



DEPARTMENT OF EDUCATION,
COMMUNICATION AND LEARNING

EXPLORING AFFECTIVE FEEDBACK DESIGN

The Impact of Feedback, Goals and
Emotions on Learning with an
Experimental eTraining Object

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Abstract

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Purpose: The purpose of this study is to and to give practical recommendations for design of automatic affect based feedback systems in eTraining. It does this by exploring the affective process which underlies the the influence of experienced feedback on learning achievement, time and efficiency.

Theory: The theoretical background of this study is the achievement goal framework (Elliot and Murayama, 2008) and the achievement emotion theory (Pekrun et al, 2005). Further, it utilizes Bloom's revised taxonomy (Anderson and Krathwohl, 2001).

Method: The method of data collection is the web-based experiment. The study was a between subject design. It was comprised of three conditions: self-referential feedback, normative feedback and no feedback. The data analysis utilizes structural equation modeling in the form of path analysis, independent samples t-tests, ANOVA and descriptive statistics.

Results: The results of this study indicate that affective variables influence the effects of feedback on learning achievement. It is suggested that automatic feedback systems focus on self-referential feedback if only general information about improvement or decline in performance is available for the learner. However, it could be expected that self-referential feedback lowers positive achievement emotions as well as negative and thus additional measures should be taken to improve enjoyment, pride and hope of learners.

Foreword

This thesis is written as conclusion of the International Master's Programme in IT & Learning at the University of Gothenburg. It is submitted in partial fulfilment of the requirements for the degree of Master of Science in Applied Information Technology with Specialization in Learning and Communication.

It describes the effects of feedback on emotions, goals and subsequent performance in an eTraining environment. The purpose of this study is to explore these effects in order to give recommendations for designers to help their decision making process in regards to automated feedback implementations.

The files and source code of this project is available via GitHub repository under: <https://github.com/Thomasrider/master-thesis>.

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Introduction

Modern technology enhanced distance education offers learners a great freedom to pursue their goals. Yet the relative isolation of the learner behind a display and away from other learners is not only an ever present issue for students, also instructional designers are concerned with it. The use of pedagogical tools like feedback on learning processes falls into emotional circumstances which are the result of a new educational isolation. Designers and educators need to understand how the practice of feedback is impacted by the emotions and goals a learner has in order to influence the learning achievement positively. The proper modelling and understanding of the affective situation in which the learners react to feedback is a significant challenge to psychological, technological as well as educational research.

Education in an online setting faces different challenges than classical “brick and mortar” classroom setting (Jones and Blankenship 2014). Especially communicative practices such as the way of providing and receiving feedback change drastically from face to face to distance education. While at a personal level the Instructor can make use of non-verbal signals to interpret the need and the reception of feedback this is not yet possible in distance education (Ladyshevsky, 2013). There is also a lower degree of immediacy of feedback in online distance settings which has to be addressed in this regard. But there are not only downsides to feedback in online courses as it is of benefit to enable every student to participate equally and may lead to a more equal distribution of feedback. This can be seen in contrast to a classroom in which only a smaller number of students is able to dominate and also to receive the most feedback afterward (AACSB, 1998).

However, despite these challenging situation there are continuous advancements in information technology which make it possible to deliver and shape educational content to a worldwide audience at a high rate. Educational companies and initiatives such as Coursera, EdX and Udacity deliver massive open online courses (MOOC) to thousands of learners. Learners in these courses can vary in age, educational background, previous knowledge, gender etc. The interest in uncovering the affective influence on technology enhanced learning has risen as a reaction to the use of user metrics from MOOC’s and online courses form analytical purposes. Rienties and Rivers (2014) presented a literature review in which they identified over 100 emotions which have influence on the learning process of online learners. And Artino (2012) emphasizes that emotions and affective variables have received only scarce attention from educational research, especially in online settings.

Open online courses also can offer new opportunities to gather vast amounts of data about learner behavior, learning achievement and learner efficiency which previously have not been so easily accessible. Along with these opportunities comes a more specific challenges which is different from traditional educational settings. According to Singh & Solar-Lezama (2013) this challenges is “to provide personalized feedback on practice exercises and assignments to a large number of students. “They see one way to cope with the large number of learners by providing automated personalized feedback. One of this paper's attempts is to provide more insight into how automated online feedback could be personalized in an affective way. It does this by modelling the affective situation of the learner, the frame of reference for feedback and the impact of the previous variables on possible variables for learning achievement in MOOCS.

The theoretical model this study attempts to test and to expand is mainly based on Pekrun et al.'s models of anticipated feedback and its effects on students' achievement goals and achievement emotions. As described by Pekrun et al. (2014) there is evidence that feedback about achievement influences not only affective variables such as goals and emotions but also has impact on students' achievement (Elliot & McGregor, 2001; Hattie & Timperley, 2007; Zeidner, 1998). Yet, affective models of the impact of feedback have rarely made the step to include students' subsequent achievement into their theories. In their models from 2014 they presented indications the influence of the aforementioned variables on Achievement emotions and the mediating role of achievement goals. They emphasize that further research should focus on experienced feedback instead of anticipated feedback, the influence of different age groups and the subsequent performance of learners.

As there are not many situations in which feedback can be experienced while learning and also learning outcome measured in a timely manner. An experimental online learning object provides unique opportunities. It can be made accessible to a wide pool of participants and the measurements are taken very near to the experience to minimize a recollection bias and to fully embed them in the learning situation (Pekrun et al. 2014, p.118). The method used in this project is an experimental setting with a learning object in which feedback standard is varied and learning achievement and efficiency measured.

Literature review

The relation between emotions, goals and learning increasingly has been subject to scientific inquiry for several researchers. Their findings provide context for this study in regard to the influence of emotions on learning, the influence of goals on emotions and the influence of feedback on emotions, goals and learning.

Influence of emotions on learning

According to a literature review by Rienties and Rivers from 2014 the relation between emotions and learning has increasingly come into the view of academic research in the last decade. There have been indications that emotions influence a wide range of cognitive and non-cognitive functions and behaviors in the learning process. For example, emotional effects have been reported for motivation in an online learning course (Kim, ChanMin, Seung Won Park and Joe Cozart., 2014), self-regulation of undergraduate students (Mega et al., 2014) and academic achievement of medical students (Chew et al., 2013).

Moreover, Rienties and Rivers have identified a specific range of emotions that has been shown to typically influence learning processes of students to a larger degree than other emotions. Namely, the negative emotions of yearning (Cleveland-Innes and Campbell, 2012), anger (Baumeister et al., 2007; deMarrais and Tisdale, 2002; Dirkx, 2008; Mega et al., 2014; Pekrun et al., 2002; Strapparava and Mihalcea 2008), boredom (Artino and Jones, 2012; D'Mello and Graesser, 2011; Nett et al. 2011; Noteborn et al. 2012) and desire (Cleveland-Innes and Campbell, 2012), play a significant role in this context. In addition, the positive emotions of enjoyment (Artino, 2010; Zembylas, 2008), happiness (White, 2012) and pride (Regan et al., 2012) seem also to be a typical influence on learning processes.

A specific instrument to measure emotions in academic situations of achievement has been developed by Pekrun et al. (2005). It has been shown that achievement emotions are predictive of several relevant variables such as academic achievement, course enrollment and dropout rate. More relations have been described by Pekrun et al. (p.6, 2005) which include various components of the learning process. These components include intrinsic and extrinsic motivation, study interest, cognitive strategies for learning, study effort and self regulation while academic learning.

Influence of goals on emotions

In 2011 Huang conducted a meta-analysis in which was suggested that achievement goals can influence learner's achievement emotions. Herein mastery goals have been shown to impact students from upper elementary school up to university generally positively in their affect. More evidence for a link to the specific positive emotions in students at university level has been found by Pekrun et al., (2006, 2009) and Daniels et al., (2009) for enjoyment, pride and hope. More evidence for the same emotions has also been presented for middle and high school students (Mouratidis et al., 2009).

In the case of the relation between negative affect and mastery goals an influence has been presented by Linnenbrink in 2005. However, Pekrun et al. (2014) view the evidence of the

influence of mastery goals on negative affect as less consistent. They provide various studies in which no relation at all has been found (Turner, Thorpe & Meyer, 1998). Also they argue that this inconclusive situation is based on the usage of negative affect measures which are summative in nature (p.2). They point to studies which have made a qualitative distinction of emotions (Daniels et al., 2009; Mouratidis et al., 2009; Pekrun et al., 2006, 2009) and suggest evidence that these have produced a significant negative relation between mastery goals and anger and boredom.

On the side of performance goals, the meta-analysis of Huang (2011) did not provide a clear picture of their relation with achievement emotions. There has been evidence for a relation (Turner, Thorpe & Meyer 1998) but also for no relation (Roeser, Midgley, & Urdan, 1996) between the variables. Pekrun et al. (2014) see the reason for this unclear picture in the use of an conceptual distinction of goals which does not use the valence dimension of approach-avoidance. They show that studies which integrated this dimension into their conceptualization have reported effects. For example, Sideridis (2003) has reported a relation for performance-avoidance goals which is positive for negative affect. Moreover, they report (Pekrun et al. 2006, 2009) positive relations for specific emotions in university students. Firstly, the performance-approach goals and the specific emotions of hope and pride. Secondly a positive relation for performance-avoidance goals and anxiety, shame and hopelessness.

In 2014 Pekrun et al. reported several findings which indicate the role of goal as a predictor for achievement emotions (p.122) of secondary school students in an exam context with non-curricular material. Mastery goals showed a positive relation with enjoyment and a negative one with anger. Performance-approach goals were also positive related with hope and pride. another positive relation was found for Performance-avoidance goals with anxiety, hopelessness, shame and relief.

Influence of feedback on emotions, goals and learning

Hattie (1999) provide a wide range of effects of feedback on achievement of students in classrooms. In an analysis of 196 studies significant effects of feedback were found. Hattie reports that the average effect size of feedback on outcome which was observed was 0.79. This places feedback in the top 5 to 10 highest influences on achievement in classrooms analyzed in this study. Yet, there also was considerable variability present which showed that some types of feedback impact achievement differently than other.

Kluger and DeNisi (1996) analysed feedback interventions which mainly were not classroom based and showed an average effect of 0.38. Herein, feedback provided from a computer had an above average effect of 0.41 on outcome. There are also indications that a lower task complexity has positive influence on the effect of feedback on learning outcome. Moreover, it was suggested that overall feedback on correctness rather than on error is favorable for learning outcome.

There has been evidence that the adoption of goals of college students can be influenced by success or failure feedback. Success feedback has been shown to lead to mastery and

performance-approach goals while feedback about failures leads to the adoption of performance-avoidance goals (Senko & Harackiewicz, 2005).

Moreover, the focus of feedback has been also shown to affect goal adoption of upper elementary and college students. Performance improvement oriented feedback facilitates adoption of mastery goals and a focus on feedback about relative performance fosters performance based goals (Butler, 1987; Steele-Johnson, Heintz, & Miller, 2008).

The influence of Instructions about feedback on goals has also been documented for middle school students (Butler, 2006). Expectation of evaluation in terms of improvement, stabilization or decline of personal performance facilitated adoption of a mastery goal orientation. While an expectation of evaluation in relation to other students' performance lead to a adoption of performance oriented goals. Expectation of no evaluation had no influence over goal adoption.

Feedback about failures has shown to affect emotions of students. Research showed influence of feedback via poor grades on test anxiety across age groups as reported by Zeidner (1998). Pekrun et al. (2014) conducted the test of a theoretical model which predicted the influence of self-referential and normative anticipated feedback on college level students' goals and emotions. In the anticipated self-referential feedback condition the students were instructed to expect feedback about their personal progress. In the condition of anticipated normative feedback the students were instructed to expect feedback about their performance in relation to other students. The results indicated that self-referential feedback led to an adoption of mastery goals while normative feedback facilitated performance goals. In terms of emotions anticipated self referential feedback showed a positive effect on enjoyment, hope and pride while reducing anger. However, normative feedback showed positive influence on anxiety, hopelessness, shame and relief. This study also showed indications that goals serve as a mediator between anticipated feedback and emotions.

Theoretical Framework

The present study uses psychological and educational concepts which are based on existing definitions from previous research in their respective areas. These definitions include emotions, goals, feedback, learning achievement and efficacy. A further definition includes Measurement instruments such as the Achievement Emotions Questionnaire and the Achievement Goal Questionnaire. Both are introduced because they evolved and specified the previously mentioned concepts and the resulting theoretical structures are used in this study. Moreover, the conceptual framework of Bloom's revised taxonomy is introduced to define the measurement of learning achievement in this study.

What is an emotion?

The definition of emotion has proven to be a challenge since the earliest days of psychology (James, 1884). And as Gross (2010) points out part of the problem is the vast amount and drastic difference in phenomena and processes which all have to be captured in a single construct. From a mild sadness because the weather is bad, over a complex sense of vengeance because of an unjustified treatment, to a month long depression there are many happening which can be included in the construct emotion.

However, one attempt at defining emotions can be made by separating it from other similar concepts and constructs. Gross shows that there are several emotion-related terms which need a separate definition. The first being "affect" which he sees as an umbrella construct describing states. More precisely he sees it as a construct which always has a valence to it: either good or bad. He sees different forms of affects within the construct: attitudes, moods and emotions. Attitudes are the most stable form of affect over time and situation. They also require an object or a person to which the attitude is linked. Moods are less stable than attitudes and do not require a focus such as an object or a person. In relation to attitudes and moods Emotions are the shortest and most unstable form of affect.

Moreover, another criteria of defining emotion is to separate it from the concept of mood by looking at the intensity of the experience. As described by Linnenbrink and Pintrich (2002) emotions not only last shorter than moods but they are also experienced stronger than moods. An significant facet of the construct of emotion is the interconnectedness of their subsumed processes. Emotions can be defined as distinct collections of various psychological processes which influence each other. Those collections or sets can contain parts which are affective, cognitive motivational or also physiological in nature (Pekrun et al., 2002).

A more comprehensive way to approach this interconnectedness of emotion is the development of comprehensive models. A significant contribution to the field of affective models can be found in the component process model (CPM) presented by Scherer (2010). Herein emotion is defined as the response of an organism to the appraisal of an external or internal stimulus (p.49). This stimulus has to be relevant to the needs, goals and values of the individual. Scherer identifies several distinct subsystems in the organism which then respond with an episode of interrelated and synchronized change. This episode or event of parallel processing is therefore defined as emotion by Scherer and its architecture summed up in the CPM (p.50). The significant advantage of the CPM is its computational nature. This

computational approach aims to eventually enable research into the previously fuzzy and complex concept of emotion with methods of computer simulation.

However, Scherers emphasis on cognitive appraisal (Scherer 1999, 2000) also enforced a more detailed view on the structural and process oriented models in psychological research and led to development of more specific models for emotion. Such as for example group-based emotions (Goldenberg et al., 2015) or achievement emotions (Pekrun et al. 2002, Pekrun et al. 2014) of which the latter will be explained closer in the next paragraphs.

The Achievement Emotion Questionnaire

This paper will use the definition of Achievement emotion as established by Pekrun et al. in their manual for the Achievement Emotions Questionnaire (2005). As mentioned previously, herein emotions are defined as interrelated psychological constructs which include affective, cognitive, physiological, and motivational components (p.4). Moreover, achievement emotions are linked in an direct way to achievement activities or outcomes.

The Achievement Emotions Questionnaire (AEQ) measures emotions in a valence x activation circumplex model. This approach leads to four categories of emotions which are measured by the AEQ. The first category being *positive activating* contains the three emotions: enjoyment, hope, pride. The second category contains the *positive deactivating* emotion of relief. The third category, *negative activating*, contains: anger, anxiety, shame. The fourth contains the *negative deactivating* emotions of: hopelessness and boredom. According to Pekrun et al. (2005) these dimensions are highly significant aspects of the influence of emotions on learning, achievement, personality development, and health.

The aforementioned emotion can be further subsumed into into three scales based on the context of the achievement situation. The first scale in the AEQ is class-related and can be used to capture emotions in a classroom context. A second test-related scale can be used to measure emotions in an test situation. The third scale makes it possible to measure emotions in a learning-related situation.

As a last distinction the AEQ definition of emotions contains a separation between trait-like, course specific and state-like emotions. Trait-like emotions are strongly habitual and have a high temporal generalizability. Course-specific emotions are typically experienced by students in a semester long course. State-like emotions are only experienced in a short time before or during an achievement situation.

However, Pekrun et al.'s model from 2014 was based on test-related emotion. This paper is concerned with learning-related emotions. The reasoning for this is based on the difference of the variables which are used in this study. In a single test situation, the effect of received feedback are hard to link to learning outcome. As feedback comes after the learning outcome and thus the influence of feedback is difficult to measure in the context of the current eTraining. Therefore, it is of benefit to investigate learning -related emotions in the context of experienced feedback. Moreover, class related feedback can not be used because as the feedback conditions can not be applied to a student in a class without affecting other student's

emotions (by adding effects of previous feedback). Thus it is preferable to use learning related emotions because they can be measured in an individual manner.

For this reason, it is to expect that specific goals and emotions will have different positions and correlations in the new model that this study produces in contrast to Pekrun et al.'s models. But, because the hypothetical constructs of achievement emotions and goals used are the same it is to expect that the overlying structure remains the same as Pekrun et al.'s model.

Achievement Goals

A person can hold distinct goals while performing any type of activity. Persons work towards these goals in order to achieve them with their activity. These goals are dynamic and cognitive in nature and thus consist of two separate dimension which focus on competence (Elliot 1997, 2001). An approach to conceptualize achievement goals on this base has been presented by Elliot's 2x2 Achievement Goal Framework (Elliot, 1997, 1999; Elliot & McGregor, 2001).

The 2x2 Achievement Goal Framework describes the aforementioned 2 dimensions of competence as firstly *definition* and secondly *valence*. The first dimension is *definition* and in this framework the definition of competence is done in regard to the standard on which it is going to be evaluated. These standards can be intrapersonal or interpersonal. This means they can be applied to a person's inner concepts of mastery of an activity or they can be applied to a person's performance in contrast to other persons. This subdivision into Mastery-Performance Goals has been one of the earliest traditional definitions of achievement goals (Maehr & Nicholls, 1980).

The second dimension of competence in the 2x2 Achievement Goal Framework is *valence*. Competence can be focused on positive or negative prospects. A person can concentrate on the possibility to avoid failure, errors and other "bad outcomes" or he or she can concentrate on the possibility to achieve success, accuracy or other "good outcomes".

The combination of the aforementioned dimensions leads to the four different goals which constitute the 2x2 Achievement Goal Framework (Table 1). Namely the mastery-approach goal which is focused on intrapersonal standards (i.e., Improvement) to reach a favorable outcome from an activity. Then the performance-approach goal which focuses on a standard based on comparison with other persons to also reach a favorable outcome. Followed by the mastery-avoidance goal which is based on a person's internal standard to avoid negative effects of an activity. Lastly the performance-avoidance goal focuses on interpersonal standards of avoiding negative effects for the person (i.e., failure in front of others).

Table 1. 2x2 Achievement Goal Framework Overview

Dimension of Competence		Definition	
		Mastery	Performance
Valence	Approach	Mastery-Approach	Performance-approach
	Avoidance	Mastery-Avoidance	Performance-avoidance

In terms of educational goals, a trichotomous model has been proposed by Elliot, Murayama & Pekrun (2011). This 3x2 model focuses more of the goals which are typically adopted by learners. It expands the mastery dimension of competence by separating it in a task-based and an interpersonal component. However, these goals are identified by Pekrun et al. (2014) as mastery approach, performance-approach and performance-avoidance in the 2x2 Achievement Goal Questionnaire which will be the conceptual base for the present paper. The reason for this is that this paper expands on the previously tested model by Pekrun et al. from 2014 and it will adhere to the same distinctions of achievement goals. An expansion onto a more distinct definition of achievement goals is beyond the scope of this paper as it aims to draw a comparison to Pekrun et al (2014).

The Achievement Goal Questionnaire

The present study makes use of the Achievement Goal Questionnaire in its revised form (AGQ-R) as presented by Elliot and Murayama in 2008. This revised version has reached an improved validity of the Achievement goal construct by a rearrangement and reformulation of several items. It is based on the 2x2 Model mentioned above but can be also used with the 3x2 model. This adaption has been shown by Pekrun et al. (2014) with their exclusion of mastery-avoidance goals.

Achievement Feedback

The information about performance or achievement in a test or task which a person is receiving can be understood as feedback (Pekrun et al, 2014). It is one of the most significant tools a teacher or instructor can use to shape the behavior of a student. For the student it is relevant because it provides him with an overview of how he or she is doing in a given task. Several criteria have been formulated by Brown, Bull and Pendlebury (1997) which feedback needs to include in order to be effective. Most importantly is that it has to occur quickly and the learner has to perceive it as relevant, meaningful and also encouraging. In regard to a task Hattie and Timperley (2007) define feedback as never occurring alone because it is always a “consequence” of performance. It is the information which one is receiving regarding regarding his understanding, work or achievement.

As mentioned beforehand feedback is a highly significant tool for pedagogues. Kepner (1991) defined feedback in the context of education and learning as a procedure which gives information to a learner whether his response to a instruction was right or wrong. It is inherently linked to an appraisal of how well an instruction is followed which was given previously by any type of educational agent.

This appraisal can be focused on different perspectives on a situation or task. The focus of feedback can lie on success or failure (Zeidner, 1998). Wherein the information is either focused on how well a student has performed or how bad he has performed. On the student's level this means that information is received about the errors one has made or the accomplishment one has made.

The information contained in feedback can also pertain to different standards as proposed by Pekrun et al. (2014). It can be self-referential and based on a single student's own improvement over a specific time/task or it can be normative and compare a single student to all other students. An example for self-referential could be a student that gets the information that he has improved in playing a musical piece from the last time he played the piece. An example for normative feedback would be that he played the piece as among the best 10 percent of the other people that played the piece in this class.

It is also possible to that the feedback compares the students' performances with an absolute criteria or with a group of other students. Moore and Klein (2008) describe differences between comparative and absolute feedback. Comparative feedback is based on a social comparison with other people's performance. In contrast to this Moore and Klein define absolute feedback as based on objective criteria. For example, informing a student that he has done three of five necessary tasks is an absolute criterion.

Feedback in e-Learning

The role of feedback in eLearning is very significant one in contrast to traditional classroom setting. While in a classroom there may be an additional room for nonverbal signals and short communication with peers, the eLearning setting is often isolated to a single user in front of a display. In order to counter this isolation of the learner it is especially important to provide timely and effective feedback.

However, it is not always a possibility to give timely, personalized, constructive and formative feedback in eLearning. This can be due to a high number of learners in a learning environment or due to the asynchronous form of content delivery. Different approaches have been undertaken by pedagogues and designers to come to a suitable technical solution.

Feedback could be provided by peers in the form of grades (Heng, Robinson and Park; 2014). Statistics about user behavior can be displayed to a learner (or teacher) to guide his future behavior in the form of a learning analytics dashboard (Verbert et al., 2013). Automated feedback can be provided by analyzing the input of the student (Singh, Gulwani, & Solar-Lezama, 2013). Combinations of this approaches are especially getting more commonly

integrated in MOOCS and used by professional “adaptive” eLearning providers (i.e. Knewton.com).

Feedback in this project is realized by a display of previous performance in a Feedback report. This reports is based on the activities which the learner has finished up to the point of the feedback. The information in the feedback contains the ratio of right answers to bad answers as well as the number of tries until all right answers where reached. It is to mention that the learner is able to advance in the object before all right answer are reached. However, he does not have the option to go back and redo the exercise once he chooses to save his current information. The standard is varied between the experimental groups in regard to self-reference to previous exercise performance or bogus normative feedback. The control group receives a feedback report without any feedback.

Learning Efficiency and Achievement

In this project learning efficiency (LE) is defined as “the gain of knowledge or expertise per learning time” (Rasch & Schnotz 2009, p. 415). The following two kinds of learning related variables are tracked and subsumed under the term learning efficiency. Namely, the number of learning goals reached divided by overall time spend in the LO.

This means that the time spend on tasks and throughout the eTraining LO is tracked. While the the time variable is simple to quantify and integrate in the statistical approach the variable of learning achievement will be described in more detail in the following paragraphs.

Learning Achievement (LA) is strongly connected to the learning goals of an educational endeavor. Bloom, B.S. and Krathwohl, D. R. presented an approach to classify objectives of the learning process in 1956. Their “Taxonomy of Educational Objectives” has been expanded upon and revised most notably by Anderson and Krathwohl in 2001. They present six types of distinct cognitive objectives of the educational process. These cognitive abilities are ordered from the lowest to the highest and most difficult. Starting with the type of *remembering* they explain the first objective as being able to recall information from memory. This information is then used to produce or recite definitions or lists. The next type is *understanding* which is described as the active production of meaning. This production is based on sources which can be graphical, audible or otherwise sensory in nature. There is also the possibility to construct meaning from mental activities like comparison, deduction, exemplification or classification. The objective type of *applying* denotes the ability to follow a procedure or to put the knowledge within of the content of the learning material into use. The type of *analyzing* is defined as the mental capability to break down concepts presented in the learning material but also to establish an overview over the same concepts. The objective *evaluating* means that the learner should be able to criticize the Learning material and to make judgments about the standards of the content in the material. Lastly, the objective of *creating* is described by Anderson and Krathwohl (2001) as the aim to rearrange the elements presented in the learning material to construct coherent new structures or patterns.

However, they also proposed that each of these cognitive processes can be targeted at different dimensions of knowledge (Krathwohl, 2002). these knowledge dimension are either factual, conceptual, procedural or metacognitive. The questionnaire items in this study pertain

to the dimension of procedural knowledge. It is defined as the knowledge or information which helps the learner to act in a specific way, to used specific sets of skills or particular methodologies. Only this dimension has been chosen to capture the overall aim of learning activity which is to raise awareness and sensibility for specific methods of self-management in group work situations. The other dimensions of knowledge are not relevant in this context and it is not theorized that significant differences in their achievement could be measured with the LO used in this project.

In this study project a multiple choice question (MCQ) item relating to each of the learning goals and to the knowledge dimension of procedural knowledge has been constructed. Table 2 below shows an overview over the 16 item stems created for this study according to the learning goals. It is to mention that the learning goals of *evaluating* and *creating* are not included in the in this project. The reason for this is that the assessment of learning goals via an MCQ requires to predict the outcome. The learning goals of *evaluating* and *creating* require thinking which produces something new and unique. This makes these two highest learning goals unsuitable for an assessment via an MCQ format.

Table 2. Application of Bloom's revised taxonomy (Anderson and Krathwohl 2001) to this project's LO procedural knowledge

	Emotional Sensitivity	Turn-Taking	Shared Task-View	Closed-Loop Communication
Remembering	What is an important source of information about the feelings of others?	What is an important action during turn-taking?	What is an important action for reaching a shared task-view in a group?	What is an important step in a closed-loop communication?
Understanding	Which of the following statements about Emotional Sensitivity is true?	Which of the following statements about turn-taking is true?	Which of the following statements about reaching a shared-task view is true?	Which of the following statements about Closed-Loop Communication is true?
Applying	What should you do to increase your emotional sensitivity?	What should you do to get other people to speak?	What should you do if someone has stated his view about a problem in your group?	What should you do if someone has acknowledged the reception of your message?

Analyzing	How does good emotional sensitivity relate to group work?	How does an polite interruption of other group members relate to group work?	How does trying to think of previously unmentioned problems relate to the other steps of building a shared task-view?	How does stating a clear and concise message relate to closed-loop communication?
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Technology enhanced learning and eTraining

There yet have to emerge clear definitions and conceptual boundaries for the various forms of technology enhanced learning (TEL) such as electronic Learning (eLearning), online learning and distance learning (Moore, Dickson-Deane & Galyen, 2011). Attempts have been made to define TEL from different perspectives. A base of defining eLearning in from the aspect of content delivery and accessibility has been proposed by Khan (2005). Here the object of delivery is an learning environment which is well-designed, learner-centered and interactive. He further emphasizes that this learning environment is available without restrictions to to anyone, anyplace, anytime. According to Khan this delivery has to be reached by using the attributes and resources of not only digital technologies but any form of learning material which is appropriate for openness, flexibility and a distribution.

However, as e-learning can also imply that the content which is delivered has a covers several activities over a longer period of time it may invoke the accompanying expectations in the participants. This paper will use the term eTraining to distinguish from the broader e-learning definitions to emphasize the practicality and situational restriction of the content chosen for this project (The situation of working in a Group).

One of the fundamental components of eLearning and eTraining are learning objects (LO). A learning object is “a collection of content items, practice items, and assessment items that are combined based on a single learning objective” (Gerard, 1967). They are used in e-Learning courses along with an software delivery system (Learning Object Management System or LOMS/LMS) to build an online learning environment for the student. They can be tagged with metadata such as interactivity, technological requirements, color scheme, topic, difficulty and learning style. Search engines within the LOMS are able to detect this tags and deliver the LO to the students. How and what LO is delivered also depends on the course curriculum and the didactical approach of the tutor.

The LO in this project are created with Xerte Online Toolkit. It is an server based authoring tool for creating learning objects. It has been developed by the University of Nottingham and is currently distributed as Open Source software (www.xerte.org.uk). That means that according to the Open Source Initiative (<http://opensource.org>) the source code of the software is available for redistribution, study and change for any kind of purpose. The LO which can be created with the tool are basic web-site like pages which can include text, video or other media. Moreover 20 simple interactive activities (such as Multiple choice, Puzzles etc.) are possible to choose and integrate into a LO from within the software interface. For the present study three different activities have been integrated along with text and pictures. As

there is currently no integration of a feedback system which is suitable for the present study or measurement instruments for emotions or goals this functionality is also added as part of this project.

As mentioned before usually LO can be used as content for an Learning management System (LMS). Examples for LMS are Moodle, GUL, Canvas or Stud.ip. For the present study it is not necessary to employ a LMS due to only investigating a single learning object. Moreover, the experimental nature of this project makes a highly customizable approach via JavaScript, PHP and MySQL preferable.

Method

The method of data collection used in this study is the web-based experiment. This experimental approach has been chosen due to its possibility of documenting causal relationships as mentioned by Pekrun et al. (2014). In regard to a traditional experimental setting in a physical laboratory the web-based approach in this study is different. A Web-based experiment is a kind of experiment that is conducted fully online and is accessible via the internet. At the time of this study many universities and private institutions employed this method to collect experimental data via a virtual laboratory (i.e.: <http://opl.apa.org/>, <https://www.socialpsychology.org/expts.htm>).

Moreover, this form of data collection is chosen due to its similarity to natural setting of eLearning/training experiences. The experiment resembles an eTraining module which is typical for eLearning or eTraining produced with similar authoring tools (such as Adobe Captivate). It furthermore makes possible to investigate a situation with an diverse range of participants due to the open access of the experiment.

Files and source code of the project is available via GitHub repository under: <https://github.com/Thomasrider/master-thesis>.

Advantages and Disadvantages

Several advantages and disadvantages can have been associated with this kind of online collection method in contrast to an “brick and mortar” laboratory. On one side the high number of prospective participants is one of the major advantages of web-experiments. Other advantages can include a higher variety in the demographic characteristics of the participants. This means that the sample diversity can be potentially greater than in traditional experiments and allow a better generalization of the results. It also to mention that the experimenter is not present during the experiment. This can be considered an advantage because it is not possible that the participants are influenced by his or her behavior. That may reduce the Rosenthal effect (Rosenthal 1966) and strengthen the reliability of the findings.

On the other side there are also disadvantages which are of concern when determining the generalizability of the findings. Namely, the dropout rate in a web-based setting is expected to be generally high due to the open access to the experimental setting. This selective dropout could undermine the detection of an effect as people could drop out of the conditions in an asymmetrical rate (Birnbaum, 2001). A very significant disadvantage of web-based experiments is the possibility of repeated submission and participation. A repeated participation is a major factor which diminished data quality and masks the expected effects. The last disadvantage of web experiments, in contrast to lab experiments, is the uncontrollability of the environment in which the participants take part. This means that the lighting, the background noises, the social situation or other factors occurring in the participants surrounding are potential sources of noise in the data.

In 2012 Germine et al. conducted an investigation into the quality of data gathered in cognitive/perceptual experiments on the internet in contrast to a “brick and mortar” laboratory setting. They concluded that online experiments do not necessarily represent a tradeoff

between participant number and quality of the data. Given basic quality assurance measures and a voluntary nature of participation online experiments can be a source of high quality data.

Quality assurance measures during this study

In the case of measures for quality assurance, this study includes technical measures that have been placed to avoid repeat participation and dropout with repeat participation. These restrictions have been realized by JavaScript functions which search for specific variables which have been saved in the participants' local browser storage. If these variables are found the user is redirected to a specific page which asks him to not participate again. However, due to the fact that the variables are stored client-side on the browser a clearing of the browser history makes re-participation possible for determined users. A public Internet Protocol address (IP) block has not been placed due to considerations that this block would affect all users which use the same router. This would exclude too many potential participants in the case of this study. In addition to this technical restriction a self report measure has been included in the first survey to let participants indicate if they have previously participated.

The participants are able to run the experiment in their web-browser. This experiment was optimized for Google Chrome, Apple Safari, Microsoft Edge and Mozilla Firefox. All of these browsers combined constituted over 90% of the browsers used by users accessing the internet at the time of the study (According to http://www.w3schools.com/browsers/browsers_stats.asp). Internet explorer was not supported due to its technical limitations. However, only the desktop versions of these browsers were supported and the mobile versions actively blocked by JavaScript functions and redirected to messages which asked the participants to use desktop browsers. As mentioned by Germine et al. (2012) data quality could be affected in unexpected ways by using mobile technology. In the case of this study this blocking was done to work towards a more homogenous situation of usage of the learning object. And also to avoid strong visual differences with small displays as they are common in mobile browsing.

Experimental Design

A single factor between subjects design has been implemented for this experiment. This means that the single factor of feedback has been varied between specific groups or participants. The feedback factor was either self-referential, normative or no feedback. This study had 3 groups: two experimental and one control. During the experiment different kinds of variables have been measured to gain insight into their difference between the aforementioned groups.

During the experiment interested persons could gain access to the experiment by following links or typing in the reserved domain name in their browser's address bar (<http://www.affectivelearning.net>). The experiment has been advertised by posts in groups on Facebook.com and Reddit.com to attract participants. The time allocated for data collection was 4 weeks during which several posts have been done on the mentioned websites.

Dependent variables

Several assessments have been made during the experiment as can be seen in the overview of table 3 below. All of these measurements, except for the demographic variables, happened after the participants were exposed to the experimental conditions or the control condition.

Before the experiment started different demographic variables have been assessed by a survey. This survey included: highest educational level, age, nationality, Employment Status, gender. Additionally, to this variable's previous experience with eLearning or online courses has been assessed. Also the question has been asked if the participant has participated already in order to control participation frequency. All these variables have been assessed via a multiple choice survey on the introduction page of the LO.

For measuring the emotions, the Achievement Emotions Questionnaire (Pekrun et al. 2005) has been adapted and used. The adaptations have been made in accordance with the guidelines mentioned in the questionnaires manual. Namely, the Instructions and items have been changed to reflect the setting of the learning situation. Additionally, the tense of the verbs in items of the first part of the Achievement Emotions questionnaire has been changed to past tense to enable a retrospective assessment. The retrospective measurement at this point was necessary to make sure that the measured values could be influenced by the experimental conditions. An assessment, for example before the start of the LO would not have been able to detect this influence.

The achievement goals have been assessed with the Achievement Goal Questionnaire by Elliot and Murayama (2008) in its revised version (AGQ-R). The assessment took place after learning with the LO for the same reason as mentioned in the previous paragraph. The 16 items have been adapted to past tense similar to the AEQ used in this study to make a retrospective assessment possible.

Learning achievement has been assessed with a Multiple choice test. This test was constructed with regard to Bloom's revised taxonomy (Anderson and Krathwohl 2001) as explained in the previous chapter on the theoretical framework. The time of the test was after learning with the learning object and it concluded the experiment. Each item contained one correct answer and 4 distractors. This means a that the chance of guessing the right answer is 1/5 or 20% in this test.

Lastly, the learning time was directly measured via a JavaScript function during the whole experiment. This tracking began at the moment the LO has been opened and fully loaded on the participant's computer. It ended when the participant had filled out the learning test and left the page. Additionally, the time the participant spent filling out the questionnaire has been tracked. The subtraction of the time spends with the questionnaires from the time spend with the whole LO is defined as the learning time. The unit of measurement was seconds in both cases.

All data was collected in local variables on the participant's machine. The data was send to the MySQL database when the participant left the learning test by clicking the navigation button. Only complete sets of data for each participant were collected in this way.

Table 3. Overview over dependent variables

Dependent variable	Measurement instrument	Measurement Time
Achievement emotions	AEQ (Pekrun et al. 2005)	After 2nd (retrospective), 3rd and 4th exercise
Achievement goals	AGQ-R (Elliot and Murayama 2008)	After learning (retrospective)
Achievement	MCQ Test	After learning
Demographic variables	Survey	Before learning
Learning time	JavaScript function (direct measurement in seconds)	During learning (time during questionnaires subtracted)

Independent variables

The three feedback conditions of self-referential, normative and no feedback have been defined as seen in table 4 below. They have been delivered at 3 specific points during the experiment: After the second activity, after the third activity and after the fourth activity.

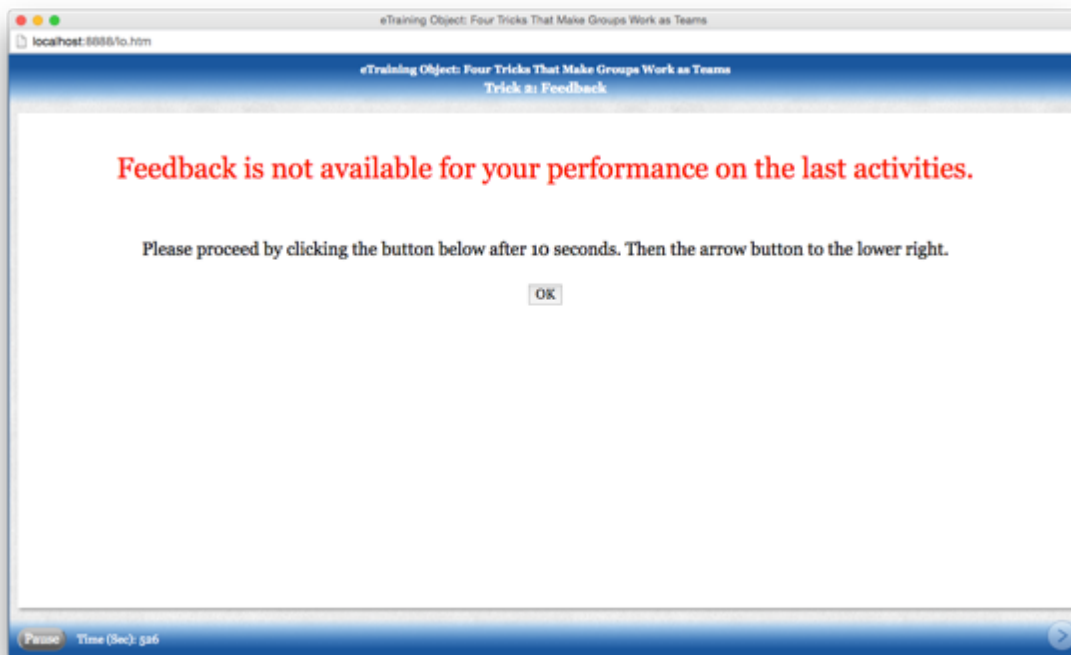
Table 4. Conditions of the experiment

Group	Independent variable	Operationalization
A	Self-referential feedback	Your individual level of performance between the activities for trick X and trick Y of the eTraining has declined by/improved by Z%.
B	Normative feedback	Your performance was among the lowest/highest 10%/25%/50% of all participants.
C	No feedback	Feedback is not available for your performance on the last activities.

All feedback conditions have been delivered as text in red color, on white background, bold formatting and in relatively large font size, placed in a central position on the participant's screen. As seen below in Image 1 additional an additional sentence has been placed before the condition in order to provide context. The sentence below the condition instructs the participant to proceed after 10 seconds by clicking the OK button and arrow (navigation) button. The OK button has been disabled on initialization of this page. A JavaScript was

implemented which enabled the button after 10 seconds. This was done to avoid that participants would rush by this page without being exposed to the conditions. This way all participants have had at least ten seconds of reading time on this page. Furthermore, the above and below the condition, have been the same in all experimental groups. Only the text in red was changed as seen in the examples below between the two experimental groups as seen in Image 1 and 2 below. In the control condition the sentence: “This is your feedback for the last activity” has been also removed as seen in Image 3. The sentence has been removed in the control condition to not induce suspicions of technical problems due to expectations of feedback (which then is not delivered).

Image 1. Control condition as seen by the participant



The wording of the feedback was held similar to the study from Pekrun et al. (p 118, 2014) on anticipated feedback. This was done in an attempt to enable a closer replication of their previous findings. However, in order to maintain this wording in an setting which investigates experienced feedback instead of anticipated feedback the following technical measures have been taken.

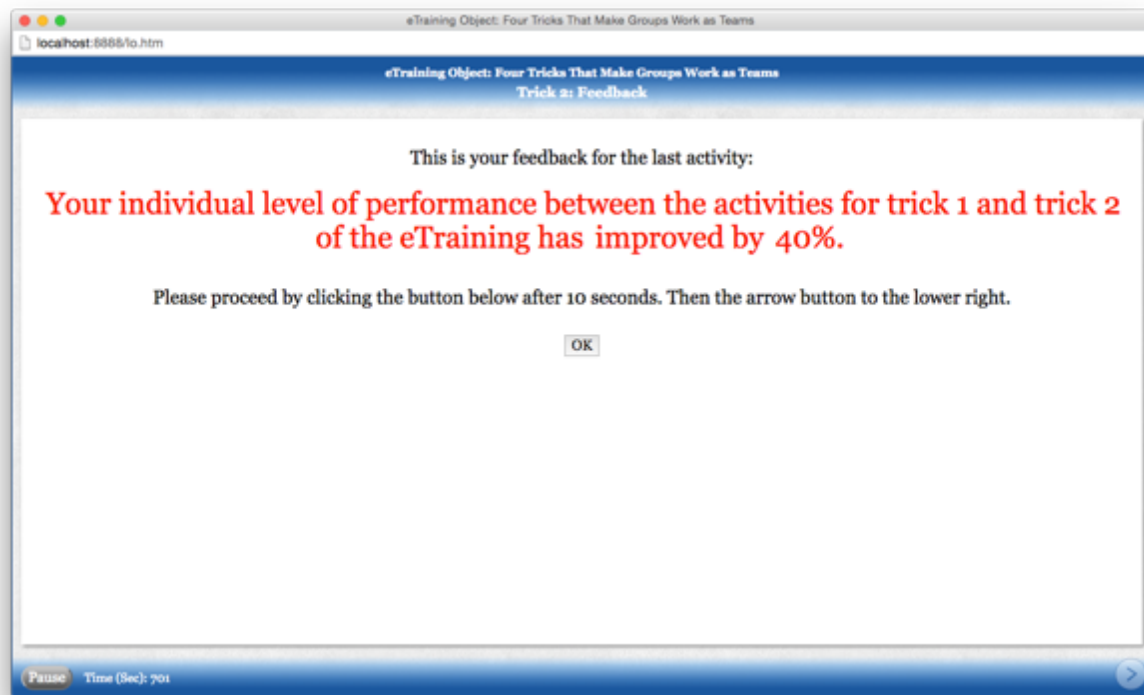
Namely two JavaScript functions have been created to give the participant the experience of feedback while studying with the learning object. Firstly, the self referential feedback was realized by two basic functions as illustrated in code 1 below. The *indimp* function calculated and displayed the percentage of improvement from the activities of the last two topics using the amount of correct answers. The *impdec* function decided if the calculated improvement is bigger than 0. If this is the case it displays “improved by” if not, it displayed “declined by” in the feedback sentence.

Code 1. Self-referential feedback functions (example from second feedback situation)

```
function indimp() {
var correctperc1 = (timelinetextmatchcorrect/6)*100;
var correctperc2 = (correctdrag/16)*100;
improventtotal4 = correctperc2 - correctperc1;
document.getElementById("percent").innerHTML = Math.round(improventtotal4) + "%.";
}

function impdec() {
groupcategories = "";
if (improventtotal4 < 0) {
groupcategories = "declined by";
} else {
groupcategories = "improved by";
}
document.getElementById("impdec").innerHTML = groupcategories;
}
```

Image 2. First self-referential feedback condition as seen by the participant



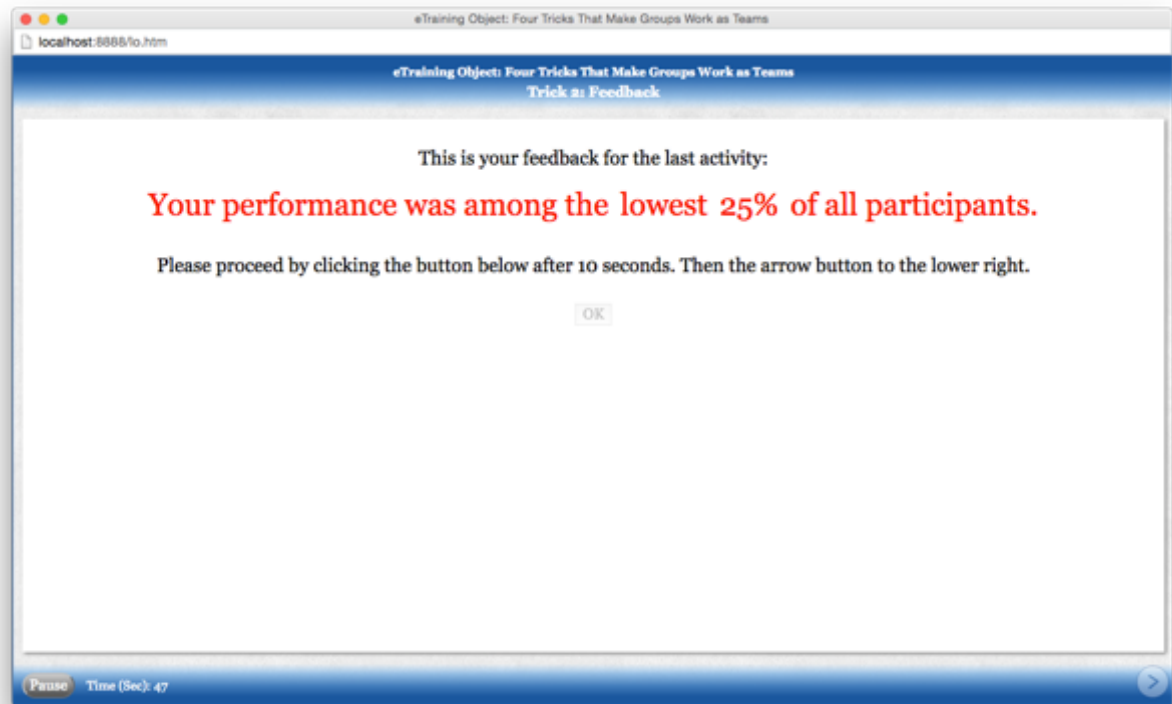
Secondly the normative condition has been realized by two similarly basic functions as seen in code 2 below. The function *hilow* checks if the correct answers (in the last activity) are lower than half of the possible correct answers. If yes it displays “lowest” in the feedback if not, it displays “highest”. The function *percentage* checks how many right answers are given in the last activity and displays 10%, 25% or 50% accordingly. However, this feedback does not really compare the participant’s correct responses to other participants. There is no databank connection and no further functionality. Thus it is important to note that it represents bogus feedback. The described functions have been only added to give the participants a more

believable feedback than with a static message. A static message which would display only one percentage would have given some participants (with extreme values of correct answers) the impression of a malfunctioning or unresponsive feedback system. Because, the participants do not have further information about the performance of the others this approach was regarded as a sufficient implementation.

Code 2. Normative feedback functions (example from first feedback situation)

```
function hilow() {
  groupcategories = "";
  if (l_correctmcq < 3) {
    groupcategories = "lowest";
  } else {
    groupcategories = "highest";
  }
  document.getElementById("highlow").innerHTML = groupcategories;
}
function percentage() {
  grouppercentage = "";
  if (l_correctmcq == 0) {
    grouppercentage = "10%";
  } else if (l_correctmcq == 1){
    grouppercentage = "25%";
  } else if (l_correctmcq == 2){
    grouppercentage = "50%";
  } else if (l_correctmcq == 3){
    grouppercentage = "50%";
  } else if (l_correctmcq == 4){
    grouppercentage = "25%";
  } else {
    grouppercentage = "10%";
  }
  document.getElementById("percent").innerHTML = grouppercentage;
}
```

Image 3. First normative feedback condition as seen by the participant



Randomization

In this online experiment a form of block randomization has been implemented. This means that participants have been divided into subgroups called blocks. This was technically realized by generating a random sequence (www.sealedenvelope.com) of the conditions A,B or C with a fixed length of 90 positions. The sequence consists of blocks with of either 3 or 6 participants which also vary randomly in their position within the list. Utilizing Block randomization in this study has the advantage of maintaining an equal sample size with a smaller number of participants in total. This advantage has to be seen relative to simple randomization (e.g. coin flip) with three small groups.

This form of randomization usually tends to be less random towards the end of the experiment. The reason for this is that the groups become unbalanced due to dropout. To counter the asymmetrical distribution, the last part of the sequence needs to be manually distributed.

In order to clearly display the experimental setting this study will also document the technical realization of this web-based experiment. The randomization procedure it was technically started by by a JavaScript which was attached to the entry button click event on the introduction page.

Code 3. Entry button click event in JavaScript

```
$('#proceed').click(function(){
    window.open('lo.htm', 'win1','width=width,height=height,status');
    $.post("random.php", {ticket}, function(data){
        xgroup = $.parseJSON(data);
        localStorage.setItem("expgroup",xgroup);
        $('#proceed').remove();
        document.getElementById("reenter").style.display="block";
    });
});
```

The JavaScript seen above in code 3 executed several actions. Firstly, it opens the pop up window in the learning object is displayed with the maximal width and height that corresponds to the participant's screen resolution.

Secondly, it activates a PHP script which writes the string “taken” in the last free position of a column corresponding to the random sequence in the MySQL database as seen below. This advances the random sequence seen in code 4.

Code 4. Random sequence is advanced in PHP

```
$ticket = $_POST['ticket'];
if ($ticket > 0) {
    $update = $conn->query( "UPDATE random SET ticket='taken' WHERE number =
    $loopadd");
}
```

Thirdly, the JavaScript calls a variable which holds the value for the experimental group as seen below in code 5. This is done by executing two SQL queries via PHP. One function then counts all values that are “taken” in the random sequence column adds 1 to it and saves it in a variable. This variable is then used in code 2 to place the new “taken” in the most recent place and in the following query which selects the value for the experimental group. This value for the experimental group is then used as seen in JavaScript in code 1.

Code 5. Position and exp. group in the random sequence are identified in PHP

```
$sql = "SELECT number, expgroup FROM random WHERE ticket = 'taken'";
$result = $conn->query($sql);
if ($result->num_rows > 0) {
    while($row = $result->fetch_assoc()) {
        $loop = $row["number"];
    }
} else {
    echo "Error";
}
$loopadd = $loop+1;
$sql1 = "SELECT expgroup FROM random WHERE number = $loopadd";
$result1 = $conn->query($sql1);
if ($result1->num_rows > 0) {
    while($row1 = $result1->fetch_assoc()) {
        $group = $row1["expgroup"];
    }
} else {
    echo "Error";
}
echo json_encode($group);
```

Fourthly, it removes the button and replaces it with a new button. This new button only allows to click it and to open the window without getting a new place in the random sequence. This has been implemented if pop-ups are blocked on the client's browser but have been enabled after the first click.

Moreover, The LO window passes a new value into a locally stored JavaScript variable and refreshes the introduction page in the background. A JavaScript function then uses this new value to change the old introduction page into a new page which asks the participant to not attempt to participate again if he has quit the LO window. This message covers the whole Introduction web-site and thus blocks repeated participation to an extend.

Reliability

The reliability of the measurement instruments has been calculated after the experiment. Both questionnaires, the achievement emotion questionnaire and the achievement goal questionnaire reached reliabilities of Cronbach's $\alpha = .9$. However, the multiple choice test for learning achievement only reached a reliability of Cronbach's $\alpha = .4$. A reason for the low reliability of the multiple choice test could be based in the inhomogeneous group of participants.

Participants

There were $n = 99$ participants in total. The normative feedback group was comprised of 32 participants. The self-referential feedback group was comprised of 34 participants. The control condition (no feedback) was comprised of 33 participants.

The self reported demographic survey gives insight into the characteristic of the participants. In terms of gender 60 reported females, 37 males and 2 gave no answer.

The age frequencies showed 52 participants within a range from 25 to 35 years, 34 participants indicated their age as being in the range of 18 to 24 years, 6 participants reported 35 to 44 years and 4 participants reported 45 to 55 years. The ages 12 to 17 years, 55 to 64 and 65 to 74 years were only reported by one participant each.

In terms of nationality 50 participants reported German. This was followed by 15 participants reporting American, 5 participants reporting Polish and 4 Austrian. Australian, Dutch or no report was given by 3 participants each. British, Canadian, Chinese, Romanian and Swedish were reported by 2 participants each. Finnish, Hungarian, Irish, Russian, Swiss, Taiwanese were reported by 1 participant each.

The highest educational degree of the participants was reported as being the bachelor's degree by 47 participants. A high school degree was reported by 25 participants and a master's degree was reported by 13 participants. No degree was reported by 4 people and a doctor's degree by 3 participants. The associate's degree or a training degree was reported by 2

participants each. A professional degree or nursery school degree was reported by one person each.

The situation of employment was reported as being as student by 62 participants. Employment for wages was indicated by 22 participants. Looking for work or self-employed was reported by 4 participants each. The situation of being a PHD student was reported by 3 people. Being unable to work or not looking for work has been reported by 1 participant each.

The previous experience with technology enhanced learning was reported as “no experience” by 55 participants. Previous experience with eLearning was reported by 21 participants. Experience with online courses was reported by 18 participants. Experience with MOOC’s was reported by 5 persons. Additionally, no participants reported of having repeated the learning object.

If including all 3 experimental groups, the mean time to complete the learning object was 1904 Seconds (SD = 1201) or approximately 32 minutes. The mean time spent only with the learning material (total time spent minus time spent with the surveys and tests) has been 640 Seconds (SD = 581) or 11 Minutes. Furthermore, the mean score of the learning test at the end of the learning object has been 9.7 (SD = 4.1). The pause function was used 30 times by 22 people.

Procedure

The experiment took part in several steps and phases. These contained introductions, measurements and activities. Participants took part in these phases while being subjected to the influence of different feedback conditions. Below, the procedure is described in detail. However, additional screenshots for the purpose of illustration are provided in the appendix.

Introduction

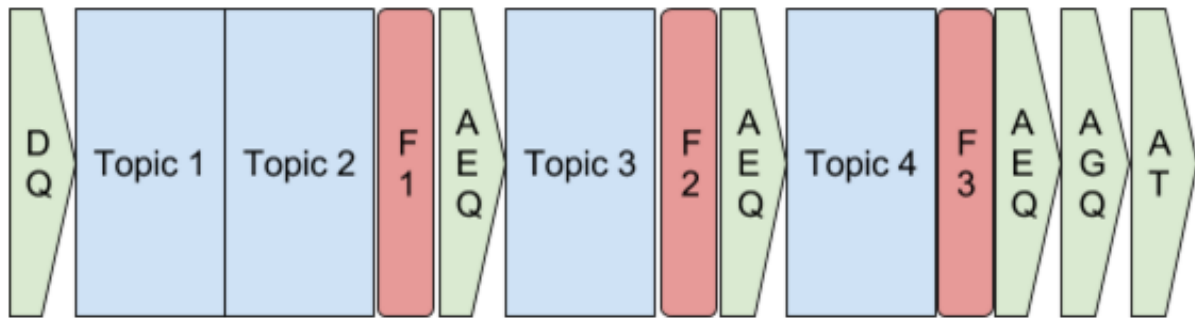
Participants were able to reach a introduction website by accessing the domain affectivelearning.net either via link or directly by typing the address into their browser. This website welcomed the prospective participant with the title: “Welcome to a Web-based Experiment in Affective eLearning” and a logo of the University of Gothenburg. The introduction website contained information about the experiment and a link to the learning object. The information stated that participants would be asked to “to take part in a research study which explores the relations between emotions and learning with information technology.” The purpose of the study was described as an investigation of the relationship between feedback, goals and emotion on learning in an technology based environment. The participants were informed that they would be completing a eTraining learning object with the title of “Four Tricks That Make Groups Work as Teams”. This learning object would consist of pictures, texts and short digital activities. They were also informed that during their progress they had to fill out questionnaires about their emotions, goals and learning achievement. The participants were asked to plan for at least 30 minutes to complete the experiment. Participants were also informed that they could pause the experiment anytime and for how long they want via a button. Moreover, participants have been informed about the intend to use the data in an anonymous way and to maintain confidentiality about any input they give. It was mentioned that this experiment is voluntary and that they are able to quit at any time and without any consequence. The last information on the introductory website was the declaration of consent to participate which stated that their consent was given by clicking the button which linked to the learning object. Below the button contact information was shown. Lastly a “Sitelock” logo which showed the last malware scan on the website was placed at the lower end to assure participants that precautions have been taken to avoid security issues.

eTraining

A click on the “Proceed to experiment” button opened a new window in the participants’ browser. The window automatically adapted to the user's screen resolution and covered the introduction website completely. This new window contained the learning object and was comprised of three areas: top, middle and bottom. The top area contains the title of the LO and the the title of the current page. The middle area contains the current learning material and questionnaires. The lower area contained the navigation button and the pause button. The position of this areas and their content remained constant throughout all participants.

The participants have been passing through the procedure as displayed in figure 1 below. As mentioned before this procedure took place only in the in the middle section of the pop-up window. The full procedure will be explained in detail in the paragraphs below.

Fig.1: The experimental procedure during working with the LO. Feedback in red, measurements in green and learning phases in blue.



After opening, the first page contained a title picture and only the options to push the navigation or pause button. After the participants pushed the navigation button they reached the second page. This page contained the demographic questionnaire (DQ) and a text which explained navigation and introduced the general topic of the LO.

After filling out the DQ the participants were able to click the until then restricted navigation button. After clicking it they were now able to read a page which introduced the setting for the LO including a hypothetical person. This hypothetical person was used to give the learner a possible point for identification and relevance of the learning content. On this page the only option was to click the navigation button.

A click on it brought them to the title page for the first topic. Here they are able to read a introductory text explaining the topic by clicking a button under a title picture. However, the navigation button here was not restricted and reading this text was thus not compulsory. After clicking the navigation button the participants were presented with a group work situation they need to solve. This situation was explained in a short text and a picture.

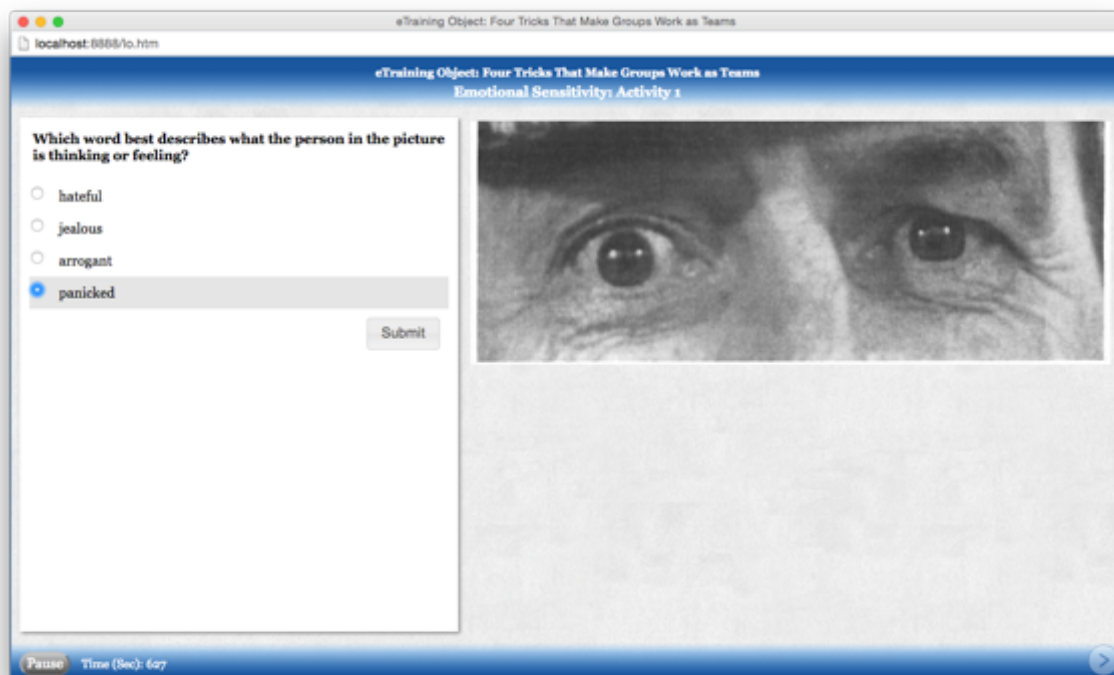
Then the first activity could be reached by clicking the navigation button. This activity was a drag and drop activity. Items in one corner of the page had to be dragged to one of three corresponding columns in the center of the page. The items which are dragged contained sentences which reflected the category on the column. Once an item had been dragged a new item occurred on its previous place and so on. This first activity provided 16 Items in total. However, for the participant it was possible at any point to continue by clicking the “submit” button. As with any of the other submit buttons in his learning object a message would then ask them if they were sure to submit their input because they only would have one chance. When the participant completed the activity by pushing “submit” a message appeared on the lower end of the screen. This message was prompting him or her to look again at the items which have been previously sorted by him or her and informing him or her that the correct answers have been marked. The correct answers have been marked with a green check mark.

The message furthermore prompts the participant to proceed by clicking the navigation button.

The next page displayed the introduction picture for the second topic and an accompanying text which was accessible via a button under the picture.

The next 5 pages contained a variant of multiple choice questions with pictures. The pictures displayed faces from the “Reading the Mind in the Eyes” test by Baron-Cohen et al (2015) as seen in image 5 below. On the left of the pictures the participants were asked to decide which word best describes what the person depicted on the picture is thinking or feeling. One of the five possible answers had now to be selected by the participant. The MCQ answers were chosen accordingly to the “Reading the Mind in the Eyes” test to assure a valid correct choice and reliable distractors similar to the original test. After the participant has made his or her decision for one of the 5 answers and pushed the submit button the left part of the page is hidden. Instead a message is displayed which shows what the correct answer was and also if the chosen answer was right or not.

Image 5. Example from topic 2 in the learning object



After the last of the 5 MCQ activities the first feedback is displayed on a white page. The feedback page can only be left after 10 seconds with the navigation button.

Clicking the navigation button brought the participant to the Achievement emotion questionnaire for emotions before learning with the LO. The questionnaire consisted of an short introduction text. The items himself were displayed as a numbered list with a question each and the corresponding Likert scale. The scale consisted of five possible options from “Strongly agree” to “Strongly disagree”. It was only possible to choose one option per item. At the end of the questionnaire a Submit button was placed which checked if at least one

answer was selected per item. If yes, then the values were saved if not a message informed the participant to select at least one answer per item.

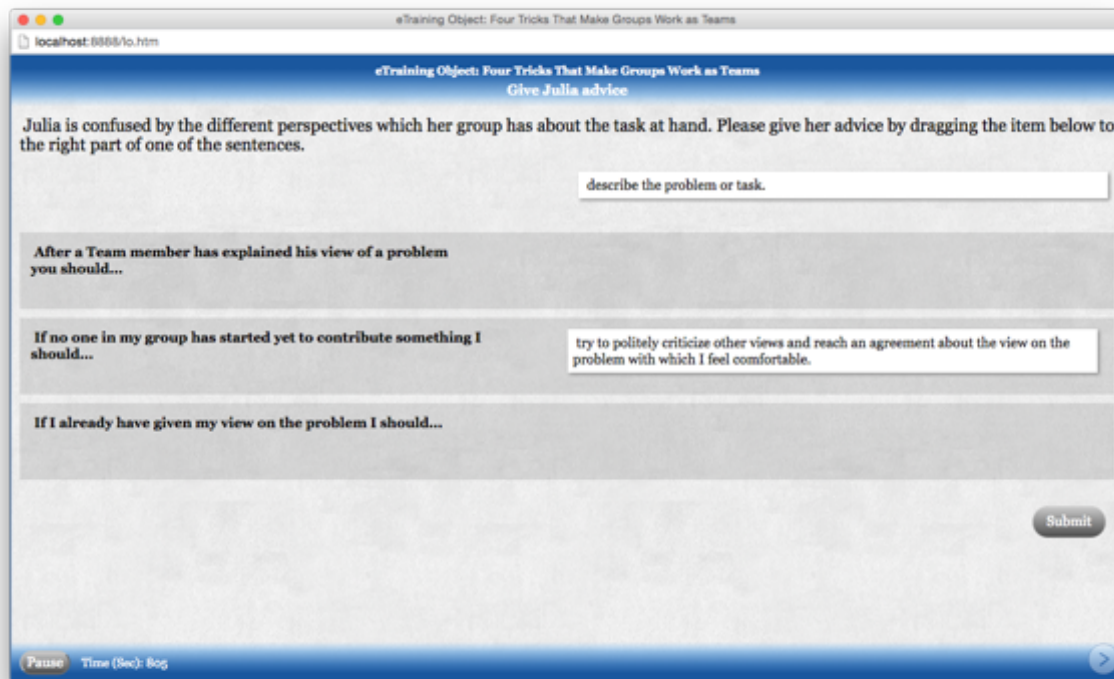
The next page introduced the third topic of the LO in the same style as the previous introduction pages.

Then, on the next page a third situation is explained to the participant in a similar way as the previous two. Namely, a picture and a small text which describe a problematic group situation for the hypothetical group member.

This situation page leads then to the first activity for the third topic as shown in image 6 below. This activity can be described as a drag drop exercise in which three sentences need to be completed. At the top of the page an instruction text explained the assignment. Three beginnings of three sentences had to be dragged on fields corresponding to three beginnings of sentences. As with all drag and drop exercises new items appeared at the same place the previous was dragged from. A Click on submit marked the correct answers with a check mark and displayed a message. The message was the same as in the previous exercises after the activity was completed and stated that the correct answers have been marked and that the participant was now able to proceed.

The second activity for the third topic opened on the next page after a click on the navigation button. It consisted of a drag and drop activity in which items had to be ordered into a chronological order. The instructions were placed on the upper end of the page and explained the activity. Each drag able item contained a small text which portrayed parts of a conversation. Participants had to read each text and then drop them onto one of three fields which corresponded to a chronological order. As with the previous activity the correct choices have had been marked with a green check mark after a click on the submit button.

Image 6. Example for a typical frag and drop activity (taken from the third topic)

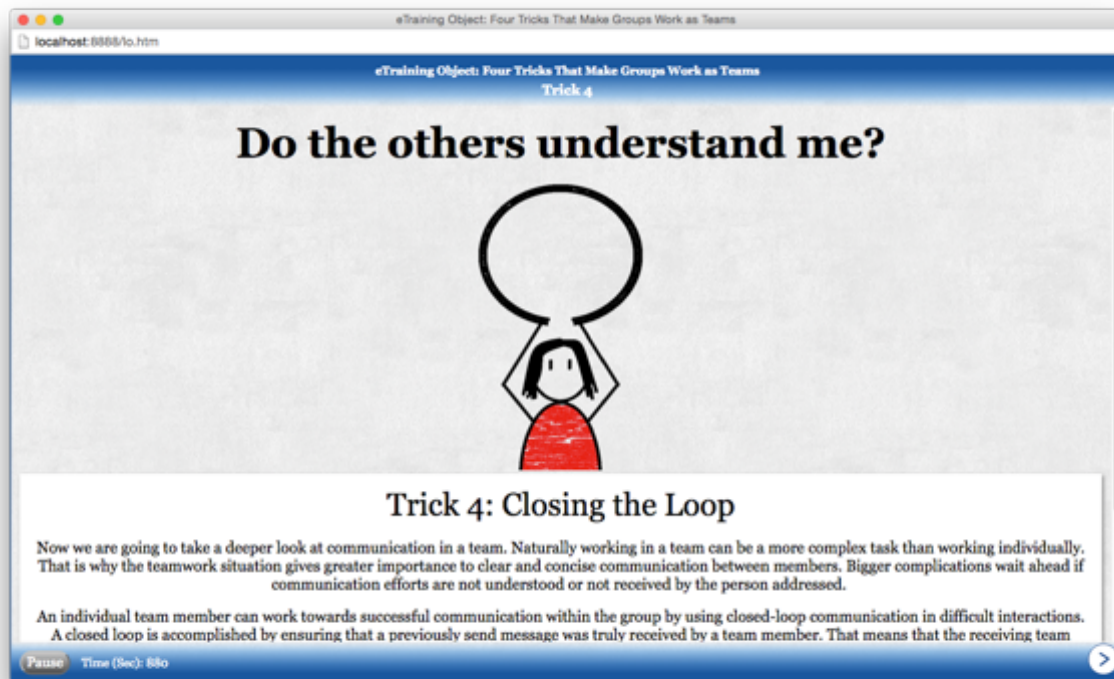


This activity was followed by the second feedback which was displayed in the same fashion as all other feedbacks in this LO. After ten seconds the participant was allowed to proceed by clicking “OK” and then the navigation button.

The following page contained the achievement emotions questionnaire for emotions during learning. It was displayed in the same style as the previous questionnaire and contained an short introduction text followed by the items. As with all questionnaires (except the demographic survey at the beginning) it was not possible to proceed until at least one choice has been taken for each item.

After clicking the navigation button the fourth and last topic of the LO was presented with a picture and text in an introduction page. This can be seen in image 7 below. As with every topic introduction the text was available after a click on “Show Me”.

Image 7. Example for a topic introduction (taken from fourth topic)



The page which followed after a click on the navigation button contained the first of the two last activities. This activity was another variant of a drag and drop exercise. Her the participants had to look at a picture and then to analyze the displayed situation. They had to choose if parts of this situation were handled right or wrong and choose a reason. To do this they had to drag 2 items for each decision onto a table under the picture. If the participants would choose the right one, then it would stick to the position on the table if not it would have snapped back. In the case that the participants would complete the activity or if they wanted to abort it they were informed in the instruction text to push the “Submit” button.

If they have chosen to submit the participants were allowed to proceed by clicking the navigation button. This would bring them to the second of the two last activities which is a variant of the first. The difference here is that the situation on the picture is different and that there are more items to be allocated.

After completing (or aborting) this activity they reached the third and last feedback by clicking the navigation button. This was the last feedback page in the learning object and was identical to the previous two in form.

After ten seconds the participant was able to proceed. He then saw a page containing the last Achievement emotion questionnaire. Except for the content this questionnaire was build up identical as the previous emotion related questionnaires.

When the participant had filled out and submitted the questionnaire he was able to proceed to the next page. This page showed him the Achievement goal questionnaire. It was build in an identical fashion as the other questionnaires and consisted of an introductory text, questions and accompanying 5 point Likert scales.

By pushing the submit button and then the navigation button the participant reached the Achievement test. This test contained an short introduction text and several Multiple Choice Items. Each item had 5 possible answers but the participant was restricted to choose only one per question.

At the point when the participant has had chosen to submit his results the last page is displayed. This page is no longer part of the experiment as all data already have been send. It contained information about how much of the learning goals the participant has achieved in the last test and the possibility to provide the email address for the raffle. It also contained a link to further reading material provided in form of a downloadable PDF file. Writing the email address into the provided form and pushing the respective button automatically closed the window.

In the moment the window closed it passed a variable to change the parent window. This means that if the parent window was not closed by the participant previously it did display a thankful statement which acknowledges successful participation and further contact information and a link to the reference PDF file.

Results

The time of data collection was four weeks. After this time 99 Persons had participated in the experiment. The groups contained at least 30 participants each and thus further explorative statistical procedures such as path analysis and analysis of variance were possible.

Preliminary analysis

In Table 5 the intercorrelations between achievement goals, achievement emotions and outcome variables (learning achievement, time and efficiency) are displayed.

On the side of the achievement emotions several relevant correlations can be found. Enjoyment, hope and pride all showed medium to high positive correlation with each other (ranging from .47 to .76). Anger, anxiety, shame, hopelessness and boredom all displayed medium to high positive correlation with each other (ranging from .31 to .91). Between these two groups of variables several negative correlations can be reported. Anger showed low to medium negative correlations with enjoyment (-.26), hope (-.45) and pride (-.21). Whereas, anxiety (-.26), shame (-.31) and hopelessness (-.42) showed low to medium negative correlations only with hope. Moreover, boredom showed medium negative correlations with enjoyment (-.50), hope (-.51) and pride (-.40) similar to anger.

All achievement goals showed medium to high positive correlations with each other (in the range from .51 to .74) and also displayed significant correlations with achievement emotions. Enjoyment, hope and pride showed significant positive low to medium correlations with all achievement goals (in the range from .34 to .62). The exception from this is the relation of performance avoidance and hope which did not reach significance. Further, mastery approach goals and boredom showed a small negative correlation (-.33). Mastery avoidance goals were positively correlated with shame (.21) and hopelessness (.21) to a small degree. Performance avoidance goals were positively correlated with anger (.22), anxiety (.29), shame (.28) and hopelessness (.28) to a small degree.

The outcome variables showed two positive and one negative correlation with each other. Learning achievement showed a small positive correlation with learning time (.24). Learning efficiency was highly positive correlated with learning achievement (.75) and negatively to learning time to a medium degree (-.36). Furthermore, these outcome variables also showed significant correlations with achievement emotions. Learning time showed smaller negative correlations with anxiety (.22), shame (-.21) and hopelessness (-.27). Learning achievement displayed a small positive correlation with hope (.20). And small to medium negative correlations with, anger (-.51), anxiety (-.53), shame (-.45), hopelessness (-.50) and boredom (-.28). Achievement efficiency had small negative correlations with anger (-.36), anxiety (-.31), shame (-.23), hopelessness (-.24) and boredom (-.23).

However, no significant correlations can be reported between the outcome variables mentioned above and achievement goals. The same is true for a correlation between the outcome variables and the emotions of enjoyment and pride.

Table 5. Pearson product moment correlations for achievement emotions, achievement goals and outcome variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Enjoyment	1														
2. Hope	.47**	1													
3. Pride	.76**	.59**	1												
4. Anger	-.26*	-.45**	-.21*	1											
5. Anxiety	,11	-.26**	,09	.74**	1										
6. Shame	,11	-.31**	,02	.67**	.90**	1									
7. Hopelessness	-.04	-.42**	-.11	.79**	.91**	.89**	1								
8. Boredom	-.50**	-.51**	-.40**	.72**	.35**	.31**	.47**	1							
9. Mastery- approach goals	.57**	.47**	.59**	-.07	,11	,08	,00	-.33**	1						
10. Mastery- avoidance goals	.46**	.20*	.37**	,08	,19	.21*	.21*	-.07	.51**	1					
11. Performance- approach goals	.51**	.37**	.62**	,06	,18	,15	,10	-.10	.65**	.55**	1				
12. Performance- avoidance goals	.34**	,13	.47**	.22*	.29**	.28**	.28**	,03	.57**	.63**	.74**	1			
13. Learning time	-.03	,15	,06	-.16	-.22*	-.21*	-.27**	-.09	-.06	-.01	,17	,08	1		
14. Learning achievement	,05	.20*	,04	-.51**	-.53**	-.45**	-.50**	-.28**	,03	,08	,05	-.02	.24*	1	
15. Achievement efficiency	,09	,02	,05	-.36**	-.31**	-.23*	-.24*	-.23*	,05	,18	-.04	,05	-.36**	.75**	1

** . Correlation is significant at the 0.01 level (2-tailed), * . Correlation is significant at the 0.05 level (2-tailed).

Effects

The analysis of effects in this study is focused mainly on effect sizes. The following effects are described as either small, medium or large based criteria from Cohen (1988) for sizes of Cohen's d and Eta Squared.

Effects between all groups

The variance between the groups has been investigated by running a one-way ANOVA for all three experimental groups. Table 6 shows that the largest effect size of $\eta^2 = .09$ can be reported for the emotion of pride ($p = .03$).

While enjoyment also achieved a medium effect of $\eta^2 = .07$ ($p = .08$), the other achievement emotions showed small effects with sizes from $\eta^2 = .01$ (hopelessness, $p = .61$) to $\eta^2 = .03$ (anxiety, $p = .25$).

Mastery-approach goals ($p = .13$), mastery-avoidance goals ($p = .14$) and performance-approach goals ($p = .12$) all displayed relative similar medium effects of around $\eta^2 = .05$. Performance avoidance goals showed a small to medium effect of $\eta^2 = .04$ ($p = .23$).

Moreover, learning achievement reached a small to medium effect with $\eta^2 = .04$ ($p = .22$). While achievement efficiency showed a small effect of $\eta^2 = .02$ ($p = .51$) and also learning time showed a small effect of $\eta^2 = .02$ ($p = .41$).

Table 6: ANOVA for the self-referential, normative, and No feedback conditions*

		Sum of Squares	F	Sig.	Eta Squared
1. Enjoyment	Between Groups	144,528	2,627	,079	0,065
	Total	2207,487			
2. Hope	Between Groups	16,586	,913	,406	0,024
	Total	697,538			
3. Pride	Between Groups	98,113	3,594	,032	0,087
	Total	1121,949			
4. Anger	Between Groups	136,262	1,336	,269	0,034
	Total	3961,795			
5. Anxiety	Between Groups	191,007	1,424	,247	0,037
	Total	5222,718			
6. Shame	Between Groups	114,809	,694	,503	0,018
	Total	6319,949			
7. Hopelessness	Between Groups	88,609	,499	,609	0,013
	Total	6742,615			
8. Boredom	Between Groups	111,965	,636	,532	0,017
	Total	6715,962			
9. Mastery-approach goals	Between Groups	20,606	2,107	,129	0,053
	Total	387,346			
10. Mastery-avoidance goals	Between Groups	21,492	2,038	,137	0,052
	Total	416,885			
11. Performance-approach goals	Between Groups	28,970	2,167	,122	0,055
	Total	530,372			
12. Performance-avoidance goals	Between Groups	24,010	1,503	,229	0,039
	Total	622,872			
13. Learning time	Between Groups	121461,264	,900	,411	0,023
	Total	5183511,179			
14. Learning achievement	Between Groups	53,391	1,545	,220	0,040
	Total	1348,987			
15. Achievement efficiency	Between Groups	,506	,671	,514	0,018
	Total	28,804			

*missing cases excluded listwise

Effects between control and Feedback conditions

Differences between the no feedback group and self-referential and normative feedback group have been analyzed by running independent sample t-tests.

As can be seen in Table 7 effects can be reported for differences between the no feedback condition and the self-referential condition. Feedback condition had a medium effect on the emotions enjoyment of $d = .48$ ($p = .10$), hope of $d = .41$ ($p = .17$), anger of $d = .53$ ($p = .11$), and anxiety of $d = .48$ ($p = .12$). The emotion pride showed a medium to large effect of $d = .73$ ($p = .01$). Small effects can be reported for the emotions hopelessness of $d = .26$ ($p = .39$), shame of $d = .24$ ($p = .42$) and boredom of $d = .30$ ($p = .31$). Enjoyment, hope, pride, anger, anxiety, shame, hopelessness, boredom was higher in the no feedback condition than in the self-referential feedback condition.

Feedback condition had a medium effect on the achievement goals of mastery-approach of $d = .54$ ($p = .06$), mastery avoidance of $d = .42$ ($p = .14$) and performance approach of $d = .54$ ($p = .05$). Performance-avoidance goals only showed a small effect of $d = .28$ ($p = .32$). Mastery-approach, Mastery-avoidance, Performance-approach and Performance-avoidance goals were higher in the no feedback condition than in the self-referential feedback condition.

Feedback condition only had small effects on learning time of $d = -.32$ ($p = .25$) and achievement efficiency of $d = -.24$ ($p = .43$) while it had a medium effect on learning achievement of $d = -.45$ ($p = .15$). Learning time was lower in the no feedback condition than in the self-referential feedback condition. Learning achievement was lower in the no feedback condition than in the self-referential feedback condition. Achievement efficiency was slightly lower in the no feedback condition than in the self-referential feedback condition.

Table 7: Independent samples t-tests for no-feedback and self-referential condition*

	No feedback (n = 25)		Self-referential feedback (n = 30)		Mean Difference	t	df	Sig. (2- tailed)	
	M	SD	M	SD				d	
1. Enjoyment	31.08	5.89	28.47	5.49	2.61	1.69	49.78	.10	.48
2. Hope	21.44	3.04	20.37	2.51	1.07	1.41	46.57	.17	.41
3. Pride	19.84	3.01	17.27	4.24	2.57	2.62	51.78	.01	.73
4. Anger	22.08	8.46	18.93	5.07	3.15	1.63	37.73	.11	.53
5. Anxiety	26.28	9.62	22.57	7.16	3.71	1.60	43.56	.12	.48
6. Shame	25.64	10.73	23.47	8.44	2.17	.82	45.20	.42	.24
7. Hopelessness	24.28	10.82	21.97	8.55	2.31	.87	45.33	.39	.26
8. Boredom	31.08	9.92	28.60	7.77	2.48	1.02	45.06	.31	.30
9. Mastery-approach goals	10.96	2.28	9.73	2.39	1.23	1.94	51.99	.06	.54
10. Mastery-avoidance goals	9.32	2.39	8.30	2.59	1.02	1.52	52.39	.14	.42
11. Performance-approach goals	10.80	2.40	9.37	3.00	1.43	1.97	52.92	.05	.54
12. Performance-avoidance goals	9.76	2.95	8.93	3.10	.83	1.01	52.02	.32	.28
13. Learning time (Sec)	733.68	246.86	814.07	270.24	-80.39	-1.15	52.52	.25	-.32
14. Learning achievement	8.64	4.86	10.37	3.56	-1.73	-1.48	43.08	.15	-.45
15. Achievement efficiency	1.21	.68	1.35	.52	-.13	-.80	44.17	.43	-.24

*Equal variances not assumed, missing cases excluded listwise

Table 8 below shows the effects from no feedback or normative feedback. The feedback or no feedback condition had a small effect on the emotions enjoyment of $d = -.08$ ($p = .81$), hope of $d = .11$ ($p = .71$), pride of $d = .22$ ($p = .46$), anger of $d = .25$ ($p = .40$), anxiety of $d = .29$ ($p = .33$), shame of $d = -.06$ ($p = .83$) and hopelessness of $d = .03$ ($p = .92$). Enjoyment, hope, pride, anger, anxiety, hopelessness, boredom were all slightly higher in the normative condition than no feedback condition. Shame was slightly higher in the no feedback condition than in the normative.

Feedback condition had a medium effect on the achievement goals of mastery-approach of $d = .37$ ($p = .22$). A small effect can be reported for mastery avoidance of $d = -.06$ ($p = .85$), performance approach of $d = .24$ ($p = .42$) and performance-avoidance goals of $d = -.20$ ($p = .51$). Mastery-approach goals were slightly higher in the no feedback condition than in the normative condition. Mastery-avoidance goals were slightly higher in the normative condition than in the no feedback condition. Performance-approach goals were slightly higher in the no feedback condition than in the normative condition. Performance-avoidance goals were slightly higher in the normative condition than in the no feedback condition.

Feedback or no feedback condition had a medium negative effect on learning time of $d = -.36$ ($p = .23$) and a small negative effect on Learning achievement of $d = -.01$ ($p = .97$). Achievement efficiency showed small effects with $d = .08$ ($p = .78$). Learning time was slightly higher in the normative condition than in the no feedback condition. Learning achievement was slightly higher in the normative condition than in the no feedback condition.

Achievement efficiency was slightly higher in the normative condition than in the no feedback condition.

Table 8. Independent samples t-tests for no-feedback and normative conditions*

	No feedback (n = 25)		Normative feedback (n = 23)		Mean Difference	t	df	Sig. (2- tailed)	
	M	SD	M	SD					
1. Enjoyment	31.08	5.89	31.43	4.02	-.35	-.25	42.57	.81	-.08
2. Hope	21.44	3.04	21.09	3.54	.35	.37	43.60	.71	.11
3. Pride	19.84	3.01	19.13	3.60	.71	.74	43.08	.46	.22
4. Anger	22.08	8.46	20.09	7.87	1.99	.85	45.99	.40	.25
5. Anxiety	26.28	9.62	23.83	7.76	2.45	.98	45.25	.33	.29
6. Shame	25.64	10.73	26.22	7.90	-.58	-.21	43.97	.83	-.06
7. Hopelessness	24.28	10.82	24.00	8.85	.28	.10	45.41	.92	.03
8. Boredom	31.08	9.92	31.04	10.64	.04	.01	44.93	.99	.00
9. Mastery-approach goals	10.96	2.28	10.22	1.86	.74	1.24	45.36	.22	.37
10. Mastery-avoidance goals	9.32	2.39	9.43	1.70	-.11	-.19	43.34	.85	-.06
11. Performance-approach goals	10.80	2.40	10.26	2.16	.54	.82	45.98	.42	.24
12. Performance-avoidance goals	9.76	2.95	10.26	2.26	-.50	-.66	44.61	.51	-.20
13. Learning time (Sec)	733.68	246.86	822.87	259.51	-89.19	-1.22	45.18	.23	-.36
14. Learning achievement	8.64	4.86	8.70	4.05	-.06	-.04	45.57	.97	-.01
15. Achievement efficiency	1.21	.68	1.16	.65	.06	.29	45.93	.78	.08

*Equal variances not assumed, missing cases excluded listwise

Effects between Feedback conditions

Table 9 reports the mean differences and independent samples t-tests for both feedback conditions. Here, feedback condition had a medium to large effect of $d = .64$ on the emotions of enjoyment ($p = .03$). Shame showed a small to medium effect of $d = .35$ ($p = .23$). Pride showed a medium effect of $d = .49$ ($p = .09$). While, small effects were shown on hope of $d = .27$ ($p = .41$), anger of $d = .21$ ($p = .54$), anxiety of $d = .18$ ($p = .55$), hopelessness of $d = .25$ ($p = .40$) and boredom of $d = .30$ ($p = .36$). Enjoyment, hope, pride, anger, shame, anxiety, hopelessness and boredom was higher in the normative condition than in the self-referential feedback condition.

Feedback condition had a small effect on the achievement goals of mastery-approach of $d = .23$ ($p = .41$). While mastery-avoidance ($p = .06$) and performance-avoidance ($p = .08$) showed medium effects of $d = .54$ and of $d = .51$. Performance-approach goals only showed a small to medium effect of $d = .35$ ($p = .21$). Mastery-approach, mastery-avoidance goals, performance-approach and performance-avoidance goals were higher in the normative condition than in the self-referential feedback condition.

Feedback condition had very small effects on learning time of $d = .03$ ($p = .90$) and small to medium effects on achievement efficiency of $d = -.35$ ($p = .26$). It had a medium effect on learning achievement of $d = -.47$ ($p = .12$). Learning time was higher in the normative condition than in the self-referential feedback condition. Learning achievement was higher in the self-referential condition than in the normative feedback condition. Achievement efficiency was very slightly higher in the self-referential condition than in the normative feedback condition.

Table 9. Independent samples tests for self-referential and normative feedback conditions*

	Normative feedback (n = 23)		Self-referential feedback (n = 30)		Mean Difference	t	df	Sig. (2- d tailed)	
	M	SD	M	SD					
1. Enjoyment	31.43	4.02	28.47	5.49	2.97	2.27	50.92	.03	.64
2. Hope	21.09	3.54	20.37	2.51	.72	.83	37.96	.41	.27
3. Pride	19.13	3.60	17.27	4.24	1.86	1.73	50.43	.09	.49
4. Anger	20.09	7.87	18.93	5.07	1.15	.61	35.51	.54	.21
5. Anxiety	23.83	7.76	22.57	7.16	1.26	.61	45.42	.55	.18
6. Shame	26.22	7.90	23.47	8.44	2.75	1.22	48.93	.23	.35
7. Hopelessness	24.00	8.85	21.97	8.55	2.03	.84	46.63	.40	.25
8. Boredom	31.04	10.64	28.60	7.77	2.44	.93	38.76	.36	.30
9. Mastery-approach goals	10.22	18.58	9.73	2.39	.48	.83	50.98	.41	.23
10. Mastery-avoidance goals	9.43	17.01	8.30	2.59	1.13	1.92	49.97	.06	.54
11. Performance-approach goals	10.26	21.58	9.37	3.00	.89	1.26	50.83	.21	.35
12. Performance-avoidance goals	10.26	22.61	8.93	3.10	1.33	1.80	50.91	.08	.51
13. Learning time (Sec)	822.87	259.51	814.07	270.24	8.80	.12	48.41	.90	.03
14. Learning achievement	8.70	4.05	10.37	3.56	-1.67	-1.57	44.03	.12	-.47
15. Achievement efficiency	1.16	.65	1.35	.52	-.19	-1.14	41.20	.26	-.35

*Equal variances not assumed, missing cases excluded listwise

In sum, the analysis of effect size showed that the self-referential feedback condition showed the largest effects. This included enjoyment, pride, mastery and performance goals and learning achievement with medium to large effect sizes.

Path analysis

Based on the previous statistical data emotions have been identified which are suspected to have an indirect or direct influence on learning achievement and efficiency. Learning time has been excluded from this analysis due to its low effect sizes in table 4. Pride and enjoyment are suspected to indirectly influence other emotions and achievement goals and thus partly

explain the medium effect on learning achievement in table 5. However, an inclusion of pride led to a bad fit of most models and as such only enjoyment based models are analyzed.

In order to examine the expected indirect influence of enjoyment on achievement goals and emotions on the relations several path analyses were conducted. Achievement goals have only been integrated into the models if no direct correlation between the two emotions of the model has been found in the preliminary analysis.

Furthermore, to make a description of the effects of experienced feedback possible a dummy variable has been created (named feedback focus). It represents the contrast between the two focal points of self-referential (coded +1) and normative feedback condition (coded 0) (similar to Pekrun et al., 2014).

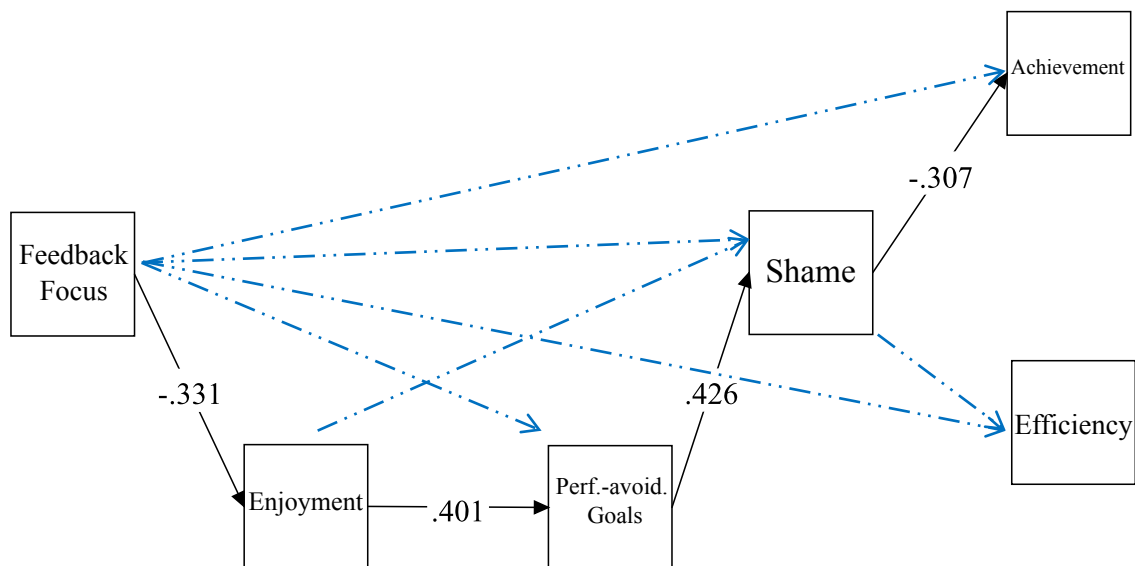
Several path models have been analyzed utilizing Mplus (Muthén & Muthén, 2012). All results are standardized using STDYX due to usage of different scales in the study. Four models have been analyzed for achievement emotions which previously had showed a bivariate correlation with learning achievement and learning efficiency as long as model fits were good and effect sizes larger than $\beta > .1$. Only models which had a possible path of direct effects ($> .1$) leading from the feedback experience to either learning achievement or learning efficiency are reported. This resulted in models for enjoyment over shame, anxiety, anger or hopelessness.

Further; In another step indirect effects of achievement goals have been analyzed in the models to investigate their role as a mediator between emotions.

Path analysis for indirect effects of enjoyment over shame

Based on the effect sizes of the independent t-tests an indirect effect of feedback instruction over enjoyment and shame is possible. This effect has been investigated in a path analysis while also including performance avoidance goals as seen in figure 2. A test-wise inclusion of mastery avoidance goals led to insufficient fit indices, thus they have been excluded. The model shows good fit indices with an RMSEA of .00 (< 0.07 , Steiger, 2007) and an SRMR of .04 ($< .08$, Hu and Bentler, 1999). Further it shows a CFI of 1.00 and a TLI of 1.06 (> 0.95 , Hu and Bentler, 1999). Lastly Chi square also has not been significant at a value of 2.80 with 4 Degrees of freedom and a p-value of .59 ($p > .05$).

Fig 2. Path analysis for indirect effect over enjoyment and shame. Effects $< .1$ are displayed in blue. Self-referential and normative feedback was coded +1 and 0, respectively.



As can be seen in figure 2 direct effects between all variables, except efficiency, can be reported. This makes an indirect effect from feedback focus to Achievement possible. Feedback focus had a negative effect on enjoyment with $\beta = -.33$ ($p = .00$). Enjoyment showed a positive effect on performance-avoidance goals, $\beta = -.40$ ($p = .00$). Performance-avoidance goals positive effect on Shame, $\beta = -.43$ ($p = .00$). Shame had a negative effect on achievement, $\beta = -.31$ ($p = .01$). All other effects were below $\beta = .1$.

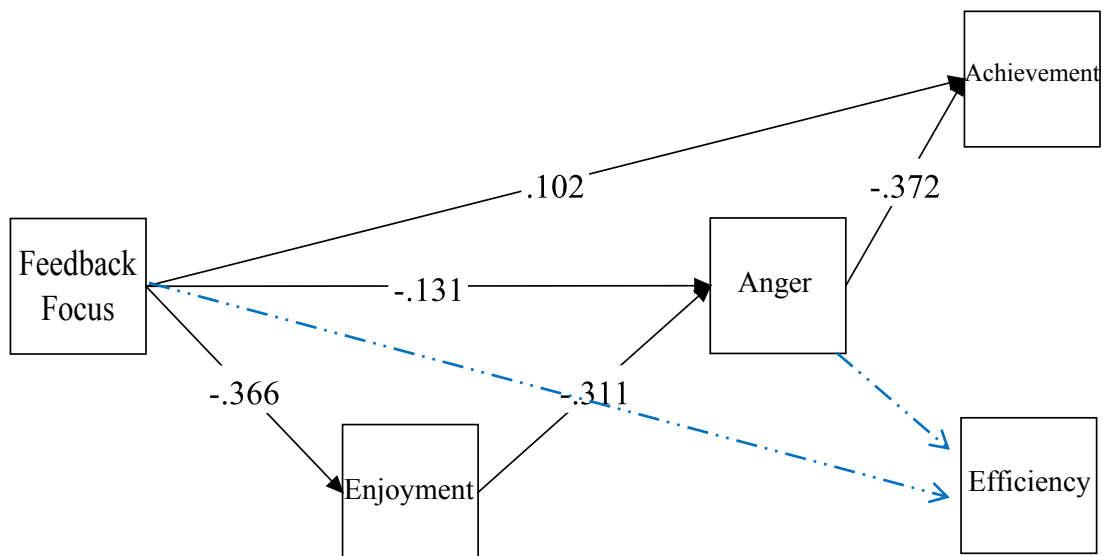
The direct effect from feedback focus to achievement was $\beta = .09$ ($p = .40$). The indirect effect from feedback focus to achievement over enjoyment, performance goals and shame was positive at $\beta = .02$ ($p = .128$). This indirect effect was offset by another indirect effect from feedback focus over shame to achievement with $\beta = -.007$ ($p = .85$) and another indirect effect over shame and enjoyment with $\beta = < .01$ ($p = .97$). The total effect from feedback focus to achievement was $\beta = .11$ ($p = .37$). This leaves the indirect mediating effect from feedback focus to achievement over enjoyment, performance goals and shame to account for 10.1% of the total effect.

To investigate the role of performance avoidance goals as a mediator between the two emotions of enjoyment and shame the indirect effect was also analyzed. It was positive at $\beta = .17$ ($p = .13$). The total effect from enjoyment to shame was $\beta = .18$ ($p = .18$). This makes the indirect affect mediated by performance-avoidance goals account for 97.2% of the total effect.

Path analysis for indirect effects of enjoyment over anger

The next model shown in figure 3 which was analyzed was starting from feedback focus over enjoyment and anger to learning achievement and efficiency. It showed also showed good fit indices: RMSEA of .000 (< 0.07 , Steiger, 2007), SRMR of .010 ($< .08$, Hu and Bentler, 1999), CFI of 1.00 and a TLI of 1.15 (> 0.95 , Hu and Bentler, 1999). Lastly, Chi square also has not been significant at a value of .203 with 2 Degrees of freedom and a p-value of .90 ($p > .05$).

Fig 3: Path analysis for indirect effect over enjoyment and shame. Effects $< .1$ are displayed in blue. Self-referential and normative feedback was coded +1 and 0, respectively.



In the model in figure 3 direct effects (which are $> .1$) can be reported for all variables except learning efficiency. As such a indirect effect from feedback focus on learning achievement will be further investigated.

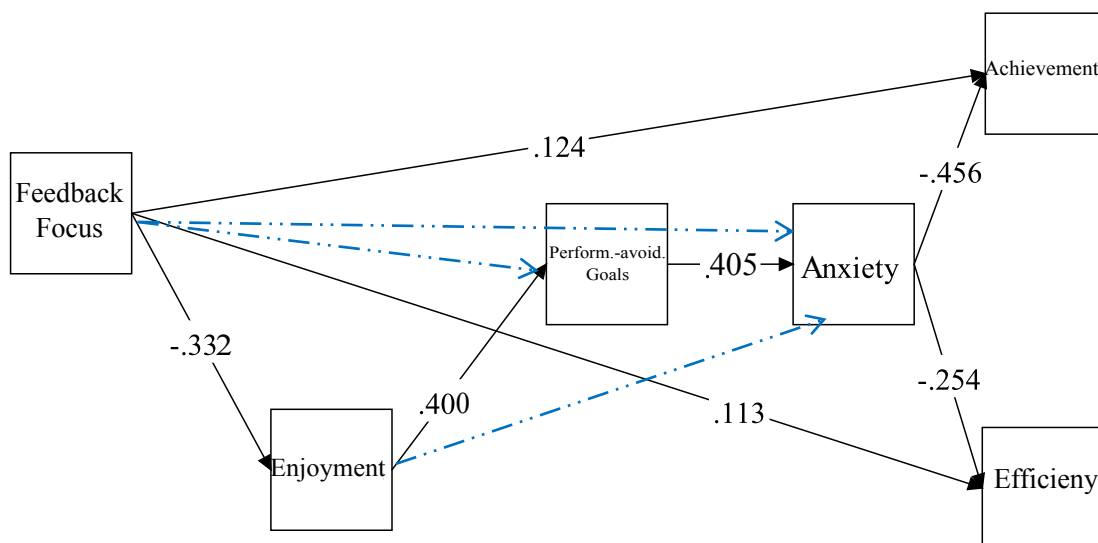
Feedback focus had a direct negative effect on enjoyment with a size of $\beta = -.37$, ($p = .00$). It also showed a smaller negative effect of $\beta = -.13$, ($p = .30$) on anger and a smaller positive effect of $\beta = .10$ ($p = .37$) directly on achievement. Enjoyment then showed a negative direct effect on anger $\beta = -.31$ ($p = .02$) anger showed a negative direct effect $\beta = -.37$ ($p = .00$) on learning achievement.

The negative indirect effect from feedback focus over enjoyment and anger to learning achievement was $\beta = -.04$ ($p = .11$). This effect was offset by a positive indirect effect from feedback focus over anger with $\beta = .49$, ($p = .32$). This only leaves the indirect affect from feedback focus to achievement over anger to account for 5.5% of the total effect.

Path analysis for indirect effects of enjoyment over anxiety

Another model which showed good fit indices and the possibility for indirect effects over enjoyment was the path over performance-avoidance goals and anxiety shown in figure 4. The fit indices for this model showed a similar good fit as the previous models did. The RMSEA was .043 (< 0.07 , Steiger, 2007), the SRMR of .055 ($< .08$, Hu and Bentler, 1999), the CFI of .994 and TLI of .977 ($> .95$, Hu and Bentler, 1999). Chi square was not significant at a value of 4.492 with 4 Degrees of freedom and a p-value of .34 ($p > .05$).

Fig 4: Path analysis for indirect effect over enjoyment and shame. Effects $< .1$ are displayed in blue. Self-referential and normative feedback was coded +1 and 0, respectively.



In the model in figure 4 all variables are directly influenced by direct effects. Indirect effects from feedback focus to achievement and efficiency are possible and are thus a focus for further analysis.

Feedback focus showed a direct negative effect on enjoyment of $\beta = -.33$, ($p = .00$) and two small positive ones on achievement of $\beta = .12$ ($p = .250$). and efficiency of $\beta = .11$, ($p = .35$). Enjoyment then showed a positive direct effect on performance-avoidance goals of $\beta = .400$, ($p = .001$). Performance-avoidance goals showed a direct positive effect on anxiety of $\beta = .405$ ($p = .001$). Anxiety showed negative effects on learning achievement of $\beta = -.46$ ($p = .00$) and on efficiency of $\beta = -.25$ ($p = .03$).

Furthermore, the indirect positive effect from feedback focus over enjoyment, performance-avoidance goals and anxiety to learning achievement was $\beta = .02$ ($p = .09$). This was offset by an indirect negative effect, $\beta = -.04$, ($p = .52$), from feedback focus over anxiety to learning achievement. Another offset was an indirect effect from feedback focus over enjoyment and anxiety: $\beta = < -.01$ ($p = .84$). The resulting indirect effect left is a negative effect from the two indirect offsetting negative effects which amounts to $\beta = .016$ ($p = .78$) this means it constitutes 14,7% of the total effect.

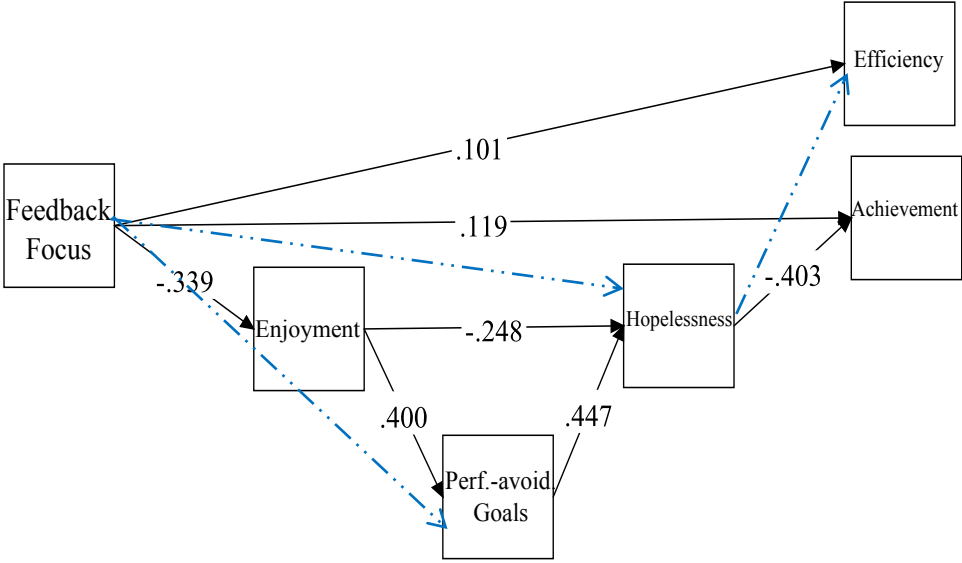
Moreover, an indirect effect positive effect from feedback focus over enjoyment, performance-avoidance goals and anxiety to learning efficiency was $\beta = .01$ ($p = .17$). This was offset by an indirect negative effect, $\beta = -.02$ ($p = .53$) from feedback focus over anxiety to learning efficiency. Another offset was an indirect effect from feedback focus over enjoyment and anxiety: $\beta = < -.01$ ($p = .84$). Like the previous indirect effect on achievement, the resulting indirect effect left, is a negative effect from the two indirect offsetting effects which amounts to $\beta = -.01$ ($p = .78$). This leads to a total negative indirect effect of 8.3% from feedback focus on learning efficiency.

To explore the role of performance avoidance goals as a mediator between the two emotions of enjoyment and anxiety the indirect effect was analyzed. The direct negative effect from enjoyment to anxiety was $\beta = -.03$ ($p = .84$.) The indirect positive from enjoyment over performance goals to anxiety was effect of $\beta = .16$ ($p = .02$) offset this direct effect. This makes this indirect affect account for all of the total positive effect on anxiety.

Path analysis for indirect effects of enjoyment over hopelessness

This models indirect effect has been investigated in a path analysis while also including performance avoidance goals as seen in figure 5. As with with previous models a test-wise inclusion of mastery avoidance goals led to insufficient fit indices, thus they have been excluded. The present model shows good fit indices with an RMSEA of .000 (< 0.07 , Steiger, 2007) and an SRMR of .04 ($< .08$, Hu and Bentler, 1999). Further it shows a CFI of 1.00 and a TLI of 1.05 (> 0.95 , Hu and Bentler, 1999). Chi square has not been significant at a value of 2.89 with 4 Degrees of freedom and a p-value of .58 ($p > .05$).

Fig 5: Path analysis for indirect effect over enjoyment and shame. Effects $< .1$ are displayed in blue. Self-referential and normative feedback was coded +1 and 0, respectively.



In the model displayed in figure 5 all variables are under the direct influence of effects. This makes an indirect effect from feedback focus to learning achievement possible. As there is no sufficiently large effect for an indirect effect from feedback focus to learning efficiency this path is not part of a further analysis.

Feedback focus displayed a direct negative effect on enjoyment of $\beta = -.34$ ($p = .00$) and also two small positive effects on achievement with $\beta = .12$, $p = .285$. and efficiency of $\beta = .10$ ($p = .413$). Enjoyment then showed a positive direct effect on performance-avoidance goals of $\beta = .40$, ($p = .00$) and a direct negative effect of $\beta = -.25$ ($p = .55$) on hopelessness. Performance-avoidance goals had a direct positive effect on hopelessness of $\beta = .45$, ($p = .00$). Eventually, hopelessness showed a direct negative effect on learning achievement of $\beta = -.40$ ($p = .00$).

A further analysis of the indirect effects revealed that the indirect effect from feedback focus over enjoyment, performance-avoidance goals and hopelessness to learning achievement was positive with $\beta = .02$ ($p = .09$). This was totally offset by by two negate indirect effects. One negative indirect effect of feedback focus over enjoyment and hopelessness to achievement of $\beta = .03$ ($p = .15$). Additionally, another small negative offset occurred with $\beta = < .01$ ($p = .99$). from feedback focus over enjoyment to achievement. This two offsets left only an indirect negative effect of $\beta = -.01$ ($p = .84$) which accounted for 9.2% of the total effects on learning achievement.

The mediating effect of performance avoidance goals also has been investigated in this model. The indirect effect from enjoyment of performance avoidance goals was $\beta = .18$ ($p = .02$). This was fully offset by the direct effect from enjoyment to hopelessness $\beta = -.25$ ($p = .55$).

Discussion

The current study has explored the effect of experienced feedback on the achievement process in an eTraining setting. The results have been gathered in a situation with a diverse and inhomogeneous sample in order to approach the setting of an open online course.

Effects of feedback on achievement goals

This study found small to medium effects of experienced feedback on goals. The experience of self-referential feedback conditions had a diminishing effect on most achievement goals. Especially the division between avoidance and approach goals became visible when contrasting the medium effects from the comparisons of no feedback/self-referential and normative self-referential. Both approach goals showed a medium diminishing effect if self-referential feedback was given in contrast to no feedback. This means that participants were less likely to approach good outcomes when receiving self-referential feedback instead of no feedback. While both avoidance goals showed medium effects when self-referential feedback was given in contrast to normative feedback. This means that participants were less likely to avoid bad outcomes when receiving self-referential in contrast to normative feedback.

All in all, the generally diminishing effect of experienced self-referential feedback on all achievement goals leads to the assumption that participants were more indifferent to their goals when receiving self-referential feedback in this study. To explain this, it is relevant to keep in mind that the achievement goals were assessed retrospectively. This way of assessment is influenced by the whole past experience of the learning situation. The experience of automated feedback without an explanation of how to improve one's performance could have led to this indifference. Participants were subject to self-referential feedback which only gave information on their performance in terms of general improvement or decline in their performance. No information was given on what is expected to improve the performance in the next tasks.

In terms of normative feedback, a trend based on small effect sizes can be interpreted. This trend displays a slight increase in both avoidance goals if participants received normative feedback in place of no feedback.

These findings are in contrast to reports on effects of anticipated feedback of Pekrun et al. (2014). In his study negative correlations were found for anger, anxiety, hopelessness and shame with mastery goals. While he found positive correlations for performance avoidance goals for the same emotions. Reasons for this difference in correlations between both studies can be a different form of feedback (anticipated vs experienced) a difference in sample size, or a difference in diversity of the participants. Moreover, Pekrun et al. assessed achievement goals prospectively while this study did it retrospectively.

Effects of feedback on achievement emotions

This study has found influences of experienced feedback on achieving emotions. Especially enjoyment and pride were influenced by the feedback conditions. As with achievement

goals self-referential feedback generally showed a diminishing effect on all achievement emotions.

Normative feedback did not show such a strong impact as self referential feedback in general. Further, normative feedback even showed a small trend for higher enjoyment and shame.

The picture is very similar to achievement goals and could be explained by the same indifference which led to a general diminishment of achievement goals. It seems that self-referential automatic feedback about improvement or decline in performance led to a decline in emotionally involvement. Normative feedback is therefore preferable in terms of general feedback as it did not show these diminishing effect as strongly, with small trend to more enjoyment. However, the higher degree of shame in the normative feedback condition might offset this positive aspect.

Effects of feedback on achievement, time and efficiency

The feedback that the participants experienced in this study had in general positive influence on the learning achievement, the learning time and the learning efficiency. Especially self referential feedback showed positive influence even if compared to the normative feedback experience.

As all three outcome variables are correlated with several achievement emotions which also have been influenced by effects from the feedback conditions in the experiment, a causal relationship seems possible. However, there could be different variables which would lead to the differences observed in this study.

The mediating role of goals

The correlational analysis in this study found no direct relationship between achievement goals and learning achievement, time or efficiency. This suggest that their influence on the achievement process is only a mediating one. The path analysis showed that performance avoidance goals played a mediating role for enjoyment and other negative emotions. However, their role was not very influential as they were fully offset or relayed only a small percentage of the indirect effect. This was true except for anxiety where the full indirect effect was mediated by performance avoidance goals.

All in all, this study has found evidence for a mediating effect of achievement goals in the form that they serve as link between positive and negative emotions. This is a new aspect in regard to previous findings on the mediating role of achievement goals by Pekrun et al., (2014). Pekrun et al., previously found evidence for mediation of goals between anticipated feedback and achievement emotions. He did not report on a mediating role as described in this study. One reason for this might be the difference in experimental condition between both studies. Pekrun et al, investigated anticipated feedback while this study investigated experienced feedback. It may be that achievement goals play a more immediate role in connection to anticipated feedback. In experienced feedback goals could shift into a less immediate position in the causal process.

The mediated effects of emotions and goals on achievement, efficiency and time

The path analysis undertaken in this study examined the indirect influence of enjoyment on learning achievement and efficiency. The indirect effects were either very low (in the case of shame) or offset completely by other indirect effects. This leads to the assumption that the indirect effects which lead through enjoyment do not play a large role in the differences between normative and self-referential feedback if looking at learning achievement. Along with a missing direct correlation between enjoyment and learning achievement and efficiency this would explain why learning achievement can rise in the self-referential group while enjoyment also diminishes.

It seems that the diminishing effect of self-referential feedback on all emotions was of benefit for the outcome variables. As enjoyment had no substantial direct or indirect influence, only the negative emotions which were diminished had a substantial negative correlation with the outcome variables. The indirect effects leading over pride could not be assessed. This is because no complete direct paths between the variables (greater than $\beta = .1$) were found leading from feedback focus to achievement over pride. This in turn shows that possible indirect effect leading over pride would be very small and possibly offset by the direct effects of the lowered negative emotions on achievement.

However, Hope was the only positive emotion which did have a positive correlation with learning achievement. But the observed effect of feedback on hope was too small to be analyzed via path analysis in this study. As hope also has diminished in the self-referential feedback condition it seems that its small effects also have been offset by the direct effects of the lowered negative emotions.

Limitations of this study

This study had several limitations. In the case of sample size, the sample might have been too small to investigate smaller direct and indirect effects. Namely, the achievement emotions hope and pride were not investigated via path models in this study due to their lack of fitting models and beta weights below .1.

This study also had a very diverse sample. This could have made those effects small or undetectable which would occur in a more homogenous group of participants.

Moreover, the normative feedback that was experienced in this study was bogus feedback. There are no indications that participants were aware that this was the case. However, true normative feedback could have different effects.

The low reliability of the multiple choice achievement test is another limitation of this study. It means that the low effects and statistical significance of the variable learning achievement and efficiency might be partially explained by it.

This study generally showed low statistical significance and effect sizes leading to a low generalizability of the findings. Apart from the low reliability of the learning test this can have its root in the diverse sample and the relatively small sample size.

Moreover, the feedback that was experienced by the participants in this study is constrained to automatic feedback with the only information being a performance comparison. This comparison being either with previous performance or with other participants. However, feedback can contain more information. It can contain information about how specifically to improve the mistakes which were made previously. It can also contain information about what exactly is expected of a learner to reach a certain goal. The focus on a specific dimension of feedback in this study makes a subsequent generalization of the findings on feedback as a whole not recommendable.

Practical implications

From the result of this study several implications can be drawn for designers of eTraining learning environments. The implications are aimed to help designers in the decision to implement feedback with more of a focus on self-referenced or on normative comparison.

The findings of this study point into a general direction. Namely, that in the case that automatic feedback does only provide information on general improved or decline in performance, self-referential feedback should be considered instead of normative or no feedback. However, this should be done only in the case that the aim is that subsequent achievement should be influenced positively.

However, this study found that the emotional background which partly underlies the achievement improving effect on self-referential feedback can lead to a problematic situation. This assumption is based on the lowering effects on positive emotions such as enjoyment, pride and hope which were present in this study. If implementing self-referential feedback additional measures should be taken to counter these effects and to improve positive emotions in learners.

In general, it is to say that achievement emotions have shown substantial correlations to learning achievement even in this small sample based explorative study. It therefore lies near to assume that in terms of the design process of technology enhanced learning systems the role of emotions should be considered. The AEQ showed a good reliability after an adaptation to the eTraining environment. It might be of good use to check the impact of design decisions on specific emotions like enjoyment with it.

Conclusion

This study attempted to explore the impact of feedback on emotions, goals and subsequent achievement in technology based eTraining setting. It has done this by conducting an experiment with an openly accessible eTraining object. The experimental conditions have differentiated between the different feedback conditions of self-referential feedback, normative feedback and no feedback.

The results indicated a relation between emotions and subsequent learning achievement. The experiment also found small to medium effects between the conditions with generally low statistical significance.

The question remains if the findings in this study can be generalized enough to be used for a valuable recommendation for eTraining designers. To answer this question, the specific situation to which the findings should be generalized is important. A broad generalization is not recommended. However, designers of eTraining environment that want to implement a form of feedback could compare their situation to the one in this study. This could help in some decisions regarding the implementation of automatic feedback features in eTraining.

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Appendix: Screenshots of the eTraining Object



Welcome to a Web-based Experiment in Affective eLearning

Department of Education, Communication and Learning

Dear participant,

Thank you very much for considering participation in this web-based experiment. You are invited to take part in a research study which explores the relations between emotions and learning with information technology. This experiment is conducted by me as part of my master's thesis at the University of Gothenburg. The input you give in this experiment will be the foundation of my research and as such has very high value. If you have any questions please feel free to e-mail me, Thomas Rider, at gusrideth@student.gu.se.

1) Purpose of the Study: In this experiment the influence of feedback, goals and emotions on learning in a technology-based environment will be investigated.

2) Procedure: If you agree to participate in this study, you will be asked to complete an eTraining learning object with the topic of "Four Tricks That Make Groups Work as Teams". By clicking the button below this learning object will open in a new browser window. It consists of short digital activities, texts and graphics. During your progress you will also be asked to fill out questionnaires about your emotions, goals and learning achievement.

3) Risks and Benefits: There are no known risks or discomforts involved in participating in this study. Completing the learning object and providing contact information will enter you into a raffle for one of two €25 gift cards to Amazon.

4) Time: Please plan for at least 30 minutes to complete the experiment. You are allowed to pause the experiment at any time and for how long you like via a button.

5) Anonymity and Confidentiality: The data gathered in this study will be used anonymously and will be kept strictly confidential. A link from your answers to your person is not intended. Moreover, all data will be stored on password-protected servers.

7) Voluntary Nature of the Study: This study is completely voluntary. Declining to participate will have no negative consequences. If you choose to take part in this study, you are free to quit at any time.

8) CONSENT TO PARTICIPATE: By clicking the button below you are indicating that you are at least 18 years of age, that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read this document and that your questions have been satisfactorily answered. Print this page if you wish to have a copy of this document for your records.

This button opens a learning object in a new window in your browser.

[Proceed to experiment](#)

(Please enable pop-ups on this page to participate)

Contact: Thomas Rider, gusrideth@student.gu.se



localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams

Welcome

Welcome to the eTraining Object:

Four Tricks That Make Groups Work as Teams



Pause Time (Sec): 385

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams

Introduction

Welcome to the eTraining Object,

this short object will let you train four tricks for working efficiently in a team. In school, university or at work you might face the situation of working with people which you know not very well. You also might not have influence on the topic or the aim of the group work. However, there is one aspect you can always influence: your own personal behavior. The tips in this learning object could let you influence team atmosphere and efficiency in a positive way through your own behavior.

You can **navigate** by using the arrow key on the lower right.

Often you are only allowed to advance if you have taken an action on a page.

You can **pause** the object by using the pause button on the lower left.

Before you can start please fill out the form on the right.

Please fill out this form before proceeding

1. What is your age?
2. What is the highest degree or level of school you have completed?
3. Choose your nationality:
4. Employment Status: Are you currently
5. Choose your gender:
6. Did you complete this learning object before?
7. Do you have experience with eLearning or online courses?

Submit

Pause Time (Sec): 524

eTraining Object: Four Tricks That Make Groups Work as Teams

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eTraining Object: Four Tricks That Make Groups Work as Teams

Meet Julia

This is Julia



In the picture you can see a group of people working in a group. The one in red is **Julia**. She previously had bad experiences in group work. Now she is trying to improve her own behavior to increase the performance of the group. The problem is that she has no idea how to do this.

Help Julia by completing activities and reminding her about some valuable tricks on the next pages...

Pause Time (Sec): 560

eTraining Object: Four Tricks That Make Groups Work as Teams

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams

Trick 1

How should you contribute in a group?



Trick 1: Maintain Equal Turns to Talk

The frequency in which every group members take part in a conversation is important. An unequal distribution of turns to talk may affect the whole group in a negative way. Communication suffers and with it the coordination of even the simplest tasks can get very hard. A clear sign of this unequal turn taking is when a few people or a single person are dominating the whole discussion.

To be an efficient group member you have to be aware of the concept of equal turn-taking and try to keep an eye on the distribution of turns-to-talk while

Pause Time (Sec): 571


localhost:8080/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams

Trick 1: Maintain Equal Turns to Talk

Look at the picture below. Julia's group has begun her meeting. But the situation is slowly getting problematic. One team member is talking a very long time while the two others are just contribute very short answers and Julia has not talked at all. Clearly an unequal distribution of turns-to-talk is at hand!

What could Julia do? Help her in the following exercise!



Pause Time (Sec): 583

localhost:8080/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams

Maintain Equal Turns to Talk

Help Julia by arranging her possible actions to a category!
Drag an Item from the right to its corresponding category. If you are finished click on 'Submit' to send in your answers. After submitting you can proceed by clicking the arrow button on the lower right.

Politely Interrupting

Taking the turn

Keeping your turn

Getting other people speaking

Submit

Pause Time (Sec): 590

eTraining Object: Four Tricks That Make Groups Work as Teams
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eTraining Object: Four Tricks That Make Groups Work as Teams
Trick 2

Are the others Ok with what I am doing?



Trick 2: Emotional Sensitivity

While it is important to enable team members to equally contribute it is also important to react to these contributions in a sensitive way. A good way of doing this is to be mindful of your own and your teams verbal and nonverbal expressions. This ability to sense and identify emotions in other people is called emotional sensitivity.


Especially facial expressions are a important link to an emotional reaction. Team members who are good in discerning them are a major asset in an successful team and can contribute immensely to a positive working atmosphere.

Pause Time (Sec): 606

eTraining Object: Four Tricks That Make Groups Work as Teams
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eTraining Object: Four Tricks That Make Groups Work as Teams
Trick 2: Emotional Sensitivity

Look at Julia's situation below. During the meeting her teammates give her many different facial expressions after her contributions. She is unsure what the other people think. Help her recognize what her teammates are feeling in the next activity by interpreting the facial cues which occurred during the meeting.



Pause Time (Sec): 612

localhost:8080/lo.htm


eTraining Object: Four Tricks That Make Groups Work as Teams

eTraining Object: Four Tricks That Make Groups Work as Teams
Emotional Sensitivity: Activity 3

Which word best describes what the person in the picture is thinking or feeling?

- arrogant
- annoyed
- upset
- terrified

Submit



Pause Time (Sec): 668

localhost:8080/lo.htm


eTraining Object: Four Tricks That Make Groups Work as Teams

eTraining Object: Four Tricks That Make Groups Work as Teams
Emotional Sensitivity: Activity 2

Which word best describes what the person in the picture is thinking or feeling?

You choose: bored. The right answer would have been: playful.

Your answer was incorrect. Please proceed to the next picture.



Pause Time (Sec): 653

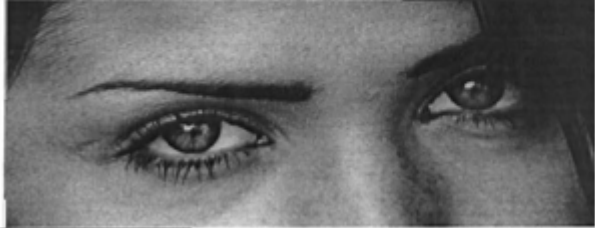
localhost:8080/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
Emotional Sensitivity: Activity 4

Which word best describes what the person in the picture is thinking or feeling?

- convinced
- flustered
- desire
- joking

Submit



Pause Time (Sec): 679


localhost:8080/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
Emotional Sensitivity: Activity 5

Which word best describes what the person in the picture is thinking or feeling?

- fantasizing
- alarmed
- aghast
- impatient

Submit



Pause Time (Sec): 687

eTraining Object: Four Tricks That Make Groups Work as Teams

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eTraining Object: Four Tricks That Make Groups Work as Teams
Trick 2: Feedback

This is your feedback for the last activity:

Your individual level of performance between the activities for trick 1 and trick 2 of the eTraining has improved by 40%.

Please proceed by clicking the button below after 10 seconds. Then the arrow button to the lower right.

OK

Pause Time (Sec): 701

eTraining Object: Four Tricks That Make Groups Work as Teams

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
LEARNING-RELATED EMOTIONS BEFORE STUDYING

Achievement Emotions Questionnaire

This questionnaire concerns your beliefs and opinions about the time you have spent with this learning object until now. There are no right or wrong answers - I am simply trying to find out **how you feel and think about your learning experience**. I am interested in your **personal opinions**, so please be candid in your responses. Your identity and your answers will be kept **strictly confidential**. The information will be **used for research purposes only** and will not be available for any other reasons.

BEFORE STUDYING

Learning with web technology can induce different feelings. This questionnaire refers to emotions you may experience when studying with this learning object. Read each item carefully and **RESPOND USING THE SCALE PROVIDED**.

The following questions pertain to feelings you may experience **BEFORE** studying with this learning object. Please indicate how you felt before you began to study with this learning object.

1. I looked forward to studying with this learning object.

Strongly agree Agree Neutral Disagree Strongly disagree

○ ○ ○ ○ ○

Pause Time (Sec): 722


eTraining Object: Four Tricks That Make Groups Work as Teams

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eTraining Object: Four Tricks That Make Groups Work as Teams

Trick 3

Do we have the same goal?



Trick 3: A shared view about the task

Every group member needs to understand what the task is if a group of people try to work together. In the case that each group member has their own idea of what to do and how to do it, teamwork will not really be efficient or coordinated. Therefore, a more similar understanding of the task between the team members is a good aim to have in the case of reaching a common goal.

As a group member you can contribute to building up a similar idea about the task throughout the group. You can do this by performing certain actions to facilitate this process if you are in a group discussion:

1. Try to describe what you think the task is

2. Try to describe what you think needs to be done to achieve the task goal

Pause Time (Sec): 791


eTraining Object: Four Tricks That Make Groups Work as Teams

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eTraining Object: Four Tricks That Make Groups Work as Teams

3. A shared view about the task

Below you see Julia's group arguing about how to proceed with the task. Everyone has a different understanding of the task. Try to give her advice about how to establish a more shared view about their task in the following exercises.



Pause Time (Sec): 795

eTraining Object: Four Tricks That Make Groups Work as Teams
Give Julia advice

Thanks to you Julia is now aware of what she could do. But she still has a problem with when to do it. Help her by arranging her possible contributions in the right chronological order by dragging them on the right place.

Step 1

I think that our task is to screw in the light bulb in order to light up the room. First we need a ladder to reach the bulb. Then someone needs to unscrew the old bulb and someone needs to screw in the new bulb. We also need someone to turn on the switch after the light has been screwed in. I think it could be a problem to reach the old light-bulb because it is very high even with a ladder.

Step 2

I also think that our task is to screw in the light bulb in order to light up the room but we also need to plug in the lamp first. So I would say that we first need to find the power socket, then plug the lamp in then we need a ladder to reach the bulb. Someone needs to search for the socket then another one has to unscrew the old bulb and someone needs to screw in the new bulb as you said. We also certainly need someone to turn on the switch after the light has been screwed in. I see the same problem as you that I think it could be a problem to reach the old light-bulb because it is very high even with a ladder. But moreover, I think we have an additional problem in finding the socket because the room is dark. So maybe we need someone with a flashlight?

Step 3

I can not really agree to the point that we would need a flashlight because it is not that dark in the room and I can see the socket from here. So that shouldn't be a problem. And also we do not really need a ladder because I am so big that I could reach the light bulb without it. To the rest however I do agree.

Pause Time (Sec): 820

eTraining Object: Four Tricks That Make Groups Work as Teams
Trick 3: Feedback

This is your feedback for the last activity:

Your individual level of performance between the activities for trick 2 and trick 3 of the eTraining has improved by 10%.

Please proceed by clicking the button below after 10 seconds. Then the arrow button to the lower right.

OK

Pause Time (Sec): 835

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localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
LEARNING-RELATED EMOTIONS DURING STUDYING

DURING STUDYING

The following questions pertain to feelings you may experience **DURING** studying with this learning object. Please indicate how you feel during studying with this learning object.

16. I worry whether I'm able to cope with all this work.

Strongly agree Agree Neutral Disagree Strongly disagree

17. Because I'm bored I get tired sitting at my desk.

Strongly agree Agree Neutral Disagree Strongly disagree

18. I feel confident when studying with this learning object.

Strongly agree Agree Neutral Disagree Strongly disagree

19. I feel ashamed that I can't absorb the simplest of details.


Pause Time (Sec): 847

eTraining Object: Four Tricks That Make Groups Work as Teams

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
4. Closed-loop Communication

In Julia's group several difficult and important interactions are taking place. She is trying her best to archive closed-loop communications. But she keeps making mistakes. Help her in the next exercises by spotting these mistakes.



Pause Time (Sec): 887

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
Closed-Loop Communication Activity 1

Have a look at the situation below. Julia is trying to communicate in a closed-loop. But she does not know if what she is doing is right or wrong. She is also unsure why it is right or wrong.

Tasks:

1. Help her by dragging either right or wrong on the table below the picture (Corresponding to the number in the speaking-bubble).
2. Place the reason for your decision adjacent to 'right or wrong' on the table.
3. If you are done please push the button on the lower right to proceed.

because the sender did state a clear message. 1. Wrong.

1. Right, 3. Wrong, because the sender did not correct the misunderstanding.

2. Wrong, 2. Right, 3. Right.

because the receiver did not consider the original message.

Pause Time (Sec): 896

localhost:8888/lo.htm

eTraining Object: Four Tricks That Make Groups Work as Teams
Closed-Loop Communication Activity 2

5. Right 2. Wrong 4. Wrong because the sender corrected the message

4. Right because the receiver interpreted the message 1. Wrong, 3. Wrong.

1. Right, 2. Right, because the sender changed his original message 3. Right.

because the sender did state a clear message.

5. Wrong because the receiver tried to interpret the message

1.		
2.		
3.		
4.		
5.		

Pause Time (Sec): 931

