Teaching and Developing Social and Emotional Skills with Technology

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1. INTRODUCTION

Primary aim of this paper is to provide a foundation and set an agenda for future research on the design of technology that would support, and help teach, social and emotional skills. By doing so, we also outline the novel opportunities and challenges this would pose to HCI.

Social and emotional skills refer to a range of skills that are crucial for our everyday life and healthy development [Weare and Nind 2011; Adi and Killoran 2009; **?**]. We define the term broadly here to include skills such as those related to emotional intelligence, interpersonal and communication skills, but also abilities such as mindfulness, self-control or empathy. The importance of such skills for personal competence and well-being is acknowledged both in research [Durlak et al. 2011; Greenberg 2010; Stepien and Baernstein 2006; Barth and Lannen 2011] and industry [Carey et al. 2011; Bono et al. 2009]. Moreover, domains such as education (from kindergarden to university education), workplace, therapy, training for medical personel or social work especially value social and emotional skills, with extensive literature on strategies on how to teach these available.

We see an increasing number of interventions and courses specifically designed to teach social and emotional skills in these areas, substantiated by a large body of peer-reviewed, scientific literature showing that *such skills are teachable* and *interventions can lead to measurable improvements*. For an example, Durlak et al. [2011] recently reviewed the effects of more than 200 interventions within primary and secondary schools, encompassing more than 270000 students. The calculated effect sizes averaged out to an 11% improvement in achievement tests and 10% decrease in classroom misbehaviour, with the effects lasting for at least 6 months after the intervention. However, very little technology gets used in the current curricula, despite its potential to help tackle some of the key challenges present.

This potential is further supported by the initial work within HCI research relevant to teaching (or influencing) social and emotional skills, and growing interests in similar topics within HCI as evidenced below. For example, we have seen work in:

— [[will need to split and elaborate a bit on each point (but not too much)]]
— autism [Escobedo et al. 2012; Porayska-Pomsta et al. 2011; Zarin and Fallman 2011; Tentori and Hayes 2010; Gotsis et al. 2010];
— facilitated therapy [Coyle et al. 2011; Matthews and Doherty 2011; de Sá et al. 2010; Hancock et al. 2010];
— as well as smaller scale systems aiming to influence particular social behaviour (e.g., discussion dominance, or rapport), but not being part of any larger intervention or curricula [Narumi et al. 2009; Piper et al. 2006; Balaam et al. 2011; Kim et al. 2008b; McAtamney and Parker 2006; Schroyen et al. 2008; Kim et al. 2008a; Toups and Kerne 2007; Kreitmayer et al. 2012; Daily 2010].
— we see also beginning of a wider interest in similar topics within HCI, as exemplified, e.g., by
    — CHI12 workshop on Interaction Design and Emotional Wellbeing,
    — Special Interest Group on Work life balance in HCI,
    — Patient-Clinician Communication workshop at CHI'13.
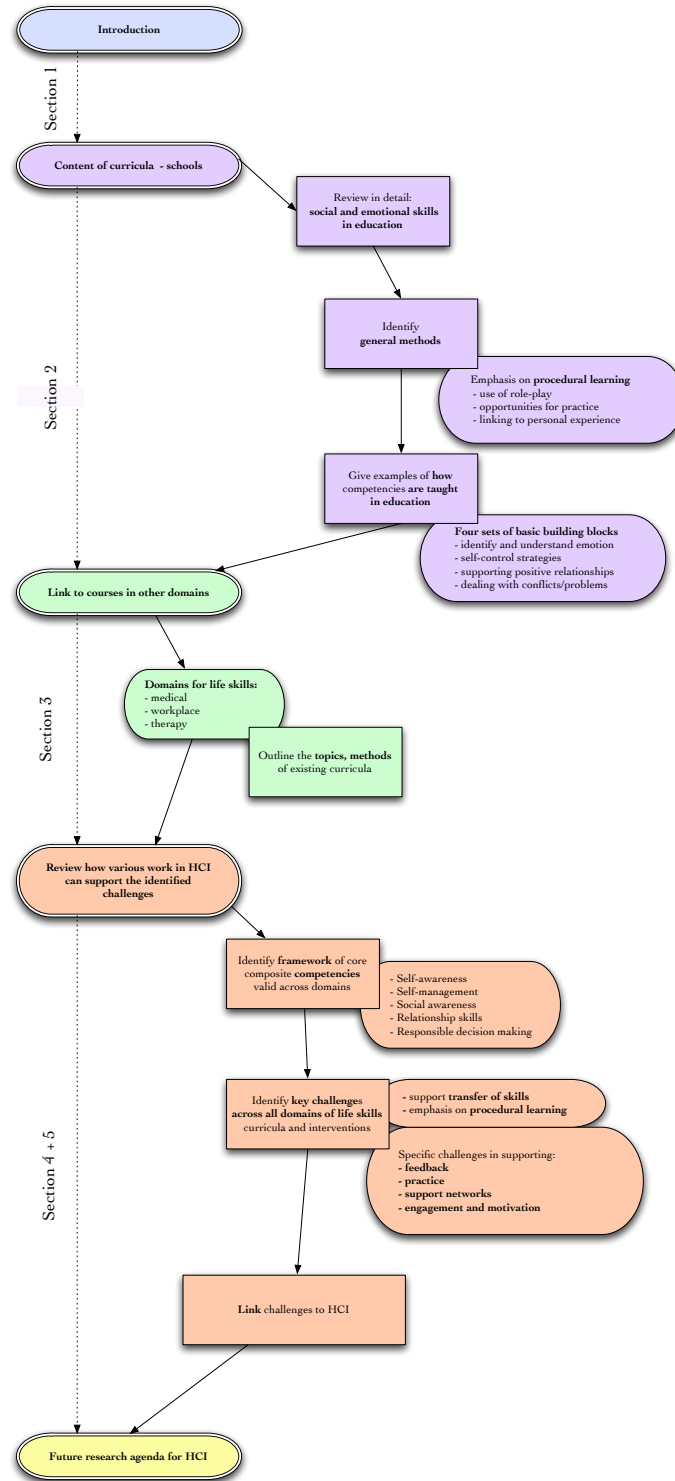
Fig. 1. Diagram of the sections links – too much detail for the final version, kept here just to help provide an overview in case some of the heads ups in the text are not good enough yet.

Still, the potential connections to social and emotional skills training and development have not been addressed in a systematic way so far. Moreover, we aim to show that much existing work, that was not so far connected to social skills training at all, is actually highly relevant and could be very beneficial for existing curricula. We will review such connections in more detail within Section 5.

This paper reviews literature across various areas where social and emotional skills teaching is key, building on what has previously been good but isolated work to present a more principled approach to defining a systematic programme for HCI. In particular, we argue that there are similar key challenges to teaching social and emotional skills across all domains that can be likely addressed by state of the art technology, and that such focus will also raise new opportunities and challenges to HCI research. Based on identifying the core goals, methods and basic building blocks of social and emotional skills interventions and courses, we draw out key aspects where HCI involvement would be useful, and provide a roadmap for further research into this topic. The identified aspects build, for example, on the emphasis social and emotional skills interventions and courses place on procedural learning, i.e., need for substantial practice and feedback; or on key importance of transfer of learned skills into the real world which fits well into, and can easily benefit from, the ubiquitous computing and "into the wild" research within HCI.

See Figure 1 for a diagram of paper structure, and for the overview of the main results. We start with a detailed review of social and emotional learning (SEL) in schools (Section 2), which we use to create a better understanding of what skills get taught and how. Section 3 discusses how the topics and issues found within education extend to other domains such as workplace settings, medical personnel, therapy and everyday social and emotional skills. Sections 5 and 4 then take an HCI perspective again, identifying topics and challenges within the existing programs, tying these to potential technology support, and suggest a broad research agenda for HCI. This specifically builds on the detailed description of the approaches and strategies used to teach skills in SEL in education, linking them to particular examples of, and opportunities for, HCI research.

2. LIFE SKILLS COURSES' CONTENTS WITHIN EDUCATION

This and the next section focus on social and emotional skills courses and curricula in more detail. We analyse (i) what are the core skills that get taught; and (ii) how do existing programs approach this. We specifically aim to identify and highlight aspects and challenges relevant to HCI perspective.

2.1. Social and emotional learning (SEL) for schools

We chose social and emotional learning (SEL) in schools as an examplary domain we review in detail and return to other domains in the next section. We outline the reasons for this choice below:

First, skills taught in school based curricula are those that have been identified by psychologists and educators as crucial not only to development in childhood and teenage years, but more importantly as key for adult life [Greenberg 2010]. In particular, it focuses on large span of ages (kindergarden to university) and virtually all social skills important in adult life. As such, it encompasses the goals of other life skills domains, which often take a more specific emphasis on particular social skills and consider various social skills to be already developed and available.

Second, SEL has more than 20 years long history of peer-reviewed, evidence based programs. These have been already deployed to hundreds of thousands pupils. For example, Durlak et al. [2011] reviews 213 programs encompasing more than 270000 students of all ages, with the interventions conducted over several years. Some studies
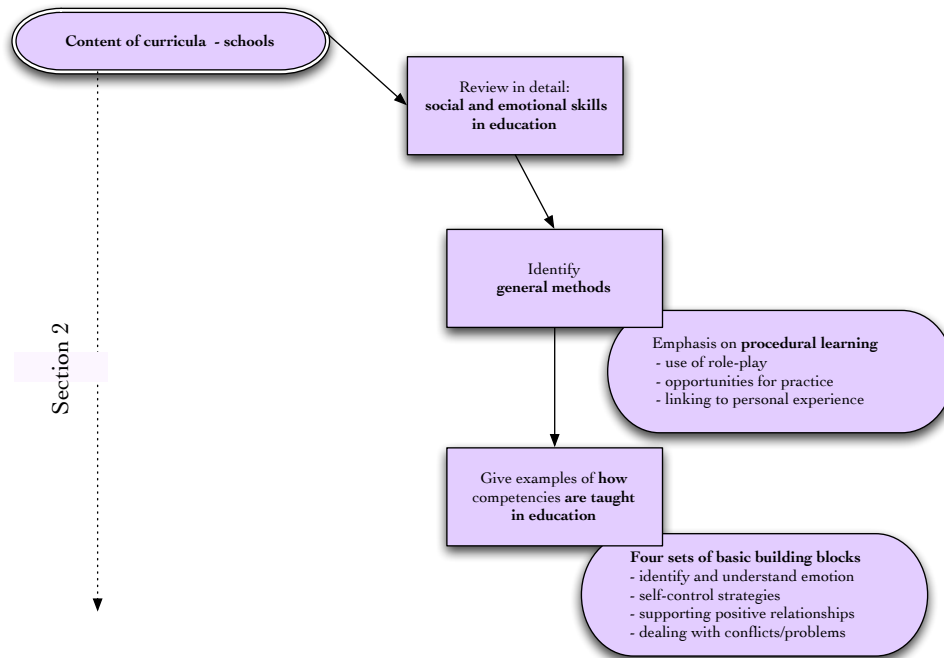
Fig. 2. Section diagram ... is this useful in some form?

have their effects tracked for even longer periods of time, as is the case for Muennig et al. [2009] who have recently presented a 37-year follow-up results of a randomized controlled trial. Such results suggest that the field is most likely already matured, with a number of well-researched approaches.

Third, recent academic reviews map the evidence showing positive effects of SEL in randomised trials in improving academic performance [Durlak et al. 2011; Greenberg 2010; Weare and Nind 2011] and teaching social and emotional skills has been also shown to impact many other ~~on~~ problematic aspects of behaviour such as mental health promotion [?], violence prevention [?; ?] conflict resolution [?; ?] and bullying [?; ?].

We will now present specific examples outlining the *methods* by which teaching of such social skills competencies can be done (section 2.2) as well as the *basic building blocks* through which it takes place (section 2.3). In doing so, this section draws on a thorough analysis of the literature available for the curricula selected in CASEL Effective SEL Programs guide 2013 and 2003 [CASEL 2013; 2003] as well as the literature referenced within key academic reviews of the SEL domain [Durlak et al. 2011; Weare and Nind 2011; Adi and Killoran 2009; Greenberg 2010; Elbertson et al. 2009; Payton et al. 2008]. See Figure 2

2.2. General methods in SEL for schools

The key concern acknowledged by all curricula is that social and emotional skills are mostly based on procedural rather than declarative knowledge [Kruglanski and Higgins 2007, p.288]. In particular, social and emotional skills are highly complex abilities, strongly dependent on external inputs and context. In other words, although people often have intuitive knowledge on how to react, it is problematic to explicitly articulate

the processing rules by which they came to these conclusions. Examples of similar dependency on procedural skills can be readily found also in other aspects of our life such as language use, where we know which form in our native language is correct but not necessarily why ("it sounds better"); or social cognition where, for example, people are very sensitive to correct proportions of human face, but are not able to correctly articulate even the most basic ones explicitly [Lewicki et al. 1987]. Moreover, the key ability for social and emotional skills is to be able to react accordingly even within 'hot' moments, i.e., despite being overwhelmed with emotions or importance of the situation. During these moments, the ability of conscious, analytical thought is often diminished [Wyman et al. 2010; **?**]. Such strong emphasis on procedural learning is also one of the main differences of teaching social and emotional skills to other parts of education, which gives more emphasis on declarative learning.

The key focus on procedural learning is highlighted also by the methods used for teaching for social skills courses. In particular, we identified several general methods and approaches used across virtually all curricula. First is focus on *extensive examples and opportunities for personal experience and practice*; often through role play. Second, curricula attempt to break the skills down into 'digestable' bits, focusing first on simple model situations, exploring these by role play, and only then linking to other known experiences. Such experiences are then drawn from real issues/experiences of the class, or linked to a book, personal narative etc. Second, even more importantly, there is a strong emphasis on *transfer of skills* outside everyday contexts. This involves providing opportunities for the learners to practice and get feedback on their new skills also in real life situations outside of the classroom. While such trasfer of skills acknowledged as key by many curricula [[refs]], this is still facilitated mainly by traditional means such as posters around the school (increasing awareness), or letters to parents (asking them to help kids trained).

In summary, the curricula aim to help children and teenagers to make the skills and concepts tangible, understandable, and support personal experience whenever possible. As such, emphasis is on repeated practice, e.g., through role play, and on transfering the learnt skills into the everyday situations, outside of the classical training context. The next section gives specific examples of such methods.

2.3 Basic building blocks used in SEL

This section outlines the commonalities among curricula in terms of (i) what gets taught; (ii) how; and (iii) in what order. Similarly to above, we draw on thorough perusal of literature describing the twenty-three interventions selected as effective by CASEL [2013]; as well as other related literature.

Building on this material, we identified four key *basic building blocks* that are common across most of the curricula. Each basic block comprises a number of simple situations or goals (e.g., being able to identify when becoming angry) and ways to train these. In addition, these sets of situations and exercises share a common, overarching focus. In particular, these blocks address skills related to:

(1) identifying and understanding emotions;
(2) self-control;
(3) communicating well (to facilitate positive relationships);
(4) dealing with conflicts and problematic situations.

These basic building blocks depend on each other in a sequential manner, as indicated in Figure 3. For example, the ability to identify and understand emotions is key for self-control (without knowing about your emotions, one cannot control them), which is in turn needed for facilitating cooperation (taking the perspective of another and not jumping to conclusions) etc. As such, they are mostly taught in the order as shown at
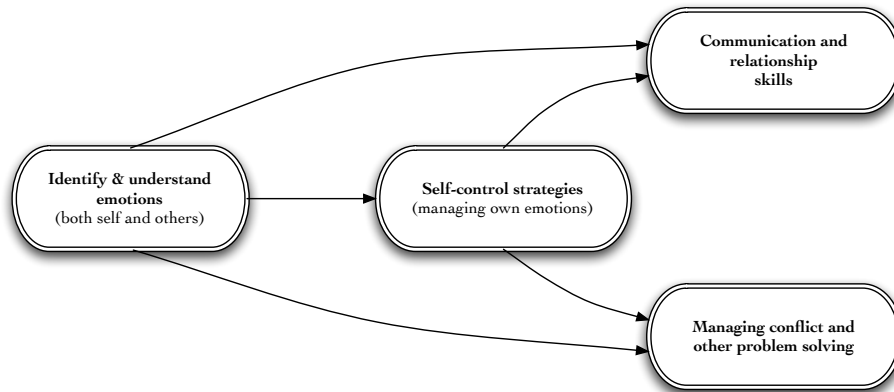
Fig. 3. Dependencies between the focal points

Figure 3. We outline each building block briefly in the rest of this section, together with a few illustratory examples of specific activities.

2.3.1. Identifying and understanding of emotions. The ability to identify and understand own and others' emotions is a precursor of most other social and emotional skills and, as such, is the first aspect taught in many curricula – see the footnote for a list[1]. Overall, the emphasis is on developing emotional awareness, which is the ability to differenciate, name and notice subtle changes of emotions. The curricula aim to train a practice of internal reflection, leading to continuous exploration of how we and others feel. Emphasis is also on distinguishing between feeling a particular way is different from acting upon that feeling/urge.

Two general approaches are used: First is based on language usage and how that affects our thinking processes. Various exercises focus on developing the ability to identify and name emotions in both oneself and others, helping learners to become more reflexive and self-aware. As an example, PATHS curriculum includes physical "Feeling Faces" cards, which kids use to signal their current emotional state throughout the day [Kam et al. 2004; Domitrovich et al. 2007]. Similarly, RULER curriculum uses popular stories to exemplify particular emotions, or draw out distinctions among subtle variants of a specific one [Reyes et al. 2012].

Second approach aims to support self-reflexion by exploring and understanding how particular emotions affect our bodies when we feel them. For an example from the Incredible Years Curriculum, "children are helped to recognize their own feelings by checking their bodies and faces for 'tight' or relaxed muscles, frowns, smiles, and sensations in other parts of their bodies such as butterflies in their stomachs. Matching the facial expressions and body postures shown on cue cards helps the children to recognize the cues from their own bodies and associate a word with these feelings" [Webster-Stratton and Reid 2004].

Similarly, emotions of others are explored through the ways in which they affect the tone of voice, body language etc. This is often incorporated as a game, e.g., "developing the "detective skills" to find out how others feel". Constant use of similar activities aims

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[1]Caring School Community, I can problem solve, Life Skills Training, PATHS, Peace Works, Quest (Violence Prevention Series), Open Circle, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, 4Rs, Competent Kids, The Incredible Years Series, Michigan Model for Health, MindUP, RULER, Social decision making, Steps to respect, Too Good For Violence. **21 in total**

to help learners think more often about how they, and others, might feel in various situations.

2.3.2. Self-control strategies. Self control and management of own emotions is another key aspect present virtually in all curricula[2]. The set of techniques used to developed self control builds on emotional awareness, aiming to teach strategies for managing strong emotions once they are recognised.

Two general approaches are often used: First are various strategies and exercises aiming to help participants to relax and/or calm down once a strong feeling is recognised. These are often based on various physiological exercises (such as muscles stretching) or deep breathing techniques. The second large set of strategies is based on the concept of verbal labelling. These techniques build on psychology and neuroscience findings showing that once a strong emotion is identified, consciously naming and acknowledging it facilitates higher cognitive control over the emotional state, see e.g., [Greenberg 2006; Reyes et al. 2012] for more details. Thus supporting explicit acknowledgement that one feels a particular emotions, as well as thinking about what could be its cause, are often used.

Specific strategies for anger management are particularly common. These often combine both verbal labelling and physical relaxation exercises approaches, for example as in the "Turtle technique" [Robin et al. 1976] which is still used in a number of curricula.

2.3.3. Communication skills. This set of activities focuses on building good communication skills and supporting positive interactions with others[3]. In general, the skills taught here aim at supporting respectful communication and thus implicitly, facilitating friendship relationships, ability to collaborate and avoiding conflicts that could otherwise occur through misunderstanding.

Generally, emphasis is on teaching active listening, which is then used to facilitate teaching empathy. Other teaching strategies also focus on training of specific communication skills (e.g., giving and accepting compliments). Example exercises include games to induce collaborative activities, practicing active listening, e.g., through listening to someone telling a story and then trying to rephrase it with as many details as possible; or disagreeing respectfully. In one example, students are taught to use "I" sentences, i.e., rather "I feel angry when you don't listen because it makes me feel ignored", than "Why aren't you listening!" [Aber et al. 1998].

2.3.4. Dealing with conflicts and problematic situations. The last building block of most curricula[4] is teaching approaches to problem solving strategies. These often emphasise that, for most conflicts, there is a "win-win" scenario. Violence prevention is commonly

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[2]Life Skills Training, Lion's Quest, PATHS, Peace Works, Productive Conflict Resolution Program , Quest (Violence Prevention Series), Open Circle, RCCP, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, Teenage Health teaching Modules, 4Rs, Al's Pals, Competent Kids, The Incredible Years Series, MindUP, Positive Action, RULER, Steps to respect, Too Good For Violence. **24 in total**

[3]While implicit in many others, this aspect is explicitly highlighted within the following curricula: Michigan Model for Comprehensive Scholl health Education, Peace Works, Open Circle, RCCP, Responsive Classroom, Second Step, SOAR, Tribes, Al's Pals, The Incredible Years Series, MindUP, Positive Action, Steps to respect curricula. **13 in total.**

[4]Michigan Model for Comprehensive Scholl health Education, PATHS, Peace Works, Productive Conflict Resolution Program, Quest (Violence Prevention Series), Open Circle, RCCP, RIPP, Responsive Classroom, Second Step, SOAR, Social Decision Making and Problem Solving Program, Tribes, 4Rs, Al's Pals, I Can Problem Solve, Competent Kids, The Incredible Years Series, Positive Action, Social decision making, Steps to respect, Too Good For Violence. **22 in total**

an important additional goal, as many of these curricula are designed also for schools and neighbourhoods with high prevalence of aggression and weapons.

The method of choice is mainly focus on structured ways of reacting, further building on communication skills and self-control. Many approaches are based on a "stop and think and evaluate before you react" approach, as conflicts tend to ignite strong emotions. For example, PATHS curriculum includes a "semaphore", where the sequence of red-yellow-green indicated the stop-think-proceed [Kam et al. 2004; Domitrovich et al. 2007]. Such structured sequences always include and emphasise a goal setting and evaluation phase. Moreover, curricula aim to teach children and teenagers to recognise which conflicts might have arisen from misunderstanding, with perspective taking exercises being the key approach. An example are workshops focusing on win-win negotiation (e.g., RCCP) and providing suggested sequences for steps to take during disagreements (e.g., Incredible Years).

2.4. Summary of SEL for education

We chose to describe the social and emotional learning in education in detail as: (i) it has long history of research and high number of evidence-based curricula, described in academic literature; (ii) focuses on large span of ages and skills; and (iii) rigorous studies testing its positive effects exist. We also argue that due to these properties, it can provide an initial structure to encompass social and emotional skills training approaches also in other domains. Based on an extensive review of the existing literature, we:

(1) Outline the **general methods** used to teach these skills: focus on procedural learning meaning a lot of practice, need for feedback, and strong emphasis on supporting transfer of learnt skills into the real-world.
(2) We also identified four **basic building blocks**, which are key sets of strategies and tasks used in the curricula as a way to reach the competencies. This provides specific examples of how the contents of the curricula look like, and will allow us to tie it in with the challenges and opportunities for HCI in Section 5.

[[Supplement by pointing to 4-5 key papers that each describes particular curricula in good detail?]]

3. COURSE CONTENTS IN OTHER DOMAINS

This section reviews some of the other domains where social and emotional skills are key. Each is more specialised than the SEL in education and each highlights particular sets of skills while downplaying others (or assuming the learners already mastered them). We do not go into such detail as in SEL in education [[reason needed? – space? need to get to the meat quicker?]]. We list the key topics addressed in each domain and outline the general methods used for teaching these, but do not identify the basic building blocks as we did for SEL in education. Instead, we provide pointers and short descriptions of selected reviews for each domain.

3.1. Workplace and business related

Focus on emotional and social skills teaching has a long history in the workplace, e.g., [Bailey and Butcher 1983b; 1983a], appearing under a wide range of labels such as interpersonal skills, soft-skills or, more recently, emotional intelligence. Social and emotional skills training appears both as a part of educational contexts such as MBA or undergraduate business students, but also later in the career, e.g., any companies offer soft-skills courses or coaching to their executives. Academic literature shows positive effects of such training [Arthur, Winfred et al. 2003]. However, training programs have been often developed outside of academic community, might not be directly based on

scientific evidence, and detailed information about the contents is not widely available [Walter et al. 2011; Clarke 2006; **?**]. Give some arguments why this can be expected (too big a business deal, hard to run academic studies in companies etc.(?))

—*Methods:* Overall, majority of courses follows similar strategies: role-play as a key approach, together with discussion of fictional and real life cases, demonstrations and modeling. Emphasis is placed on *procedural learning* and the opportunity to practice and automate the skills. Time-frames differ from a few hour long course to multi-day or even longer term learning (e.g., as in coaching).
—*Topics*:
  —Focus on courses developing aspects of *emotional intelligence*, i.e., [[fill in from Mayer2008]].
  —Specialised leadership programs ... focus often on relationship skills [[(such as conflict management and interviewing)]] and self-management [[(e.g., dealing with stress)]], but also, e.g., the links to time-management activities.
  —Coaching – inherently client based, with the goals depending on the situation. The general techniques involve emphasis on honest feedback, supporting reflection and trying things in real-world situations.
—*Reviews:* Point to recent, excellent reviews of this literature (each with a short description?) [Bono et al. 2009; Feldman and Lankau 2005; Carey et al. 2011; Arthur, Winfred et al. 2003]

3.2. Medical settings

Social skills such as communication skills or empathy are gaining importance in medical community, e.g., [Rider and Keefer 2006; Barth and Lannen 2011; Makoul and Curry 2007; **?**]. There are three key areas are highlighted: training of medical students during university [Kalet et al. 2004]; support/courses for practicing doctors [ref?]; and specialised groups of doctors and nurses, such as cancer care or end-of-life care, where specific skills related to empathy and communication are even more important (e.g., when giving bad news to patient) [Tulsky et al. 2011].

—*Methods:* Role play with peers or trained actors is emphasised [Stepien and Baernstein 2006; **?**; Kalet et al. 2004; Barth and Lannen 2011], followed by facilitator or peer based feedback [Rao et al. 2007]. Courses also include workshops, lectures, discussions of case studies. Many courses that aim at general communication skills include scripted exchanges or examples to practice on.
—*Topics:*
  —Strong focus on generic communication skills, supporting patient/clinitian encounters. Emphasis on both the ability to inquire for diagnosis related information as well as communicate the results clearly (e.g., [Kalet et al. 2004; Barth and Lannen 2011] for examples and review).
  —Second topic emphasises responding to emotions from patients [18] and the improved understanding and identification of patients psychosocial issues and concerns [13, 33, 36, 37]. As Barth oulines [Barth and Lannen 2011], without training, doctors tend to block both own and patients' emotions and concentrate on the pragmatics, which might lead to negative consequences. This is specifically important for oncology and similar disciplines, but in lesser extent also other general practice.
  —Recently also focus on "inwardly directed emotion skills such as personal reflection, mindfulness and stress management as equally important and teachable emotion skills that belong in the realm of medical education and clinical practice. [[17,18 from there]]" [Satterfield and Hughes 2007] $\Rightarrow$ links to self-awareness and self-management.

—*Reviews:* Point to recent, excellent reviews of this literature (each with a short description?): [Barth and Lannen 2011; Stepien and Baernstein 2006; Pedersen 2009; Rao et al. 2007; Satterfield and Hughes 2007]

3.3. Everyday life skills

— mention Mindfulness and calming technologies
— A way to tap into also more everyday life and self-help courses and technologies? This probably shouldn't be too long, just a one or two paragraphs pointing out that this exists.

3.4. Therapy

— .... not sure how much space this should get, given it has been already addressed in earlier work. Although, I guess that this could also point to a slightly different approaches than those used at the moment?
— Probably need to emphasise that each and every competency can be addressed, depending on the therapy style/clients issues.
— A short paragraph with link to David's review for specific work done in HCI. Plus a few sentences linking the way how students become therapists, through again role play, a lot of practice etc. Have a decent link for this [Hill et al. 2007], but will ask Stef in Nottingham for others.
— Also links to autism literature for additional examples?.

4. SUMMARY OF LIFE SKILLS TRAINING

In this section we identify what goals that are common across the domains. More importantly, we then characterise the challenges present within most of the curricula, with particular emphasis on those that could be supported by technology.

4.1. Framework of life skill goals

Despite the wide range of curricula and approaches within them, there are a over-reaching goals that most interventions have in common. A set of *five core composite competencies* is widely accepted within the educational community [Zins and Elias 2007; Durlak et al. 2011; CASEL 2003; 2013], as such a list of general goals shared by most of the existing curricula. We suggest that this list can also serve well as an initial of systematising the goals across all of the life skills training domains reviewed above. We list the competencies as per Durlak et al. [2011]:

— **Self awareness:** The ability to accurately recognize ones emotions and thoughts and their influence on behavior. This includes accurately assessing ones strengths and limitations and possessing a well-grounded sense of confidence and optimism.
— **Self-management:** The ability to regulate ones emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.
— **Social awareness:** The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.
— **Relationship skills:** The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.
— **Responsible decision making:** The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of
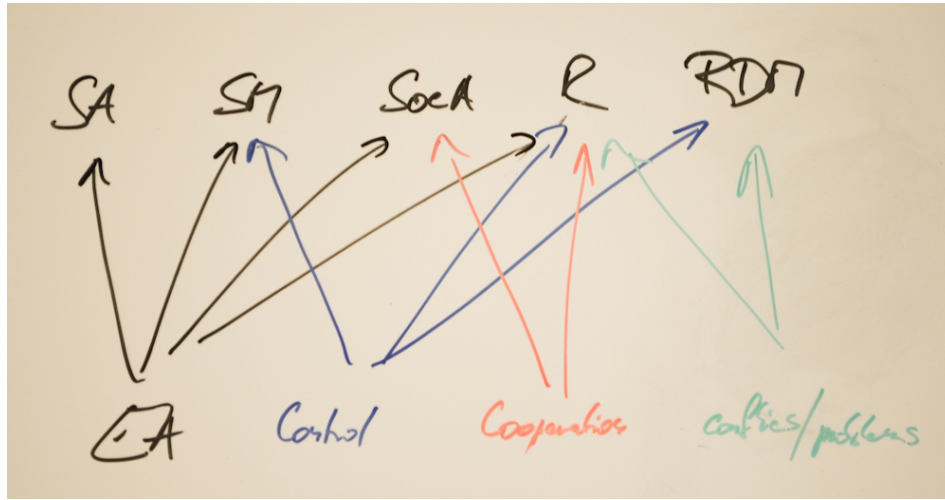
Fig. 4. Mapping of basic building blocks to competencies

	Self-awareness	Self-management	Social awareness	Relationship skills	Responsible decision making
Education	✔	✔	✔	✔	✔
Business	✔	✔		✔	
Medical			✔	✔	✘
Mindfulness	✔	✔		✘	✘
Therapy	POSSIBLY ALL, DEPENDS ON THE CLIENT/TOPIC/APPROACH				

Fig. 5. Mapping of domains to competencies – full color means strong focus, less saturated colour means that it is still emphasised but not absolutely key

ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.

Figure 4 maps how the basic building blocks identified for the educational curricula contribute to learning skills included in the goals above. Similarly, Figure 5 shows the differences in goal focus of the other domains. [[Need more detail about why this actually fits to the other domains as well? Or can we just say so and it is obvious?]]

[[More importantly ... is this subsection and the "framework of goals" actually useful at all (e.g., by giving an appearance of a clear, overreaching structure), or does it only break the flow?]]

4.2. Challenges

Based on the literature above, we identified challenges to social nad emotional skills learning, commonly appearing across all domains; with specific focus on those that could be enhanced by technology. While these challenges are not mutually exclusive, and form an interrelated structure, we distinguish them to highlight particular approaches/issues one can consider. In this sense, they are useful as they allow us to more clearly outline how this ties with (and could benefit from) HCI focus. However, we want to emphasise that any system designed will draw on multiple if not all of these aspects, although perhaps focusing on some more than the others.

First, we see that the emphasis on **practice** and providing opportunities for personal experience and exploration of the skills is consistent across all of the reviewed

domains and training approaches. Second, all curricula facilitate various ways to give the learners **feedback** on their behaviour, mostly as social and emotional skills are very complex and challenging to track easily by the learners themselves. [[Thus ... ? Do I need to link this more clearly to the review above?]] As the teacher personally (or peers) are the only ways of providing feedback in the current curricula so far, additional feedback systems based on technology could be useful to help participants receive "more" feedback, either on a more micro level or just more often. Such additional feedback opportunities would be particularly useful outside of training sessions (when the trainer or mentor is no longer available), but also during the sessions when there is often only one instructor giving feedback to many students.

Third, the core goal of all social and emotional skills training programs is to create skills that will *transfer* from the lessons also into everyday behaviour and real-world situations. There are two ways in which the curricula and courses reviewed above approach this. On one hand, they try and include real-world examples and situations within the learning context – e.g., asking students to recall and discuss particular experience they had; doctors and therapists analysing data from their own practice. However, this is still deeply rooted within the learning context. On the other, they extend the learning context also outside of the lessons by **embedding** part of it the learning into everyday life. This is highlighted as extremely important; yet the current approaches use only quite 'crude' approaches, such as posters placed around the building that should remind learners of some of the processes taught; following up in a few days after the training to help people remember what they learned, or, for educational contexts, trying to involve parents and other social contacts to help reinforce the learning and skills. [[Again explicitly mention the gap?]]

Fourth, supporting high **motivation and engagement** of the learners plays a large role in all learning experiences and is acknowledged as a challenge across all domains and curricula.

Overall, Figure 6 places all these into context: First, feedback and practice play a central role, regardless whether within or outside of the learning contexts. Second, supporting transfer of skills by embedding parts of learning into everyday contexts and real-world situations is one of the key challenges in the training reviewed above. Third, all learning experiences need to be engaging and motivating. Finally, we will argue later how the facilitated nature of most of the training programs poses a valuable setting for initial exploration of the social and emotional learning space.

The next section describes in detail how HCI can contribute to each of these central issues within social and emotional skills learning; and how doing so might also raise interesting novel questions and issues for HCI.

5. SUPPORTING LIFE SKILLS WITH TECHNOLOGY

We now return to reviewing exisiting HCI research, structuring it according to the four challenges identified above. The aim is to show potential links to existing HCI interests and results, and exemplify those by drawing on the specific teaching strategies and curricula outlined in previous sections.

5.1. Feedback

Given that many of the skills are quite complex and hard to track by the learners themselves, all curricula facilitate various ways to give feedback. These are currently based on trainers' instruction, peer feedback and evaluation, or encouradging personal post-hoc reflection. As such, there are explicit challenges and opportunities for supporting feedback outside of learning sessions as well as enhancing the feedback available within the sessions. Additionally, prior HCI research suggests that there is potential
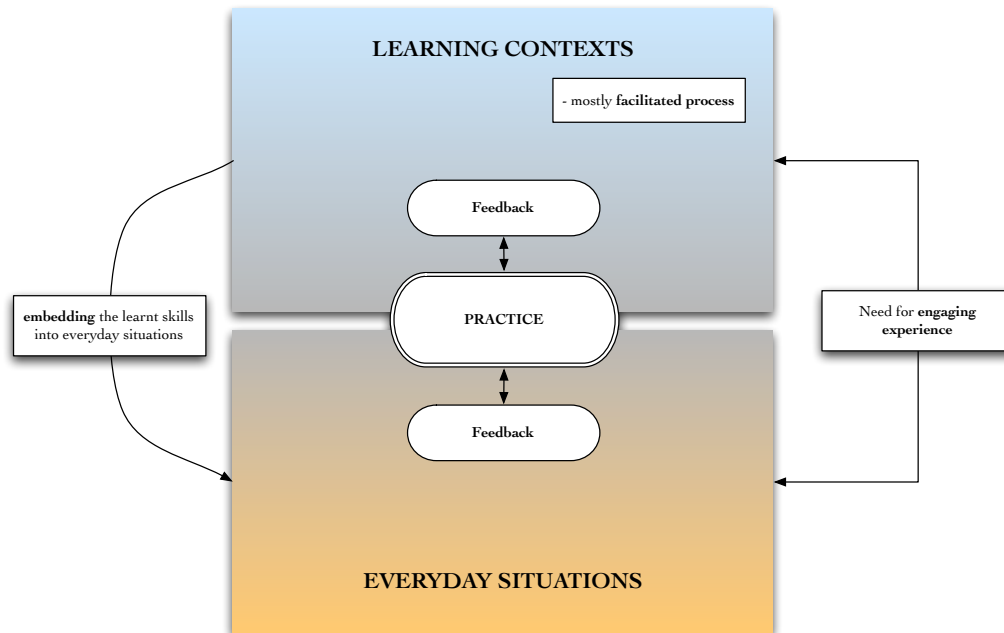
Fig. 6. Diagram of the identified challenges and their relationships

for novel, technology based types feedback altogether, such as those based on physiological signals or other sensed data.

We argue that feedback opportunities could be especially fruitful topic in this space, as HCI has only recently started focusing and tracking many aspects important to skills learning such focus on emotion from affective computing, social signals processing, emphasis on reflection and reminiscence as well as the initial work into supporting therapy. These could then not only readily enhance or be incorporated into existing curricula, but, in doing so, raise challenges for HCI and address "Tech looking for a problem"?.

We structure the rest of this section following the basic building blocks from education, pointing to examples of related HCI research which illustrate the potential synergy:

— self-reflection, emotional awareness (5.1.1)
— self-control (5.1.2)
— communication skills, e.g., active listening, correct communication pattern non-verbal behaviour (5.1.3)
— structured ways of reacting, e.g., following a sequence of steps to deal with a conflict situation (5.1.4)

5.1.1. Reflection and emotional awareness. Much work has been recently done in HCI around supporting reflection, including recognising and tracking emotions. On one hand, research is driven by advances in sensor technologies leading affective computing systems and social signals processing in general (e.g., [Sun et al. 2011; Pentland 2008]). However, other work also looks at supporting personal reflection and reminiscence by other means (e.g., [Kalnikaite et al. 2010; Höök et al. 2008]).

To illustrate on a few, more detailed examples: a number of paper focused on tracking and visualising emotional changes over the period of days, helping users to become more self-aware and draw out patterns that they wouldn't have noticed otherwise. This can be either on a more automatic, affective computing basis, as used by AffectAura [McDuff et al. 2012]; or with more emphasis on the interpretation on the part of the user (e.g., Affective Diary work [Stahl et al. 2008; Sengers et al. 2007; Höök et al. 2008]. As a similar example, Subtle Stone [Balaam et al. 2011] presents users with options to indicate their current emotion through an ambient, ambiguous visualisation, very closely resembling the Feeling Faces used in PATHS curriculum. However, the nature of technology would allow for enhancing this to be more than "just" a moment-to-moment reflection tool by tracking and facilitating reflection over time, providing an overview of class mood and similar; all of which might be useful additional information in some of the curricula. Such systems could, for example, fit well into the initial stages of curricula in schools, for example as a part of exercises aimed to teach children to reflect on, and label, their emotions; but also in a more advanced contexts such as a part of reflective exercises in bussiness social skills courses.

Other work has focused on a more in-the-moment self-awareness. Examples are systems such as designed by Moraveji et al. [2011] to support greater awareness of own breathing, helping the user to maintain calm and relaxed state; or mobile tracking systems exemplified by Rabbi et al. [2011]. Such systems might be used either in a nearly unchanged form as a part of supporting breathing relaxation exercises taught across domains; or serve as inspiration for new systems aiming to reflect background awareness of other aspects trackable by technology.

[[Add some of the autism work? Argue that this could be somehow extended beyond the limited focus on simple skills within autism? But probably this is rubbish.]]

5.1.2. Self-control. Second, self-control is the key emphasis in many of the curricula, with specific focus on anger management.

Pivotal aspect is *realising* that one is getting angry (or feels other strong emotion) and then triggering the appropriate response, e.g., calming down. It is challenging to get feedback promptly when learning this. The recent advances within affective computing drawing on physiological signals to detect stress could be particularly useful here. For example:

— some of the Picards' work on autists, linking the development of wearable GSR detectors. The bookmarking paper from last CHI + Philips Zen trader (?) as additional support that similar sensors can be effective to detect things of interest even in the wild.
— Explicitely note that the physiological sensors are wearable, thus practicable (in terms of no problems with lightning etc) and unobtrusive. Could be also used to support feedback outside of classroom.
— Can open additional interesting real-world problems for affective computing and emotional detection in the wild.
— More generally, physiological computing could help learn kids reflect on the reactions of their bodies to various events – fitting well with the key aspects of existing curricula.
— include the biofeedback army example [Bouchard et al. 2012]

Also focus on dealing with stress, keeping up motivation, postponing pleasurable experiences ... [[elaborate?]]

Any relation to mindfulness/meditation?

5.1.3. Communication skills. Many curricula involve exercises to teach particular interaction styles and strategies, as emphasised in the Communication skills and Dealing

with conflicts sections above. Also here earlier work in HCI suggests ways in which technology might be able to support and enhance the feedback possibilities, thus potentially making the learning more effective.

In particular, a number of papers have provided proofs of concept evaluations showing that interesting aspects of interaction are possible to track in real-time and that such feedback provided in real time can affect interaction in positive ways.[[Add links Honest signals literature [?; ?; ?] focussing on .... and social signals processing reviews [?; ?; ?]]]. For more detailed examples:

— Meeting Mediator, where they represent audio behaviour of participants in a discussion, showing that this lowers domination and helps achieve a more balanced discussion. Can be tied to some of the examples above (listening to others' opinions)
— Madeline's ripples paper, showing how things potentially trackable by social signals processing technology can be feedbacked to positively affect non-verbal behaviour and increase rapport.
— Link to physiological synchronisation and it's connection to empathy and reactivity, suggesting that this could potentially be useful for active listening and perpective taking exercises. Add link to the older MIT work by Daily [Daily 2010], which uses physiological data to provide posteriori feedback on group discussion in classes, supporting improved reflection of the shared experience.
— Visualisation techniques for medical interactions paper (ref'd within the rejected CHI).

5.1.4. Reacting in a structured way. Parts of the curricula also involve following structured reactions to particular situations. Various relevant, mainly therapy and autism related, work in HCI exists ... For example:
— MOSOCO and other autism related structural things
— therapy related mobile stuff supporting recollection and triggering the right reactions.
— We could say that some of the Honest signals stuff could be used to help following the structure properlyu – e.g., the calming before reacting bit?
— however, all is this is bordering on supporting better practice outside of the lesson, rather than feedback, isn't it? WOuld it be worthwhile to move this whole point to the practice subsection?

Summary of feedback opportunities. To summarise, HCI work from many domains could be directly useful for these contexts, helping with some of the key challenges in skills teaching. Moreover, these contexts also pose interesting and important challenges also for HCI. [[These are ...]]

5.2. Practice

Majority of the reviewed curricula aimed to provide extensive opportunities to practice within and outside of lessons, using role-plays and model situations setups. Through these methods, the goal was to practice 'proper' reactions and understanding of situations and challenges one can face in daily life.

Existing HCI literature points to three areas which are directly relevant. First, the feedback opportunities from earlier section can directly extend the options to practice both within and outside of learning sessions. It is particularly using technology to support practice 'in the wild' that suggests high potential of, as well as opportunities and challenges for, ubiquitous computing based applications. Second, recent work on conversational/relational agents together with research on virtual spaces points to novel, easily controllable and configurable environments allowing for practice in a a

wide range of possible model situations and topics. Third, the rising interest in serious games could also bring opportunities for further practice of particular skills.

5.2.1. Bringing practice opportunities into the wild

— Some of the mobile phone therapy research?
— tie in some of Honest signals type of work?
— Can we argue that this is a part where these is potential, but not much done yet? ⇒ will have to point to more general work looking at "into the wild" literature?

5.2.2. Virtual environments for practice

— Work on therapy in VR – such as the work by Manuel Sprung.
— Bailenson's research, e.g., [Bailenson and Yee 2005; Bailenson et al. 2008], shows how changing aspects of interaction in virtual reality affects learning/behavioural change. For example making feedback to your actions more visible (if you eat your character gets literally fatter); also changes in non-verbal behaviours such as shown eye-contact effect interaction. When "turned around" (e.g., emphasising your non-verbal gestures and body position by changes in an avatar you are interacting with) it is possible that these could be reappropriated for learning purposes.
— Augmented reality in education, as per review by Wu et. al. [Wu et al. 2012].
— Echoes project [Porayska-Pomsta et al. 2011] – virtual environment and embodied agent
— use example from [Core et al. 2006]
— Also the trivial implications of having "safe" space to test or stage cooperation/interaction activities (e.g., more elaborate role-plays where the VR helps to support the "realness" of the situation).

5.2.3. Serious games

— game implementing buillying prevention exercises Rubin-Vaughan2011 [Rubin-Vaughan et al. 2011].
— digital story telling as a minor point? See Yang 2012 [Yang and Wu 2012]
— Include the military study of games+biofeedback used to help soldiers control and reduce stress level first in the game, which then got transfered into real-world situations [Bouchard et al. 2012] (as an example of novel practice space that would not be available without technology).
— helping to practice the ability to take perspective of another, e.g., Halpern et. al. [Hailpern et al. 2011] and software supporting understanding of the aphasia disorder.
— Social psychology research using specifically constructed games to induce particular feelings (e.g., being left out by group of peers). These could be turned around from the normal usage there into an opportunity to help people understand a particular concept/situation better. Similarly to the aphrasia gaem above, one could image a game that would aim to help bullies experience (and live through) the emotions of the bullied ones.

[[***]]
[[********* HERE ON BE DRAGONS **********]]
[[***]]

5.3. Embedding learning into everyday

— key aspects identified in the curricula
    — providing support from parents and family key for many curricula
    — potential way of embedding the learning into everyday life

— such embedding in everyday life is, in some ways, the least developed aspect of the curricula – mainly done by: (i) meeting with parents at the beginning/end (ii) sending letters and asking kids to do homework
— Related HCI literature –
— behavioural change literature and the findings on how one can incorporate particular habits into everyday life. One could argue that it would be interesting to see how many of these strategies would continue working for the skills (which could be understood as particular, novel type of habits) needed here.
— Some of the positive psychology literature as per what Paul Resnick had last year at CHI workshop
— Work on online support communities
— Must be a lot around Facebook and other stuff
— [[still under work ...]]

5.3.1. Situated social support. The power of support networks to influence behavior has been emphasized by Fogg, who points out that social facilitation, i.e. the use of technology to facilitate connections between people, is one of the most powerful persuasive strategies [Fogg 2006]. This has been expanded further by Oinas-Kukkonen et al. [Oinas-Kukkonen and Harjumaa 2009], who list social support as a design principle for persuasive systems. They divide this principle into several sub-categories including competition, social comparison and cooperation, all of which could be leveraged in the design of systems that aim to embed social skills learning into people's everyday live. Based on a grounded theory analysis of Facebook as an existing example of an online social network, Weiksner et al. [Weiksner et al. 2008] identified six design patterns for behavior change. While some of them are similar to the general principles laid out by Oinas-Kukkonen et al., and patterns like deception should be ruled out in the teaching of social skills for ethical reasons, the patterns provoke and retaliate and self expression might potentially be useful additions to the repertoire for the design of systems utilizing support networks.

The principles outlined above have already been successfully utilized in systems for behavior change in various areas, with most studies conducted in sustainability and energy conservation and health and well being. The game Power Agent [**?**] is a particularly salient example in the latter area, since it uses social facilitation, particularly cooperation (with family members and peers) and competition (with other teams) and aims to facilitate learning of energy saving behaviors in a game setting. The game uses mobile phones as a platform and incorporates actual energy usage data into the gameplay, thus providing feedback about the effect of their actions and thus real world relevance to the users. The BinCam [Thieme et al. 2012] is another system that promotes sustainability by leveraging social influence, in this case mediated via a social network, to foster reflection and behavior change regarding waste and recycling. Again, actual input regarding the issue at hand, in this case pictures of people's garbage, was combined with an application tied into the users' social network in order to support the desired target behaviors.

In the area of health and well being, the use of games based on social competition to influence people to become more physically active can be exemplified by Fishn-Steps [**?**]. This game connects different users and uses a fish bowl metaphor with fish size changing based on the daily step counts of users, and fish of users also present in the fish bowls of other user, thus enablng comparison and competition. Gasser et al. [Gasser et al. 2006] also use social facilitation to support healthy nutrition and activity, using both mobile phones and a pc based application.

A commonality of these approaches is the integration of contextual data (e.g. from sensors) into applications utilizing support networks to influence behavior. This integration helps to better embed them into the users everyday life and have the desired impact. Social skills teaching similarly might benefit from combing sensor data about user behavior, physiological states and context with applications utilizing support networks in order to allow continuous learning outside the classroom while still maintaining connections to the student's peer group.

5.3.2. Ambient and ubiquitous persuasion. ambient persuasive displays, e.g. perFrames [Obermair et al. 2008] etc. [[extend, elaborate, and give SEL example...]]

5.4. Engagement and motivation
— key aspects
  — games/stories
  — things students can relate to
  — showing progress/importance
— Related HCI literature:

5.4.1. Feedback and rewards. There are several mechanisms to foster continuous engagement and motivation, with feedback, as discussed above, and rewards being amongst the most commonly used ones. Oinas-Kukkonen et al. see rewards as part of the broader category of dialogue support which also includes the similar design principle of praise. The principle of rewards works by giving credit to the users for performing the target behavior. Consolvo et al. [Consolvo et al. 2008] for example do this by using a garden metaphor in a mobile app, where new flowers are growing whenever the users perform a fitness activity, so the more active the user is, the more beautiful the grade becomes. Virtual rewards as part of a game to motivate physical activity in younger players have been shown to increase the amount of activity performed by the players [**?**].

5.4.2. Gamification and gameful design. : Over the last years, there have been numerous examples of applications and services that aim to influence users' towards a desired behavior using a persuasive approach often summarized as gamification or gameful design [Deterding et al. 2011] [McGonigal 2011]. Gamification works by integrating game mechanics like rewards, scores and points into real life activities. Applications in this area e.g. aim to influence users towards becoming more fit, e.g. via activity tracking sensors coupled with gamified services such as Fitbit (http://www.fitbit.com) and Nike+ (http://nikeplus.nike.com/plus/), to loose weight (Withings) or to improve people's sleep (Zeo). Superbetter https://www.superbetter.com/ is an example of a game that particularly demonstrates the potential of this approach towards the learning of skills. This game aims to help players to increase their personal resilience by relying on game mechanics like quests, bad guys, and power-ups to engage players into sound scientifically proven exercises that help them to e.g. raise their mental or social resilience or improve their social connections or their mood. In a similar way, selected exercises from the basic building blocks of social skills learning could be embedded into gamified services that would augment the classroom based learning or even provide a form of social skills learning for people without access to regular courses. todo elaborate examplebehavioural change literature (as a specific example of how motivation and engagement are used in "habit teaching/changing" purposes). seems quite obvious topic where HCI could be good at,

Challenges	Identified aspects	Topics within HCI
feedback	emotional awareness self control communication skills structured reacting	affective computing, social signals processing, ubiquitous computing, systems for reflection
practice	bringing practice to real-world virtual environments serious games	into the 'wild' studies, ubiquitous computing, virtual reality, embodied agents, serious games
embedding into everyday life	situated social support ambient and ubiquitous persuasion TBA	behavioural change, persuasive technology social networks analysis, Ambient Intelligence, Ubiquitous Computing, Mobile Computing, Big Data, Multimodal
engagement and motivation	feedback and rewards gamification and gameful design tailoring and personalization	games research, game design, behavioural change (motivational aspects), story telling, ...

Fig. 7. Depicting relations between challenges, identified aspects, and wider topics within HCI

but again I lack the background knowledge to come up with other that obvious and boring ideas.

5.5. Summary

The previous sections unpacked the identified four challenges, linking them to existing work within HCI and pointing out aspects that could be especially relevant to HCI. The Figure 7 shows a summary of this, including a list of more general topics within HCI for challenge, from which we drew the examples mentioned in sections above. [[It is still a very rough draft of the figure – not sure if it makes sense, and what "buzzwords" from HCI should be used in the end for each challenge. Still, the goal is to somehow tie the examples showed before in a more simplistic way to the research within HCI, and also indicate that it could be relevant to fairly large crowd.]]

6. FUTURE RESEARCH AGENDA – OPPORTUNITIES AND CHALLENGES FOR HCI

Previous section discussed ways in which HCI could help address challenges within social and emotional learning curricula. This chapter highlights what challenges and opportunities doing so might raise for HCI. At the moment, I have several ideas that could be turned into arguments, as outlined below. However, it is still far from final framing, and it feels a lot is still missing – comments or additional ideas will be much appreciated.

First, curricula provide a way of potentially structuring research on social interaction, bringing methodologies, contexts and goals that are well defined, well researched and very well motivated.

— Such structure might for example promote more systematic research, higher comparability of and building on existing studies and blah blah blah ...

— In particular, apart from the autism domain, existing HCI work on teaching skills has been fragmented, often in form of single studies, with little follow-up or elaboration.

The goals of social and emotional skills learning also supporting new directions of research looking at support/enhancement/automatic analysis of social interaction, while suggesting real-world applications for much of social signal processing and related research. For example, the topic of SEL within education also gains increasing political support in the US and Europe, suggesting that social and emotional learning programs for schools might be soon common within many schools. Overall, SEL provides a novel design space for HCI that could have a strong impact on everyday life and direct real-world applications.

6.1. Challenges for HCI

— [[key questions we need could look at:]] e.g., what are the limits and potential of current social signal processing in terms of tracking such skils? Are they applicable in real-world use? etc.

— ... all of this potentially opening novel and challenging contexts for HCI, blah blah blah

— How do we deal with the need for interdisciplinarity, as identified by Porayska-Pomsta et al. [2011] or Coyle et al. [2007]. Emphasise the need for co-development with the practitioners.

— Real systems will need to combine most of the challenge categories above – example of MOSOCO, which helps receive peer feedback, aims to support practice in the wild, and keep engagement through gamifying the situations (earning stars, comparison etc.).

6.2. Facilitated learning – valuable design space

Most courses consist of *facilitated learning*. This points to a valuable design space, where novel technologies can be developed, enjoying both ease of application into practice, but also within well constrained and manageble environment. This could help address some of the challenges mentioned above.

— The sessions typically take place indoors, involving a mix of lectures and hands-on experiences, likely with an expert trainer/coach present. These training contexts are an interesting design space in and of themselves as they could provide a valuable initial context in which to consider the design of new systems supporting life skills teaching and long-term development.

— Moreover, the training experience has a particular quality of being real and not-so-real at the same time. It often involves participants trying things out in a safe place (e.g., through role play), where potential failures are actually a valuable basis for reflection and learning.

— This leaves open opportunities for technologies that could not be applied in everyday settings for various reasons. There are also opportunities to support the facilitators expert role, as well as directly supporting the learner.

— For example, it eases the generation of databases and corpuses of training data for automated approaches, allows for easier tech deployemnt than in less fixed settings etc.

— [[extend, elaborate, emphasise...]]

do we need to/want to have other "design guidelines"

7. SUMMARY

Lorem ipsum, yaddy yadda da.

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