attributions ($\beta = .16$, $p = .01$), and expectancy discrepancy ($\beta = -.02$, $p = .02$) (H5 is partly confirmed for feedback seeking). Total feedback study time per student was regressed on Task-Value Beliefs and the three dimensions of success expectancy using a linear analysis ($N = 113$). Results showed no significant relations (H4 and H5 are disconfirmed for total feedback study time).

5.6. Effort and feedback behaviour

Feedback seeking was regressed on Effort using probit analysis ($N = 113$). Results showed a positive relation ($\beta = .16$, $p < .01$). No significant relation was found for total feedback study time and Effort. As such, H6 is confirmed for feedback seeking and disconfirmed for total feedback study time.

6. Discussion

The purpose of this study was to examine the relations between students' motivational beliefs, effort invested in a CBFA, and feedback behaviour. The motivational beliefs studied are success expectancy and task-value beliefs. Success expectancy encompassed the following three dimensions: expectancy appraisals, attributed expectancy and expectancy discrepancy. A considerable amount of Health students (75%) showed willingness to invest time and effort in seeking additional feedback pages (on average eight out of twenty pages) included in a CBFA on information literacy. Measures for expectancy discrepancy showed that on average students experienced the CBFA to be more difficult than expected in advance (H1 was confirmed).

Based on Eccles and Wigfield (2002) expectancy-value-theory it was expected that student effort invested in a CBFA would be explained by their success expectancy and beliefs about the value of a task. Students who perceived the CBFA to be more valuable reported more effort invested in completing the CBFA (H2 was confirmed). No relation was found between success expectancy and student-reported effort invested in the CBFA (H3 was disconfirmed). Students' goal orientation might add to an explanation for the results encountered. Students with a more intrinsic orientation tend to focus on learning and understanding. This *learning goal orientation* is assumed to lead to the use of more appropriate learning strategies compared to performance goal orientation (Aleven et al., 2003). The respondents attended a non-compulsory lesson, a learning strategy which suggests an inclination towards learning goal orientation. From a learning goal orientation perspective, the influence of success expectancy on effort is expected to be limited as the focus is on mastery instead of performance. In

Table 2
Descriptive statistics.

Variable name	*N*	# Items	Mean	SD	Minimum	Maximum
Task-Value Beliefs	151	2	2.79	.44	1	3.5
Expectancy Appraisals	151	4	2.32	.22	2	2.9
Attributed Expectancy	151	5	2.08	.45	.6	3.2
Expectancy Discrepancy	151	1	3.54	3.08	−10	10
Effort	141	6	2.61	.46	1	3.5

addition, the introduction of the CBFA included an explanation of the formative function of the CBFA, which aimed at reassuring students that the assessment aimed at provided an opportunity to learn instead at judging performance. After all, students were confronted with the CBFA for the first time and without the opportunity to prepare themselves. This could have limited the effect of success expectancy on effort. Task-value beliefs are still expected to influence effort within the context of a learning goal orientation, as students have to perceive the task as valuable enough to invest effort in.

Feedback behaviour was assumed to positively relate to task-value beliefs and success expectancy. Feedback behaviour was represented by feedback seeking as well as feedback study time. Results showed that feedback seeking was indeed positively related to task-value beliefs (H4 was confirmed for feedback seeking). Furthermore, higher levels of success expectancy before completing the CBFA (expectancy appraisals) positively related to feedback seeking. Higher levels of success expectancy after completing the CBFA (attributed expectancy) also related positively to feedback seeking. As such, the results are largely in line with the results of Pintrich (1999), who found that students who feel more efficacious about their ability to do well are more likely to be cognitively involved to learn, for example by seeking additional feedback. On the other hand, results showed a small negative relation between expectancy discrepancy and feedback seeking. This means that an increase in underestimation of the difficulty of the CBFA led to a decrease in feedback seeking. As such, an increase in expected and perceived difficulty seems to lead to an *ego-based motive* to defend or enhance one's ego by rejecting or ignoring the feedback (Ashford, Blatt, & VandeWalle, 2003; Kluger & DeNisi, 1996). The aim of a formative assessment is to support learning, and, as such, to address an instrumental motive, to achieve a goal or perform well, for feedback behaviour instead of an ego-based motive (Ashford et al., 2003). In conclusion, a positive relation between success expectancy and feedback seeking is largely confirmed, but needs to be refined by noting that a high expectancy discrepancy seems to lead to an opposite effect and should therefore be limited (H5 is largely confirmed for feedback seeking, but needs to be refined).

Results showed that differences in the logarithm of total feedback study time per student could not be attributed to task-value beliefs nor the three dimensions of success expectancy (H4 and H5 were disconfirmed for feedback study time). Time measures can be expected to highly vary due to random events of various sorts, for instance, individual differences in reading speed. This results in a power problem which hampers finding significant results for the relation between feedback study time and variables such as success expectancy and task-value beliefs. Furthermore, previous research has shown response certitude to influence feedback study time (Kulhavy & Stock, 1989; Mory, 1994). Response certitude contrasts success expectancy per item against the KR of the respective item. Unfortunately, the CBFA system used did not include the option for students to indicate their certitude about their response. For further research, it is recommended to study differences in feedback study time while controlling for response certitude.

The negative relation between expectancy discrepancy and feedback seeking suggests that difficult test-like events can lead to loss of motivation and, as a consequence, rejection of feedback. Easy activities, on the other hand, might lead students to perceive a small performance gap that is not worth any additional effort, such as seeking and studying feedback. As a task should not be too easy or too difficult, the relation between student achievement and feedback behaviour cannot be expected to be linear (Sadler, 1989; Schunk, Pintrich, & Meece, 2008). Further research is needed to examine motivational beliefs, such as success expectancy and goal orientation, and feedback behaviour in relation to student achievement.

The effects observed for motivational beliefs and feedback behaviour were rather small. However, the measures used did not have very high reliability coefficients so the effect sizes may well have been underestimated. In addition, it is reasonable to expect the non-compulsory setting to have influenced the findings. Skipping lessons of the research training programme was not linked to any consequences. As such, the setting led to self-selection of respondents. A total of 190 first-year bachelors of Health were expected to attend the lesson in which they were requested to complete the CBFA. Instead a total of 151 students showed up. The motivational beliefs of students ($N = 39$) skipping the lesson can be expected to differ from those students attending the lesson. Inclusion of all first-year bachelors of Health would have led to a wider variation in motivational beliefs and, possibly, stronger effects. On the other hand, if completing the CBFA had been compulsory, students' task-value beliefs might have increased extrinsically, as students would be influenced by the impression that lecturers consider the CBFA to be an important aspect of their research training.

There are limitations to the measures used to represent feedback study time and student effort invested in completing the CBFA. In the present study it is assumed that the time between opening and closing an additional feedback page represents the time that a student spends studying the additional feedback. However, student might have been interrupted between opening and closing a feedback page. As a consequence, the time measures may not accurately represent the time students spent studying the feedback. Furthermore, effort was measured through self-report. It remains unclear to what extent the self-reported measure approaches actual effort invested in the CBFA.

Based on the results developers of and lecturers using CBFAs are recommended to take into account students task-value beliefs and success expectancy. Motivational interventions should be considered to create attractive CBFAs as well as a context which positively fosters students' task-value beliefs and success expectancy, and, as a consequence, effort invested in a CBFA, including feedback seeking. An exemplary intervention is asking students to set specific goals, related to the respective topic, before using a CBFA (Boekaerts & Corno, 2005). In addition, a CBFA should not be experienced as begin too difficult to prevent frustration or loss of motivation. On the other hand, a CBFA should be difficult enough to perceive a need for feedback.

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