Developing a Novel Interface for Capturing Self Reports of Affect

Abstract
This paper describes the Subtle Stone, a tangible handheld tool which supports the communication of emotional experience in the classroom. The results of an initial evaluation suggest that this novel interface is easy to use within a busy working context, and renders the concept of emotion more accessible to young learners. The highly adaptable nature of the tool may make it a useful research instrument within other experimental contexts as well as a communication device for different experiential reports.

ACM Classification Keywords
H5.2. User Interfaces

Keywords
Emotion, Affect, Handheld Devices, User Studies

Introduction
Teachers, parents and learners have considered emotion essential to the learning process for centuries, yet it is only in the last thirty years that the links between emotion and learning have been empirically explored. In conjunction there has been increased inclusion and time given to emotion within educational practice. This greater awareness of the role emotion plays not only in learning and education, but also within

Madeline Alsmeyer
Department of Informatics
School of Science and Technology
University of Sussex,
BN1 9QJ, UK
madela@sussex.ac.uk

Rosemary Luckin
London Knowledge Lab
School of Education
23-29 Emerald Street,
London,
WC1N 3QS
r.luckin@ioe.ac.uk

Judith Good
Department of Informatics
School of Science and Technology
University of Sussex,
BN1 9QJ, UK
J.Good@sussex.ac.uk

Copyright is held by the author/owner(s).
ACM 978-1-60558-012-8/08/04.
broader HCI concerns such as user experience [6] has encouraged researchers to explore the extent to which technology might be used to evaluate emotional experience [see 7 for a review of techniques]. But surprisingly research has neglected to explore how technologies might be incorporated into formal learning settings (e.g. the classroom) to support the emotional experience of learning within these contexts. Perhaps this lack of research is due to the assumption that humans are good at recognising and reacting appropriately to the emotional experiences of other humans and therefore teachers will naturally be able to recognise the emotional experiences of their pupils [4]. Yet, other research suggests the expression of emotion is context dependent [3] and as a result of our previous research [1] we hypothesise that the British school or classroom context is not conducive to extensive emotional expressivity. The students within the classes participating in our studies did not express their emotional experiences through typical channels, such as facial expressions, body language or vocalisations. So, whilst there is a belief that emotions are inseparable from the learning process, the teacher’s (or indeed the other students’) job of supporting “useful” emotional experiences becomes near impossible since there is little information to guide the teacher as to what emotions are being experienced by their students. The key contribution of our work is the design of a tool which provides a private channel for emotional communication between young learners (aged 11-14 years) and their teacher. The tool provides a means through which students can privately tell their teacher about changes in their emotional experience whenever they want. The incorporation of this tool into the classroom not only makes clear to the class teacher how their lessons impact on students’ emotional experiences, but can in addition increase researchers’ understanding of the emotional lives of young teenagers and the emotional landscape of the school classroom. Students can benefit from use of the tool, not least because it enables teachers to better adapt their methods to the needs of the students, but furthermore, by providing a channel for emotional expressivity in the classroom we can encourage greater reflection and understanding in student users about the emotional side of their own learning. The tool also allows for further investigation of the relationship between the perception of a learner’s emotional state by a teacher and the learner themselves.

Inspiration for Tool Design

Traditionally self report tools of emotion have been retrospective and based upon questionnaire or reflective interview strategies.

In recent years a number of novel approaches have been devised for collecting self reports of emotional experience. The sensual evaluation instrument [5] allows users to provide meaningful emotional feedback to observers whilst interacting with a computer system. The sensual evaluation instrument is a haptic instrument made up of a number of anthromorphic forms which individually create a strong sense of a particular emotion, whilst at the same time being free from the narratives which might impact on the way in which the instrument is used.

Stahl et al [9] have also proposed a methodology for communicating emotional experience which emphasises the physical aspect of the emotional experience. Emotional expressivity is achieved within text messages
by generating a coloured, shaped and animated background through the shaking, pressing and moving of a phone’s stylus. Similar to Isbister’s methodology [5] it is non-verbal and emphasises the somewhat subtle and subjective nature of everyday emotion.

Evaluations of these methodologies report that the participants found the use of tangible, bodily and sensory channels for communicating emotional experiences enjoyable and engaging. This notion of encouraging engagement in the process of self reporting emotional experience is an important finding and something which we have incorporated in our own tool design to encourage independent use of the tool by the students in the classroom.

However, neither of these methodologies is an answer to the emotional communication gap within the classroom. Whilst subtlety is an important aspect of the emotional experience, one of the distinct difficulties teachers have in interpreting students’ emotional experiences in the classroom is exactly because the expression of these experiences is subtle. These tools may therefore be too subjective and subtle to enable a teacher to understand and react according to the emotional experiences expressed by their students.

The next section will discuss the requirements and initial design of a tool aimed specifically at bridging this emotional communication gap within the classroom.

**The Subtle Stone**

*Design Requirements*

Based on two previous studies [1] we have developed a number of requirements for a tool to be used by 11 – 14 year olds in high school learning contexts to report subjective emotional experiences.

**Privacy of Communication**

Since our hypothesis is that the social context of the classroom hinders the expression of emotional experience, it follows that a tool should provide a means for private communication between a student and their teacher.

**Real Time Information**

We propose that it is real time emotional communication between students and their teacher which is lacking within the classroom experience. A provision of real time information may help the teacher to further understand the impacts of their teaching methods as well as empowering a teacher with extra information so he or she can know when a teaching plan needs to be adapted throughout a lesson in order to better meet the needs of the students.

**Easy to Use and Interpret**

Anything used in the classroom shouldn’t detract from the learning experience itself. The tool should not just be easy to use, but the concept also accessible to young learners. Whilst non-categorical emotional information is an interesting source of emotional data, a teacher has little time to spend interpreting the emotional content of messages sent by students, as such the tool should allow for the communication of categorical emotional data.

*A Description of the Subtle Stone*

The Subtle Stone is a handheld, squeezable instrument (Figures 1 and 2). The tool uses the notion of colour as a means of supporting private communication between
a student and their teacher. At present, the Subtle Stone displays seven different colours and can communicate seven different emotions.

At the start of use each student develops their own colour:emotion language by choosing which colour signifies which emotion (out of a fixed set of emotions). Only the teacher can access a decryption of this secret language, unless the student wants to share it with his or her fellow students.

Each Subtle Stone is wired to an EZIO board which is connected to the teacher interface via an RS232 cable. The Subtle Stone is (in this version) an adaptation of a commercially available juggling ball. As it stands the teacher interface is an abstraction of the classroom (see Figure 3), with an individual person-shaped object representing each of the students using a Subtle Stone. Whenever a student chooses to report an emotion to their teacher, they select the appropriate colour on their Subtle Stone by squeezing the stone until it displays the colour. In response, the student’s representation on the teacher’s interface changes colour. However, it would be implausible to expect a teacher to recall each individual’s colour:emotion language, so the colour transmitted by the Subtle Stone is translated into the appropriate colour as defined by the teacher’s colour:emotion language.

**Taking the Subtle Stones to School**

We wanted to explore a number of issues relating to the use of such an instrument within a live classroom environment, for example:

- Is the Subtle Stone and the teacher interface intuitive and easy to use?
- How useful is the concept of colour as a means of communicating emotional information?
- Does the Subtle Stone bridge the communication gap in the classroom, i.e. does it provide enough privacy to users that they feel comfortable using it to communicate emotional experiences to their teacher?

We gave eight high school students and a German language teacher the Subtle Stone technology to use throughout a four week long evaluation. Four of the students were year seven students (aged 11 – 12) and the Subtle Stone technology was available for use throughout 10 hours of their timetabled German language classes. The four other students were year nine students (aged 13 – 14) and the Subtle Stone technology was available for use throughout six hours of their timetabled German language lessons.

The four students within each class were chosen based on discussions with the class teacher to ensure that a reasonable spread of personalities (shy vs. outgoing) and abilities were included in each user group.

At the beginning of the study the concept of emotion was discussed with the participants and the Subtle Stones were introduced. The students discussed and chose together which emotions they would like to incorporate within their colour:emotion language and individually set up their own colour:emotion language. In this study the students chose to include motivation, pride, enjoyment, confidence, relief, boredom and frustration. The Subtle Stones were available for use within each German language class throughout the period of the study. The use of each Subtle Stone was logged and the classes were video recorded. After the study, a semi-structured interview was conducted with
each individual student and finally the teacher to collect user experience data.

The log and video data is being analysed, the results of which will feed into the next iteration of the design.

**User Experience Data**
The methodology has been designed for use within a live learning experience, so it is of utmost importance that the Subtle Stone technology is easy and intuitive to use. In general, the transcribed interviews show that the inclusion of the Subtle Stones within the classroom was initially distracting for the students (which was evident not only within the interviews, but also during classroom observations). However, as the study continued, the Subtle Stones became less of a novelty and less of a distraction.

**Interviewer:** How distracting did you find using the Subtle Stone?
**Student 8:** It was a little bit at first but then you sort of get used to just clicking them when you feel something.

In a previous study [2] we found that the emotional terms typically used by researchers [for example those used in 8] were inaccessible for 25% of the target age group. We wanted to find out whether the incorporation of colour as a metaphor for emotion might encourage greater engagement with emotional concepts. In general, interviews with the participants suggest that the use of colour was easier to understand than the use of the emotional terms themselves.

**Interviewer:** So what did you think about using the colours and linking them to emotions rather than using the words themselves?
**Student 5:** Umm, the colour coding is easier to understand, so yeah.

We were also concerned as to whether the design of Subtle Stones enabled or encouraged the students to communicate their emotional experiences with their teacher. As Figure 4 illustrates, the Subtle Stones were regularly used by the students throughout their lessons, with the younger participants reporting on average 14 emotions to their teacher over the period of an hour, and the older participants reporting 5 emotions to their teacher over the same period.

The class teacher reported finding the students’ reports of emotional experience useful and sometimes eye opening in terms of which aspects of his lessons had particular effects on the students. But, he felt that the volume of information provided by the students was overwhelming and at times he simply did not know how to react to the received emotional information.

**Conclusions and Ongoing Work**
The Subtle Stone is a novel method for the capture of affective and emotional information. It is the first tool to address the emotional communication gap which exists in the classroom. It has been specifically designed to provide real time, private emotional communication between students and their teacher. The Subtle Stone is based on colour which renders it highly adaptable and personalisable. Whilst the Subtle Stone has a clear application within formal education setting, it may also be of use within broader HCI settings, in particular in the evaluation of user experience in mobile or exploratory settings. Due to its semantic flexibility the Subtle Stone could also be used.
to support the subtle communication of a number of other discrete concepts. For example, the tool could be used as a communication interface between patient and nurses to support patient care.

Further development of the Subtle Stone technology is already in progress. Currently a wireless solution is being explored, which would greatly improve the current design, particularly as it will reduce set up time as well as trip hazards within the classroom. As a consequence, a follow up study is in preparation which will incorporate a greater number of simultaneous student users. This will enable wider generalisation in our accounts of experience for teachers and students using the Subtle Stone in the classroom and furthermore allow for deeper investigation into the emotional landscape of the classroom.

Based on results from the previous study, the teacher interface is being re-developed to provide a higher level of abstraction of the students' self reports. Rather than provide the teacher with the unfiltered data (as in the last study) we will instead filter the information so that the teacher is only alerted when a student reports to have moved from a positive learning mood to a negative learning mood and vice versa and furthermore when a student has reported experiencing a negative learning mood for a prolonged period of time. Future versions of the Subtle Stone may also incorporate biometric sensors to provide further emotional experience data. Further work will investigate what support could be offered to help teachers manage the emotional experiences of their students.

Acknowledgements

Many thanks to Rose Luckin, Judith Good, Eric Harris, Geraldine Fitzpatrick and the teachers and students of Sackville School.

Citations