Pupils' perceptions about technology-enhanced feedback: do emojis guide self-regulated learning?

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Abstract

Although technology-enhanced feedback (TEF) from teachers to pupils is given daily, little is known about pupils' thoughts about this feedback in Finland. Pupils' perceptions were studied to evaluate whether TEF support self-regulated learning, as suggested. Interviews (N=62) and questionnaires (N=132) about pupils' perceptions and emotions related to TEF were analysed. TEF, enriched with smiling emojis, is used to monitor performance and behaviour. Reported emotions varied from joy to disappointment. TEF seems to direct pupils to understand that the appropriate behaviour is one of the more desired learning goals and TEF may encourage pupils to become dependent on reassurance from teachers. To support pupils' self-regulatory skills, TEF should be developed to improve learning and support pupils' active participation on feedback as a process.

Keywords: technology-enhanced feedback; self-regulated learning; emotions; emojis

Introduction

Technology-enhanced feedback given via online platforms is an everyday practice in education (see e.g. Cutumisu, 2019; Palts & Kalmus, 2015) and digital records are used to draw conclusions about pupils' learning and self-regulatory skills (Winne 2017). There is an urgent need to understand the perceptions of pupils themselves about technology-enhanced feedback as in Finnish basic education, teachers give feedback after the lessons by clicking predefined feedback options, and pupils even have the opportunity to read these messages from their smartphones during the school day.

Feedback may have a powerful effect on learning if it is given appropriately (Hattie & Timperley, 2007; Shute, 2008). Learners appreciate honest feedback, which helps them to observe their progress and provides them concrete suggestions about how to improve performance in the future (Peterson & Irving, 2008). Even though the intention of feedback from a teacher is targeted at learning, it also has an impact on pupils' other internal processes (Butler & Winne, 1995; Ryan & Deci, 2017). The importance of sensitive feedback has been emphasised by university students, as receiving feedback from a teacher arouses emotional experiences, such as joy, anxiety or shame (Ferguson, 2011). According to Pekrun (2009), pupils experience both positive and negative emotions, which may either activate or deactivate learning. Self-regulation skills are mentioned as being essential when coping with emotions (Eynde, De Corte & Verschaffel, 2007).

Previous studies have shown that some pupils receive a large amount of either encouraging technology-enhanced feedback related to learning and desired behaviour, or negative notes related to behaviour problems or forgotten homework (Oinas, Vainikainen & Hotulainen, 2017; 2018). Although there are studies about pupils' conceptions of feedback in general (Peterson & Irving, 2008), little is known about

pupils' perceptions and emotions related to feedback received during the school day (Hargreaves, 2014; Van der Schaaf, Baartman, Prins, Oosterbaan, & Schaap, 2013), and even less about emotions attached to technology-enhanced feedback. The aim of this study is to fill this research gap by using interviews with pupils and a questionnaire to understand pupils' perceptions and emotions in order to evaluate whether technology-enhanced feedback provides benefits to learning. Throughout the paper, *feedback* refers to information given face-to-face or in a written form. If information is completely computer mediated, then the term *technology-enhanced feedback* is used.

Although cognitive and emotional processes influence learning simultaneously, they are separate constructs (Pekrun, 2006). Therefore, in theoretical section of this study, technology-enhanced feedback is observed from two perspectives. First, the European education policies around learning are described in order to analyse whether the current technology-enhanced feedback practices of teachers support metacognitive skills and self-regulated learning as suggested. Second, the relationship between feedback and emotions is observed. In empirical section of this study, pupil interviews and questionnaires related to achievement emotions (Pekrun, 2009) by pupils were analysed to obtain an understanding of pupils' perceptions and emotions related to technology-enhanced feedback. A total of 132 pupils completed the questionnaire, and 62 of them were also interviewed. Pupils were in grades 5 and 6, and the data were collected during May 2018.

Technology-enhanced feedback and learning

Feedback can be defined as information from an internal or external source about the gap between the current and desired level of knowledge or behaviour (Hattie & Timperley, 2007; Hughes, 2010; Shute, 2008; van der Kleij, 2013). In the school context, internal feedback refers to self-reflection on performance to adopted learning

goals or comparison between peers for instance (Zimmermann, 2000). External feedback from a teacher means verbal or written comments and silent gestures about a learner's activity (Hargreaves, 2014). Shute (2008) separates *task-level immediate feedback* as information about how to improve work in relation to learning goals and learners' characteristics, and *summary feedback* to summarise the level of learners' understanding. Moreover, Shute (2008) reminds us that a learner should be motivated to need the feedback and have willingness and abilities to use it in order to feedback to be effective. Recently, Carless and Boud (2018) have emphasised a shift in thinking to understand feedback as a process, to seek and make sense of information and use it to develop learning strategies actively (see also Boud & Molloy, 2013). Therefore, in order to support self-regulated learning, technology-enhanced feedback should also be seen as a process, where pupils by themselves are encouraged to seek information from a teacher via an online platform. Based on earlier studies, most technology-enhanced feedback refers to behaviour (Oinas et al., 2017; 2018), although research evidence and the Finnish National Core Curriculum underline the importance of feedback targeted at the learning process (Hattie & Timperley, 2007; National Bureau of Education [NBE], 2014).

Since 2000, there has been an emphasis on learner-centred, self-regulated learning as prerequisites to lifelong learning in the European education policy framework (European Council, 2006; 2018; Lüftenegger, Schober, van de Schoot, Wagner, Finsterwald & Spiel, 2012) to prepare learners for a society in which flexible higher order thinking skills (Persico & Steffens, 2017) and the ability to carry out learning processes are required (European Council, 2018). Also, the Finnish National Core Curriculum follows these policy lines by stating that 'basic education creates the conditions for lifelong learning as learning is an integral part of building a good life'

(NBE, 2014, p.15). The lifelong learning framework builds on a constructivist paradigm through which a learner is an active owner of the learning process (Persico & Steffens, 2017). Furthermore, metacognitive skills as a part of self-regulated learning for future learning is highlighted by both the curriculum (NBE, 2014), and the literature (Winne & Nesbit, 2009).

Metacognitive knowledge, originally described by Flavel (1979), 'consists of knowledge and beliefs about how person, task or strategy act and interact in ways to affect the course and outcome of cognitive enterprises'. Winne and Nesbit (2009) define metacognition as a combination of knowledge of knowing, relationship of knowledge, behaviour and agency. However, definitions and research related to learning-related metacognition has already produced a vast body of material, too wide to handle in detail here (see e.g. Akturk & Sahin, 2011 for a review). In this study, the concept of academic metacognition is closely linked to the definition of feedback as a process; technology-enhanced feedback should support pupils' own active reflection of the learning process.

Self-regulated learning means having the volition to set learning goals and competencies to self-generate thoughts, feelings and actions, which are cyclically adapted and dependent on feedback from prior performance (Zimmermann, 2000). In other words, self-regulatory learners can reflect, control and adapt knowledge and emotions by themselves. Usually, pupils need practice to become self-regulatory learners by having the opportunities to reflect feedback orally with their teacher for instance (Van der Schaaf et al., 2013).

Sensitivity to external feedback and regulation of cognition are components of metacognitive skills (Meijer, Sleegers, Elshout-Mohr, van Daalen-Kapteijns, Meeus & Tempelaar, 2013). In a recent study by Cutumisu (2019), those who were adaptive to

constructive feedback performed better than those who perceived the feedback as a person-targeted criticism. Feedback may arouse decline in performance even in pupils with high self-concept if feedback is discordant with the expectations of pupils (Baadte & Schnotz, 2014). As sensitivity to feedback is also dependent on earlier learning experiences and individual differences (Hughes, 2010), it is important to study pupils' perceptions of technology-enhanced feedback to evaluate whether the feedback supports the development of self-regulation and metacognitive skills which are the basis of lifelong learning in the future.

Earlier findings of feedback practices of teachers vary. Lüftenegger and colleagues (2012) showed that pupils who were encouraged to regulate learning by themselves were more interested in learning and reported higher self-efficacy. See, Gorard and Siddiqui (2016) have observed that most of the time, teachers use inefficient person-targeted praise and only occasionally take the effort to support their pupils' own self-regulation or suggestions about how to work towards learning goals. However, Hargreaves (2014) reported opposite findings, that a teacher observed gave mainly process-targeted feedback supporting pupils' own autonomy. According to Corno (2009), teachers are more likely to praise and reward pupils who have adopted the social norms of the classroom with good working habits. Study of technology-enhanced feedback showed that teachers provide feedback with different patterns to pupils in a single classroom (Oinas et al., 2018).

A qualitative analysis by Peterson and Irving (2008) described how 11-13-year-old pupils understand feedback as a part of assessment; it is important to them, and further, it seems to be one way to please parents. However, if feedback was perceived as complex or dishonest, it was considered to be irrelevant (Peterson & Irving, 2008). Pajares and Graham (1998) found that pupils appreciate sensitive but honest

constructive criticism instead of meaningless praise. Griffin (2018) wrote that pupils perceive teachers' feedback as being helpful as they could monitor what they had done correctly and where they would need to improve. Feedback was mostly related to behaviour and some teachers said that they tended to follow guidelines to balance the feedback between positive and negative (Griffin, 2018).

Butler and Winne (1995) underlined the importance of understanding the influence of feedback on self-regulated learning and according to Persico and Steffens (2017), technology-enhanced learning environments allow learners to re-read and reflect on the recorded data, thus improve their self-regulatory skills. Recently, the literature has emphasised supporting pupils' own active role in seeking feedback (Cutumisu, 2019; Dawson et al., 2018), perhaps as an effort to develop self-regulation as a learner. Therefore, understanding pupils' perceptions of feedback is needed to support their own agency and regulation of the learning process.

Technology-enhanced feedback and emotions

Emotions play an important role in classrooms (Weiner, 2007; Pekrun, 2009) and an emotionally-secure teacher-pupil relationship provides better opportunities to learn (Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008). Weiner (2007) defines emotions as subjective and private experiences resulting in physiological reactions. Usually two dimensions of emotions are distinguished: positive, pleasant emotions and negative, unpleasant emotions (Pekrun, 2006; Weiner, 2007), although Pekrun, Goetz, Titz and Perry (2002) argue that positive emotions are not automatically as good and negative as bad, only that they function differently in learning situations. Recent meta-analysis by Loderer, Pekrun and Lester (2018) confirms that pupils' experienced emotions also have an impact on learning in technology-based conditions.

A*chievement emotions*, as emotions experienced in a school context arose from success or failure related to achievements (Pekrun, 2009; Weiner, 2007). Related to a three-dimensional taxonomy of achievement emotions, Pekrun (2009) concludes that both positive and negative emotions may have an activating or a deactivating effect on learning. Furthermore, emotions are divided into *activity focused* and *outcome focused* emotions, based on the perceived ability to control learning by one's own effort and ability, and whether learning is experienced as self-regulated or externally controlled (Pekrun, 2009). For example, fulfilment of expectations of earning positive feedback related to successful achievement arouses joy or hope and activates learning in the future (Pekrun, 2009). For example, unexpected demands or feedback about failure may arouse anxiety, and activate a pupil to try harder. However, it may also arouse hopelessness, which deactivates learning, especially when the pupil perceives the situation as outcome-focused and uncontrolled (Pekrun, 2006; 2009). Pekrun and colleagues (2002) also warn that experiencing strong emotions such as anxiety, distract attention and reduce cognitive resources.

Individual differences and earlier learning experiences of success and failure shape how one interprets feedback (Kluger & DeNisi, 1996). A study by Hargreaves (2014) revealed that feedback from a teacher may even arouse fear in pupils. Ryan and Henderson (2018) found that university students who perform worse than they expected often perceive the feedback as being more negative than higher performing students do. They argue that a student can take feedback as a personal judgement and therefore, the teacher has to be sensitive and thus avoid using person-targeted emotional expressions when providing feedback (Ryan & Henderson, 2018). Eynde and colleagues (2007) conclude that although corrective feedback may benefit learning, pupils first need support for their self-regulatory skills to cope with stressful emotions related to

feedback. Positive emotional experiences to support learning are emphasised in the Finnish Core Curriculum (NBE, 2014) and have been shown to be as important for maintaining motivation and fostering self-regulated learning (Pekrun et al., 2002). Many of the emotions are embedded into the feedback delivered via online applications. Research is needed to study emotions, especially if the applications used are targeted and used for monitoring purposes.

Research questions

Self-regulation and metacognitive skills are highlighted to support lifelong learning (Lüftenegger et al., 2012; NBE, 2014) and to adapt to feedback from the teacher (Eynde et al., 2007). Loderer and colleagues (2018) showed that emotions also mediate learning in technology-based conditions, and therefore it is important to study pupils' perceptions and emotions related to technology-enhanced feedback. The research questions are:

(1) How do pupils perceive technology-enhanced feedback in general?
(2) Does technology-enhanced feedback have an effect on self-regulated learning according to pupils perceptions?
(3) What emotions related to technology-enhanced feedback have pupils experienced?

Methods

The overall research procedure was cyclical, starting with a literature review to create the research questions and ending back with the theory, after content analysis of the interviews and questionnaires. The phases of the process are described in more detail in the next section.

Participants and context of the study

In Finland, technology-enhanced feedback is given through a commercial educational platform, called Wilma, used in over 90 per cent of basic education schools. Via the platform, teachers can communicate with pupils and their parents, and for example, give feedback concerning pupils' school day. The types of feedback can vary between written messages or predefined feedback options (e.g. emojis). There are no guidelines for the use of the platform, and therefore, the practices vary: in some schools, only parents have the access and they deliver messages to their children, while in other schools pupils themselves may see the messages during the school day. Earlier studies indicate that 5th and 6th graders are the ones who receive the largest amount of negative feedback related to forgotten homework and behaviour problems, in addition to a large amount of positive feedback (Oinas et al., 2017; 2018). Therefore, pupils in grades 5 and 6 from three schools in three municipalities were chosen for this study. Approval letters for participation were sent to pupils' parents and guardians in advance, and 132 out of 221 pupils returned the signed approval form that allowed them to be part of this study. All 132 pupils (83 girls, 49 boys) filled in the questionnaire related to emotions and 62 of them (21 boys) also took part in the focus group interviews

Measures

The data comprised two sets: pupils' responses to a short questionnaire related to emotions, and pupils' group interviews. Researchers visited all 5th and 6th grade classes in each research school, and the session started with a brief introduction concerning the possible technology-enhanced feedback types that had been drawn from earlier research. In the introduction, pupils were told that according to earlier findings, it is common for pupils to receive technology-enhanced feedback related to three issues: teacher praise, forgotten matters and behaviour problems (Oinas et al., 2018).

Furthermore, it was also mentioned that it is typical for some pupils to receive no technology-enhanced feedback at all (Oinas et al., 2017). After presenting the examples of feedback types, pupils were requested to look at the questionnaire and circulate the types of emotions they had experienced related to technology-enhanced feedback.

The questionnaire contained 16 emotions presented in a four by four grid drawn from the three-dimensional taxonomy of achievement emotions by Reinhard Pekrun (2009). Pupils were instructed to circle as many as they remembered they had experienced. Further, as background information, pupils were asked to provide their gender, and to state whether they had access to feedback via smartphones or computers, and if they had received any technology-enhanced feedback notes.

After completing the questionnaire, participants in the group interviews were selected from among the volunteers. Two of the researchers conducted the interviews; both had groups of two to six pupils in a quiet space in the school. The interviews were guided by a semi-structured interview schema, to ensure the later comparability of interviews. The interview questions were based on the research literature about the use of technology-enhanced feedback in schools (e.g. Oinas et al. 2017, 2018; Palts & Kalmus, 2015). Pupils were encouraged to discuss freely the topics and questions from the interviewee. All interviews were audio recorded and later transcribed for analysis. No personal information about the pupils was collected during the data collection.

Data analyses

Questionnaires about the emotions experienced related to technology-enhanced feedback were interpreted qualitatively with frequencies and simple percentages, as the relatively small sample cannot provide reliable statistical generalizations.

Methodologically, the approach was close to what Hsieh and Shannon (2005) describe as conventional content analysis. The process is based on interpretations and

meanings drawn from the data without using any predetermined categories or codes for analysis, and the coding categories develop and specify through the various rounds (Gulliksen & Hjardemaal, 2014; Hsieh & Shannon, 2005).

In the first phase, the data were read through by two of the researchers independently and coded freely (open coding) in thematic units using Atlas.ti software (www.atlasti.com). As a result of the blind coding done by two researchers, the number of codes and the code names varied in the data coded, which is typical for the process of blind coding (Forsgren, Christensson, Rodulfsson, & Rejnö, 2020). Therefore, in the second phase, the contents of each code were discussed in detail in order to form an understanding about them in terms of differences and similarities. For example, we noticed that the codes “externally-regulated monitoring of learning” (researcher I) and “knowing to know” (researcher II) contained citations related to pupils perceptions of self-regulation. Through this phase it appeared that slightly differently named codes were used to mark the same phenomenon in the data, and it was possible to group the codes and coded data excerpts under four major themes: emotions, learning, pupil-parent discourses and perceived meanings of feedback (Table 1). The code *assessment*, used only by one researcher, were excluded from further analysis as it included viewpoints that went beyond the scope of this study**.** Next, the themes were looked at more closely. Interview quotations within the themes were read, compared, and discussed in order to develop the analysis further, and to identify the more precise parts belonging to the themes of this study: how pupils perceive technology-enhanced feedback, and how they see it affecting their learning, and further, what emotions are related to this feedback. Finally, the revised analysis framework was linked with the theory guiding the study, and the data were read once again and interpreted to provide the results presented below.

Table 1. Comparison of the codes from the first round used by two researchers independently.

	Researcher I	Sessions*	Researcher II	Sessions*	Major themes
RQ1 Thoughts about technology-enhanced feedback in general	Thoughts about technology-enhanced feedback	11	Suggestions	13	Pupil-parent discourses
	Technology-enhanced feedback vs. feedback with face-to-face	15	Discussion about technology-enhanced feedback with teacher	6	
	For whom technology-enhanced feedback is targeted to	16	Discussion about technology-enhanced feedback with parents	16	
	Reading the feedback	8	The amount of feedback	9	
	What kind of feedback would be meaningful for pupils	8	Technology-enhanced feedback vs. feedback with face-to-face	13	
	Discussion about technology-enhanced feedback with parents	13			
	Receiving feedback	11			
	Access to the platform				
	Frequency of technology-enhanced feedback	12			
	The meaning of feedback	16	Opinions about feedback options	10	Perceived meanings of feedback
RQ2 Perceptions related to learning	Externally-regulated monitoring of learning and behaviour	15	Knowing to know	10	Learning
	Learning	11	Improvement	10	
			Learning	14	
			Assessment	5	
RQ3 Perceptions related to emotions	Experiences about positive feedback	8	Emotions	12	Emotions
			Unequally given technology-enhanced feedback	11	
			Negative remarks	13	
			Positive remarks	15	

*) The number out of sixteen sessions where the coded themes occurred.

Results

Results of the questionnaire and interviews are presented hand in hand. Pupils' voices are included in the story through interview citations. Each citation has been referred to with the interview participant number and the interview session code: a boy participant number 16 in the third session is *B16, S3,* for example. Although the data gathering started with a questionnaire focusing on emotions and followed with the interviews, the results are presented in reverse order by proceeding from general-level perceptions to learning and emotions.

General perceptions about technology-enhanced feedback

All interviews started with a general-level discussion about the online-tool for computer-enhanced feedback system (RQ1) that was in use at the school. It appeared that pupils were familiar with the procedure of teachers providing feedback via the

online platform and their overall attitudes towards it were positive. Technology-enhanced feedback was often given using emojis.

> *G29, S11– 'If you've done something – for example, actively participated in the lesson or done something extra – you'll get a smiling emoji.'*

In all the interviews, it became clear that number of separate feedback units and the frequency of feedback received from their teachers varied (cf. Oinas et al., 2018; Griffin, 2018). Some teachers tended to give technology-enhanced feedback more regularly than their colleagues did, and further, according to pupils' interpretation, sometimes the habits of the same teacher varied according to the day or week. Consequently, it became clear that systematic use of the technology-enhanced feedback would be appreciated by the pupils. Therefore, technology-enhanced feedback appeared in pupils' expressions as an occasionally-used tool lacking shared practices for the use of it. These general-level observations resonate with earlier studies indicating uneven distribution of technology-enhanced feedback given by teachers (Oinas et al., 2018).

Almost all of the pupils interviewed for this study had access to the online platform for technology-enhanced feedback, and if they did not have their own passwords, they got information about the contents and were given feedback by their parents. The pupils reflected the broader purpose of technology-enhanced feedback in interviews; who is the feedback targeted at and what purpose does the feedback serve in their own schooling. These reflections formed four thematic categories: meaning of feedback, information about own performance, contents of feedback, and feedback and learning (Figure 1).

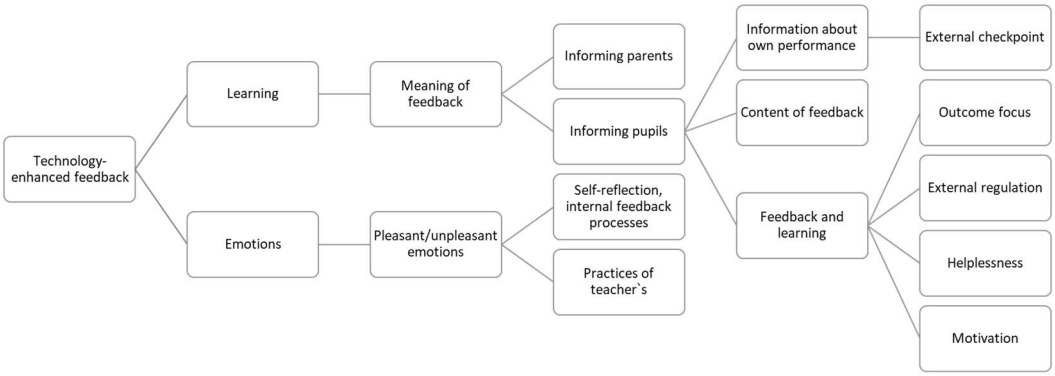

Figure 1. Thematic categories of technology-enhanced feedback.

The meaning of feedback category, consists of what pupils understood about the target group for technology-enhanced feedback given by their teachers. Two main interpretative lines appeared for the target group of the feedback, and these lines were often present and partly shared in the pupils' discourses. Firstly, many pupils described the technology-enhanced feedback system as one way to keep parents updated on how their children were doing at school, and through that, the transparency of daily school life was increased.

G2, S1– 'it is important that your parents know how you are doing and behaving.'

Moreover, pupils interpret this as a good thing, and no one opposed the idea of this online platform being a good channel to inform their parents. Some pupils raised the question concerning those pupils who did not receive any feedback from teachers via that platform, and whether their parents were kept in the dark in terms of their child's school life. The main concern in these cases was that the flow of information between school and home would be dependent on the pupils' own activity, and not be the responsibility of the teachers as users of online feedback system.

B7, S6 – 'And then, if the pupil doesn`t get any [technology-enhanced feedback]

then his parents don`t know how he`s doing. It can be that he don`t want to tell parents anything about school.'

The other common interpretation of the target group, along with parents, was the pupils themselves and these results are presented below.

Pupils' perceptions of technology-enhanced feedback and learning

Pupils appreciated technology-enhanced feedback targeted at them as a level of external regulation for their own behaviour and activity in the class. Thus, in these descriptions, what pupils understood about the meaning of the feedback in relation to their own schooling became visible. Therefore, this second interpretative line leads to the three other thematic categories: information about one's own performance, contents of feedback, and feedback and learning.

Under the category of information about one's own performance are pupils' descriptions about how they received information about how well they were doing at school through the technology-enhanced feedback from teachers. External feedback from teachers was perceived as being a source of knowledge of knowing (Winne &Nesbit, 2009), thus indicating that pupils are not so capable of reflecting on their learning or using their metacognitive skills without the feedback from teachers.

B16, S10 – 'If the remarks in the system are positive then you know that you have done a good job. It keeps you updated about happenings, both good and bad.'

Furthermore, some pupils mentioned that feedback functioned as guidance from teachers through which pupils received information concerning the required direction of their actions.

G5, S3 – 'Those [feedback notes on the online platform] are meant to guide pupils about what they should do, and how.'

Some pupils also stated that they would like to receive more technology-enhanced feedback, in order to know better how they are doing.

> *G10, S3 – '[It would be beneficial to get information about] all activities and diligence from every lesson. It's really nice when it's a little bit of a thing to know how they go.'*

For the 5th and 6th graders interviewed, technology-enhanced feedback functioned as an external checkpoint concerning their daily performance at school, and through feedback they received valuable information about their performance concerning both learning and behaviour during the school day. Depending on the contents, the feedback was perceived as a sign to keep up the good work or guidance to improve one's own behaviour, activity in the class/lesson, or achievement.

> *B4, S4 – 'If you get a negative feedback note then you try to fix it as you don't want to get another.'*
> *G22, S8 – 'Then you can see how well you have worked at school, and then you can improve.'*

Consequently, the pupils' discussions showed that without feedback from teacher, it seemed to be difficult to form an understanding about one's own performance and evaluate one's own activity and behaviour in the classroom. That was the main reason pupils seemed to want more rather than less feedback concerning their school day. This is in line with earlier studies indicating that pupils appreciate feedback making suggestions about how to improve performance (Peterson & Irving, 2008).

However, not all feedback was described as good, and under the category contents of feedback, there were two sets of perceptions concerning issues related to those contents. Thus, there was feedback that was described as meaningless or empty.

In both cases, the information value of feedback was low; it was not specific enough or it seemed to be randomly given just for the sake of giving feedback.

> *G38, S15–* '*Sometimes it* [technology-enhanced feedback] *is just random, and it may be useless, because if teacher gives only emojis without explanation …then you don`t get so much information out of it.*'

Pupils' experiences support earlier findings (See et al., 2016) that technology-enhanced feedback rarely consists of practical suggestions about how to work towards desired goals.

> *B9, S8 –* '*If you have done something bad, it would be nice if teacher could give a little hint through the feedback note, that what you could have done differently.*'

Often pupils described that they did not know what the given technology-enhanced feedback related to. In terms of meaningful feedback from teachers to pupils, the emojis with smiling or sad faces are not enough; according to the pupils, information that is more specific is needed.

During the interviews, pupils were asked to evaluate whether technology-enhanced feedback notes helped them to learn, and the immediate answer was "no". However, after pondering the questions further, most of them had second thoughts and pupils started to reflect on the difference between positive and negative feedback. Their interpretation was that they could regulate their behaviour in order to improve their overall achievement-level from hints received through technology-enhanced feedback. They considered positive and supportive feedback to be motivating and it made them push forward harder in their studies or at least it encouraged them to keep the same level of activity, behaviour or achievement they had already reached.

> *B3, S4*: '*Yes, it* [technology-enhanced feedback] *helps you to learn. For example, it is motivating to see positive feedback on the platform. And then, you always see how you have behaved and then you see if you must improve.'*

Negative feedback could work in two ways, according to the pupils. If provided in small amounts and in a constructive form, it could correct their direction, and they wanted to do things better at school. However, constantly-received negative feedback concerning forgotten school books or unwanted behaviour, for example, were described as unmotivating or discouraging

> *G39, S15 –* '*Well, the first thing that came to my mind is that if they continuously point out some minor things, then you may start feeling that you don`t want to do this at all, if they make comments all the time.'*

Overall, negative remarks were considered to be person-targeted criticism, which may have a detrimental effect on learning (Hattie & Timperley, 2007):

> *B5, S5 – 'If you get positive feedback notes, it is encouraging and improves your willingness to do better work. Then, if you get negative notes, I feel that the impact is a little bit opposite. You may feel…that this is not interesting anymore. At least I would think so, if I would get negative feedback.'*

In the Finnish National Core Curriculum, feedback is defined as a means that aims to support pupil learning (NBE, 2014). Moreover, Hattie and Timperley (2007) pointed out that feedback supporting learning should contain clear suggestions/instructions for steps towards the desired goal. According to the interviews, pupils both denied the value of technology-enhanced feedback on learning and considered remarks about behaviour as helpful information for achieving better grades. Thus, the pupils understood learning as an action related to measured and graded outcomes and external behaviour, not as a self-regulated process to gain knowledge.

B10, S8 – 'Yes, I think it teaches you how to behave better at school, and how you may get much more good feedback and much higher grades.'
B6, S6 – 'I don't know. I might think that they are trying to guide pupils so that what they should do and how. And then, when you have to do something well, then a pupil gets a good note, so the pupil knows that he or she has done something right.'

Pupils' perceptions of technology-enhanced feedback and emotions

In the questionnaire, pupils were requested to circle as many emotions as they had experienced in relation to technology-enhanced feedback. On average, they circled 3.5 positive pleasant emotions, and 1.6 negative unpleasant emotions. Thus, more than double positive than negative emotions were chosen from those listed (see Table 2). Only one pupil out of 132 did not report any positive emotions, and 24 per cent of them did not recall any negative emotions. Otherwise, pupils circled both positive and negative emotions. The most frequent emotions were joy and contentment. One girl described the meaning of technology-enhanced feedback compared to face-to-face feedback from the teacher as follows:

G39, S15 – 'But then, if you get a positive feedback note, it feels like greater joy than if you had got it face-to-face. That`s how I think of it.'

Pride and relief were also experienced often, indicating that pupils value technology-enhanced feedback if they perceived being proud when receiving it. Relief may indicate uncertainty about success or failure, as emotions are shown to arouse out-of-learning achievements compared to adopted goals (Pekrun, 2006; Weiner, 2007).

Table 2. Frequencies of pupils' (N=132) perceived achievement emotions related to technology-enhanced feedback according to Pekrun`s (2009) three-dimensional taxonomy.

	Positive, pleasant emotion, 464		Negative, unpleasant emotion, 213	
	Activating	Deactivating	Activating	Deactivating

Activity focus	Enjoyment, 15	Relaxation, 31	Anger, 22* Frustration, 44	Boredom, 26
Outcome focus	Joy, 114 Hope, 20 Pride, 78 Gratitude, 36	Contentment, 97 Relief, 73	Anger, 22* Anxiety, 16 Shame, 25	Sadness, 19 Disappointment, 51 Hopelessness, 10

*) *Anger* belongs in both the activity focus and outcome focus, but in the questionnaire, it was mentioned only once. In summarising negative, unpleasant emotions, anger was calculated once.

Disappointment and frustration were the most frequently perceived unpleasant emotions and these were also discussed during the interviews. Pupils explained that disappointment may be aroused from their own actions.

> *B8, S8 – 'Sometimes there comes pride if you get a good feedback note. And then, if a bad note comes, then it will be a disappointment against yourself. You will be disappointed in yourself a little.'*

Furthermore, unpleasant emotions were explained by practices of teachers that were perceived as being unfair, indicating that pupils are aware that teachers are likely to praise pupils differently (Corno, 2009).

> *B18, S14 – 'Yes. One time when we had a lesson, the teacher said that everybody who raises their hand will get a positive feedback note, but then he didn`t ask me at once, so I didn`t get one.'*

Overall, these results support the earlier findings of Loderer and colleagues (2018) by showing that pupils experience a variety of emotions related to technology-based conditions.

Discussion

In this study, pupils' perceptions and emotions related to technology-enhanced feedback were observed by analysing 62 interviews and 132 questionnaires of pupils

qualitatively, in order to evaluate whether these feedback notes support self-regulated learning (Butler & Winne, 1995; Pekrun, 2009; Zimmermann, 2000), and metacognitive skills of pupils, as suggested (Winne & Nesbit, 2009) in current educational policies (European Council, 2006; 2018; Lüftenegger et al., 2012; NBE, 2014).

Although the literature (e.g. Hattie & Timperley, 2007; Shute, 2008; Peterson & Irving, 2008) and the Finnish National Core Curriculum (NBE, 2014) emphasize feedback targeted at the learning process, the current findings confirm earlier findings that technology-enhanced feedback, often given as emojis, is differently distributed in terms of the content and amount, and is mostly targeted at the behaviour of pupils (Oinas et al., 2017; 2018). Thus, the results of this study indicate that teachers may understand feedback somewhat differently compared to the definitions in the feedback literature**.** According to current understanding, feedback should be a process, where a pupil actively seeks information in order to improve learning (Boud & Molloy 2013), but this approach was not seen from the data at hand. However, it must be remembered that specifically in a school context, feedback may also have motivational purposes instead of promoting cognitive or self-regulatory skills. In the interviews, pupils were unanimous that by reflecting on technology-enhanced feedback, they knew how they were doing and could improve their learning results. Consequently, technology-enhanced feedback seemed to direct pupils to an improved understanding of their external behaviour as being important for their learning achievements and outcomes. This phenomenon can be interpreted in two ways: on one hand, pupils seem to be skilled and willing to regulate their behaviour in order to improve their learning, and on the other hand, they seem to need external guidance to monitor their learning. Thus, they use metacognitive skills to reflect on the information received via technology-enhanced feedback and try to adapt their behaviour to meet the desired criteria. Yet, at

the same time, their knowledge of knowing (Winne & Nesbit, 2009) is based on external control targeted at surface level behaviour instead of the deeper learning processes.

Regulation of feelings play an important role in self-regulated learning (Zimmermann, 2000) and emotions have an impact on learning in technology-enhanced environments (Loderer et al., 2018). Also in this study, both pleasant and unpleasant emotions related to technology-enhanced feedback were reported. Experiencing emotions represents the internal feedback processes of pupils as they described experiencing a variety of emotions when self-reflecting their performance against their goals, whether they succeeded or failed in relation to the technology-enhanced feedback they expected to receive. Hence, the successful performance seems to be important for pupils.

Some pupils in this sample experienced negative feedback as frustrating and as something that lowered their motivation, indicating that perhaps they perceived it as person-targeted criticism (Cutumisu, 2019). Thus, this study is in line with earlier findings showing that learners appreciate sensitive, encouraging feedback the most (Ferguson, 2011), although they can also adapt to desired behaviour by using hints from negative feedback. It is important to consider the effect of emotions, as pupils may read technology-enhanced feedback notes during the school day. Eynde and colleagues (2007) remind us that pupils first need support for self-regulatory skills, as receiving feedback may be also stressful.

Limitations

There could be several reasons why not every pupil wanted to participate in the interviews that formed part of this study. In the questionnaire, one-third of the reported emotions relating to the technology-enhanced feedback received were negative, but in

the interviews, almost all participants perceived the feedback notes mainly positively, indicating that pupils who wanted to participate in the interviews have a trustful relationship with adults. Ryan, Stiller and Lynch (1994), conclude that pupils who have a good relationship with adults at home also have them at school, resulting in better school adjustment and thus positive attention from teachers. In contrast, at school there are also pupils who do not trust adults (Ryan et al., 1994) and it may be that they did not wanted to share their private thoughts with researchers by participating in the interviews. According to Hughes (2010), pupils who are afraid of failure reject feedback, as they perceive it as being a negative assessment of themselves. Thus, another important reason for refusing to participate in the interviews could have been that these pupils are perhaps vulnerable to the criticism they might have received and were afraid that this could have been revealed during a group interview. Therefore, it is likely that the results of the interviews mainly represented the opinions of better-adjusted pupils who had enough courage to discuss these issues with peers and an unfamiliar adult.

Achievement emotions by Pekrun (2006; 2009) were translated and used in the questionnaire. It should be kept in mind that conceptualising the emotions may differ between countries and pupils in Finland might define for example contentment differently compared with those elsewhere.

Conclusions and future implications

Self-regulatory learners set learning goals through reflection of feedback (Zimmermann, 2000). The pupils in this study described how the technology-enhanced feedback received from teachers related mainly to their behaviour and learning outcomes, resulting perhaps in an idea that these are the more important and desired learning goals

at school. Adapting feedback related to behaviour seems to lead pupils to regulate their external behaviour rather than their inner learning processes. Thus, there is a danger that technology-enhanced feedback supports an externally-regulated surface-level approach of learning rather than development of metacognitive and self-regulatory skills as recommended in European educational policy (European Council, 2006; 2018). It may be that some teachers use technology-enhanced feedback with the intention only to support the desired behaviour of the pupils, however it could be more fruitful to target all feedback on learning as pupils' ability to self-regulate their thoughts and actions seem to be efficient. Encouraging pupils to seek feedback when they considered it to be needed (Boud & Molloy, 2013; Dawson et al., 2018) could support more meaningful learning goals.

Unfortunately, most technology-enhanced feedback seems to provide information only for parents instead of supporting the learning processes of pupils. There is evidence that feedback has impact on teacher-pupil relationship at school (Corno, 2009; Griffin, 2018) and therefore it is likely, that feedback affects also parent-child interaction at home. It should be studied, how pupils perceive feedback delivered via their parents. However, this being the case, more importantly we should provide teachers more support and detailed instructions to guide the feedback processes.

Pekrun and colleagues (2002) concluded that experiencing strong emotions may reduce the capacity to use cognitive resources. In this study, pupils reported experiencing a variety of both pleasant and unpleasant emotions during the lesson related to received technology-enhanced feedback, thus findings indirectly provide evidence that technology-enhanced feedback may be emotionally energy consuming and interrupt learning at least when it is targeted mostly to behaviour. However, more research is needed to confirm the connections of technology-enhanced feedback,

emotions and learning. Opportunities for effective research-based technology-enhanced feedback ought to be studied in more depth, such as through intervention, where pupils are invited to be active participants in their own learning.

Results of this study imply that technology-enhanced feedback supports somewhat old-fashioned paradigm of learning, in which the role of a pupil is not the one of autonomous learner but instead to adapt to the teachers' evaluation. Therefore, platforms used in educational purposes should be developed in a way that they would enable more meaningful methods, especially pupils' active participation and interaction between teachers and pupils. Pupils should be encouraged to seek and reflect the feedback by themselves. Moreover, teachers should avoid targeting their feedback towards outcomes or behaviour only as it seems that pupils may perceive those as person-targeted criticism harmful for learning. To reach the current paradigm of lifelong learning, a step should be taken towards technology-enhanced feedback as a process to support learning and trusting pupils' self-regulatory and metacognitive skills.

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