Reflective Practicum: A Framework of Sensitising Concepts to Design for Transformative Reflection

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ABSTRACT

Designing for reflection is becoming an increasingly important part of many HCI systems in a wide range of application domains. However, there is a gap in our understanding of how the process of reflection can be supported through technology. In fact, an implicit assumption in the majority of existing work is that, just by providing access to well-selected data, in-depth reflection can and will occur. To counter this view, we draw on Schön's notion of reflective practicum and apply it as a sensitising concept to identify the complex interplay of factors that support transformative reflection in the context of two social-emotional learning (SEL) studies. The results highlight the need to carefully scaffold the process of reflection, rather than simply assume that the capability to reflect is a broadly available trait to be 'triggered' through data. Building on this analysis, we develop a conceptual framework that extends the concept of the reflective practicum towards identifying appropriate roles of technology to support transformative reflection. While our case is within the context of SEL, we argue that a deeper understanding of these opportunities can also benefit designing for reflection in other areas.

AUTHOR KEYWORDS

Reflection; Social-emotional skills; SEL; Reflective Informatics; Personal Informatics

ACM CLASSIFICATION KEYWORDS

H.5.m. [Information interfaces and presentation]: Miscellaneous.

INTRODUCTION

Over recent years, a substantial work has already been undertaken in HCI around design for reflection, spanning a range of applications including behavioural change [8, 28], personal informatics [19], mental health [40] and emotional wellbeing [31]. However, while many of these works aim to lead to transformative reflection – i.e., eliciting change in behaviour or mental schemas – there is a clear gap in our understanding of how such in-depth reflection can be facilitated through technology (cf., [1, 13]). In particular, it is not yet clear (i) what are the key ingredients/components of a reflective *process* that make reflection transformative; (ii) if and how it needs to be scaffolded; and (iii) what specific design strategies could support such facilitation.

Instead, as Baumer [2] notes *"prior work carries an implicit assumption that [just] by providing access to data that has been 'prepared, combined, and transformed' for the purpose of reflection, reflection will occur."* Such a view of the reflection process, as purely triggered by providing 'information' about the situation is, however, in direct conflict with the underlying reflection theorists (such as Schön, Boud, or Kolb), who highlight the extensive support and scaffolding needed for transformative reflection to happen. As such, although for example a reference to Schön's reflection-in-action is common in most of these works (more than 70% according to [2]), the intricacies of how people do reflect and how the reflection process can be supported through technology seems to be mostly missing from the HCI work so far.

This paper aims to address this gap and argues for a framework to design for transformative reflection by highlighting the need to scaffold the reflection process, rather than assuming the ability to reflect is a trait that can be readily triggered by providing the relevant information. We develop this line of argument in four steps:

We start by reviewing the concept of the *reflective practicum*, by Schön [33] as an articulation of mechanisms to scaffold transformative reflection, arising predominantly from Schön's empirical work in architectural studio settings. In essence, Schön emphasises the importance of the 'right sort of experience' for the learners, which is deliberately scaffolded through an interplay of curricular components.

Second, we illustrate how these core aspects of the reflective practicum can serve as a useful sensitising concept [4] to help identify the mechanisms supporting transformative reflection in other settings. In particular, we retrospectively analyse the findings of two long term (24+ months) case studies unpacking the learning processes, challenges and opportunities for technology in two social-emotional learning contexts: masters counsellor training [39] and primary school education [36–38].

Third, this analysis enables us to extend the concept of reflective practicum into a framework to guide technology development in SEL. We do this by abstracting key strategies and curricular components across the case studies, particularly highlighting the (i) considerations of what makes experiences the 'right sort of' experience for SEL learning, and (ii) identifying the roles technology can play in three identified curricular components (explicit, social, personal).

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Finally, we illustrate how approaches to scaffolding transformative reflection similar to those described in the reflective practicum and our own case studies, can be found in other previous HCI work in varied settings, such as those supporting reflection of diabetes patients [21], eating habits [26], or within romantic relationships [41]. Overall, this suggests the potential value of reflective practicum framework as a lens to understand designing for transformative reflection also outside the immediate domain of social-emotional learning.

RELATED WORK

Over the last decade, HCI researchers have shown increasing interest in designing systems to support reflection. These have been fueled by the realisation of the key role that reflection plays in areas such as education [12], behavioural change [8], design for wellbeing [31,40], personal informatics [19], or reflective design [34]. These developments are further emphasised by a series of recent review papers (including at DIS and CHI), taking stock of the field [1,2,13]. As such, we do not replicate their synthesising work in what follows, and instead directly build on their analyses to motivate and set the gap addressed in this paper.

While various conceptual and theoretical accounts of reflection co-exist across HCI work (cf., [2]), there is a shared understanding that reflection can take multiple forms differing in its 'depth': from simple 'revisiting' of an event to 'transformative' reflection that leads to change in practice or understanding of why and what happened [1,13,22]. Such a transformative effect—i.e., leading to a change in behaviour or an insight—is what makes reflection a key process for education [6,18,22,32,33] as well as a crucial part of systems in behavioural change, personal informatics, and wellbeing.

Despite more than a 75 HCI papers on reflection in the last 7 years [2], there is still a lack of understanding of how transformative reflection can be supported through technology. In particular, although it was raised as an open question already by Fleck and Fitzpatrick [13] in 2010, supporting transformative reflection was still seen as *"the most difficult challenge for designers"* in 2015 [1, p591]. As Baumer et al [2] point out, one possible explanation for this gap is that—for majority of HCI projects—*"reflection was implicitly defined as something that would happen by providing the user with some type of information about a particular situation, and as a result the user would have a newfound awareness in the interventions domain of interest"*. Kay [17] goes even further to characterise the reflection strategy of many current systems as *"show the user a graph and hope"*. While there are exceptions within the body of prior work that do not conform to this trend of triggering reflection through presenting data (such as [21,26,41] discussed later in the paper), to the best of our knowledge there is little systematic understanding in HCI of what transformative reflection entails, how it can be scaffolded, and how such a process could be meaningfully supported by technology.

In contrast, the educational literature has long acknowledged the importance of reflection (e.g., Dewey's [10]) and worked to develop practical approaches to promote transformative reflection for the purpose of learning [22]. What connects many of the leading scholars in this area—such as Boud [6], Kolb [18], Moon [22,23], and Schön [32,33]—is the emphasis on the reflection process as requiring substantial scaffolding while being tightly linked to a learners' particular experiences.

In the rest of this paper, we draw on one such approach: Schön's work on identifying the strategies to scaffold transformative reflection in what he labels a 'reflective practicum' [33]. Schön's treatment of how practitioners—particularly in the design studio—manifest and develop expertise through 'reflection-in-action' has been highly influential in HCI work, with the concept of reflection-in-action referenced in over 70% of research papers (that include a definition of reflection at all) [2]. However, the associated idea of reflective practicum, as a set of strategies to promote and scaffold reflection-in-action, has received much less attention (e.g., searching for "reflective practicum" in the ACM library yields zero hits). Moreover, we argue that, in fact, it appears that much of the complexity underlying Schön's idea of reflection-in-action—such as the crucial intertwining of reflection as a discussion with the on-going experience—has often been lost in HCI applications. The aim of the next section is thus to draw out the key concepts and ideas underpinning the concept of reflective practicum, providing the articulation of reflective practicum as a sensitising concept driving the discussion in the rest of this paper.

SCHÖN'S REFLECTIVE PRACTICUM

> *It is as if the mentor said: "I can tell you that there is something you need to know, and with my help you may be able to learn it. But I cannot tell you what it is in a way you can now understand. I can only arrange for you to have the right sorts of experiences for yourself. You must be willing, therefore, to have these experiences". Donald Schön: Educating the reflective practitioner, p93*

In Schön's description, reflection has both a crucial importance for helping the expert to orient and make sense of the unique situation they are facing, but is also also seen the method through which the experts develop their competence. In particular, a practitioners' expertise relies on patterns that the practitioner can, consciously or unconsciously, draw on and appropriate within the novel situation; and these patterns are learnt through earlier reflection-in-action (e.g., [32, p140]).

Importantly, reflection-in-action is strongly grounded in specific experience. Schön describes it as necessarily including a 'discussion' as part of the experience, in which the expert probes and works 'with' the situation to transform their understanding of how a solution might look. As such, doing and thinking are complementary in reflection-in-action as *"[d]oing extends thinking in the tests, moves, and probes of experimental action, and reflection feeds on doing and its results. Each feeds the other, and each sets boundaries for the other."* [32, p280]. In other words, though reflection-in-action the actor 'experiments' within the situation by acting on the experience with the expectation of a particular reaction (doing), and analyses the reaction—the 'backtalk'—of the situation to inform further action (thinking).

Reflection-in-action occurs while we are still engaged with the situation; as such, one of it's core aspects is the opportunity to

experiment with and affect the on-going activity. In contrast, we may reflect on action by *"thinking back on what we have done in order to discover how out knowing-in-action may have contributed to an unexpected outcome"* [33, p26]. For Schön, the defining characteristic of reflection-on-action is that it has no direct connection to the present activity. It is thus closer to the reflection process as understood in the work of other reflection theorists, such as Kolb's experiential learning cycle [18], as well as the post-hoc reflection processes in learning that Boud emphasises in his work [6]. As we will see in the following sections, the distinction between reflection-in/on-action is complex for reflection within SEL curricula and a subtle combination of both is key.

Developing expertise – the 'reflective practicum'

Going beyond describing the reflection-in-action as the defining component of (developing) expertise, Schön also looks at strategies by which reflection-in-action can be taught. He draws on the architectural design studio and the training process in (freudian) psychotherapy supervision as two key examples to identify a set of learning processes—the **reflective practicum**—that underpin the learning in these two domains. In the rest of this section, we outline the main characteristics of reflective practicum:

What is a reflective practicum

Schön characterises the practicum as multiple layered settings whose sole purpose is the structuring of the learning process: *"In a context that approximates a practice world, students learn by doing, although their doing usually falls short of real-world work. They learn by undertaking projects that simulate and simplify practice; or they take on real-world projects under close supervision."* [33, p36] As such the practicum is seen as a *'virtual world'* that is that is free of the risks of the real one. This 'virtuality' of the practicum is crucial for the learning processes to happen: it provides the opportunity for safe exploration as well as structures the tasks so that the core aspects of the learnt competencies are highlighted. It seeks to enable students to *"experiment at low risks, vary the pace and focus of work, and go back to do things over when it seems useful to do so."* [33, p170] As such, it frames the activity as happening within a particular 'we-do-this-for-learning' mindset, which is crucial for the reflective engagement with the experience.

Paradox of learning by doing

The paradox of supporting students' reflection-in-action rests in the fact that the students do not, at first, *"have the necessary mental concepts so that they cannot understand what they need to learn; and can learn it only by beginning to do what they do not yet understand"* [33, p93]. The mentor's—and more broadly the practicum's—role is in arranging the right sorts of experiences for the students [33, ibid].

This points to what we argue is the key characteristics of reflective practicum: as reflection-in-action and the underlying expertise cannot be directly taught to students, the role of the practicum is to arrange the right sorts of experiences for the students. In other words, active engagement with the experience is necessary on part of the learner and the practicum is there to carefully scaffold the learning experiences so that these can successfully grasped by the learner.

In outlining the structures by which practicum accomplishes this scaffolding, Schön strongly emphasises the mentors' role. In his view, it consists of two equally important parts: (i) they need to scaffold the 'right sort' of experiences for the learner through well chosen tasks; but then also (ii) support the reflection-in-action process on these experiences so that the learner can learn. As such, the process is *"more like coaching than teaching"* [33, p157] in that the role of the mentor is in providing modelling and an opportunity for a dialogue around student's experience.

It is this 'in-action' feedback and support that is used as means to scaffold students' attempts at reflection-in-action; and is thus seen are instrumental to successful learning on part of the student. As Schön says, *"whatever the coach may choose to say, it is important that he says it, for the most part, in the context of the students doing. He must talk to the student while she is in the midst of a task (and perhaps stuck in it)"* [33, p102]. The scaffolding of reflection-in-action itself thus comprises three essential features: (i) it takes place in the context of the students attempts to do the activity, i.e., their immediate experience; (ii) it makes use of actions as well as words; and (iii) it depends on reciprocal reflection-in-action between the student and mentor.

Reflective practicum – summary

Based on the literature above, we now summarise Schön's concept of reflective practicum into a set of core points:

- ⋆ The key assumption that the expertise (and thus transformative reflection) cannot be taught *to* the learners, but needs to be actively constructed *by* the students who rely on the practicum to facilitate and scaffold their experiences to lead to learning.
- ⋆ *Reflective practicum* is a setting designed specifically to generate a particular sort of experiences that allow the students to explore by doing, through an enmeshed interplay of action, imitation, and reflection leading to further action.
- ⋆ This includes (i) appropriate teachable moments that provide the experience to work with; and (ii) the (scaffolded) processes of reflection that facilitate the act of 'grasping' of the experience and transforming it into learning.
- ⋆ In particular, the reflective curriculum provides a *'virtual space'*, where the core of the task-to-be-learnt can be explored/practiced repeatedly (thus is 'experience-able'), but without the adverse effects of failure. The main difficulty is then in facilitating activities that include the core characteristics of needed expertise but without the full associated pressures of the real-world.
- ⋆ Such 'right sort of experiences' often do not arise automatically; they are generated through an interplay of the varied *curricular components* that comprise the practicum.
- ⋆ In Schön's apprenticeship contexts, the curricular structures have predominantly relied on the role of the mentor: mentors played an instrumental role in facilitating meaningful teachable moments through well-selected tasks while at the same time providing modelling and in-the-moment scaffolding to help students make sense of the resulting experience through reflection.

Before moving onto the case studies, we briefly mention two aspects that are missing in Schön's account but would be beneficial for HCI applications: First, as a learning theorist, Schön's interest was predominantly in understanding how the existing curricula work. As such, his framework does not directly address how technology might be drawn in to augment or support reflective processes. Second, the reflective practicum as described by Schön relies strongly on mentors' in-the-moment support as the main curricular structure. This is mainly as both architecture and Freudian psychotherapy training come with a strong apprenticeship focus. As such, other possible curricular components are not described in detail. We will touch on both of these aspects in the rest of the paper.

SEL CASE STUDIES

We begin by briefly reviewing the two SEL case studies, offering an overview of each and summarize the key findings as they relate to supporting reflection. In particular, we draw on two long term (24+ months) projects aimed at understanding the learning processes, existing challenges, and the opportunities for technology within:

- ⋆ a masters counselling course, where the future therapists are going through an in-depth, sophisticated training aimed to develop expert social-emotional competencies [39].
- ⋆ universal prevention programs in primary schools, where the students are taught basic life skills, such as self-awareness, self-regulation or relationship skills [36–38].

The case studies presented here will help us further two arguments: First, the next section will use these empirical observations to exemplify how reflective practicum *sensitises to particular aspects of the reflection process that have not been unpacked by previous work* [36–39]; as well as *provides a conceptual framework that allows us to identify the strategies through which reflection is scaffolded across these two very diverse contexts*. We note that such fit of Schön's within the SEL context was not immediately apparent as neither the counselling nor prevention science are directly building on or even referencing Schön. Second, such analysis allows us to *extend the concept of reflective practicum with considerations of the possible roles for technology*, given that both of the case studies included user-centred design methodologies and focus on meaningful technology involvement as core part of the research process. Given the challenges with developing SE competencies—such as their intangibility, embeddedness in social interaction, and the inherent role of (strong) emotion that disrupt reflection—we will see how the curricula draw on a broad set of evidence-based strategies and mechanisms to both generate meaningful 'teachable moments' and scaffold students' reflection on these.

In doing so, the case studies exemplify how that the opportunity for transformative reflection was deeply tied with the underlying experience of the learners; and how such experiences were painstakingly designed for and orchestrated by the curriculum setting. Similarly, neither curriculum took the learners ability to reflect on their experiences for granted and it was instead carefully scaffolded within the experiences through an interplay of curricular components.

SEL in Counselling

The first case study, drawing on [39], is unpacking the learning processes of a person-centred counselling masters course at a major UK university. In what follows, we briefly summarise the aim of the curriculum, the methods used to teach students, as well as the challenges and opportunities for technology identified by the previous work.

The counselling curriculum has a strongly experiential focus, emphasising the importance of an in-depth understanding of the client (empathy) and well-tuned self-awareness ability. The program had very explicit processes and tools to promote reflection of students, always closely tied to a particular experience (such as a 'practice counselling session' with a peer student). For example, the 'Interpersonal Process Recall' (IPR) was used throughout the course. IPR is a traditional technique developed by Kagan [16] in the 1970s, aiming to facilitate counsellors' deep reflection on, and awareness of, their own feelings and thoughts during counselling sessions[1]. However, these were complemented by carefully designed learning sessions (such as lessons facilitating of particular emotions or structured ways of providing feedback during practice counselling sessions), as well as intricate set of social norms encompassing all interactions (such as a 'learning contract' where all students commit to helping each other learn, and create a safe space where trust and confidentiality are a norm). The aim of such curricular scaffolding was two-fold: first, to create 'real' experiences for the students, whether that was working with actual emotions of a peer client, or getting to grips with their own emotional states facilitated by a particular lesson; and second, to then allow for experimentation and reflection on own behaviour in the safe learning space established by the curriculum. To allow students to do so, the full first year of the course was dedicated to developing their reflective abilities, so that they were able to process and analyse their experiences in detail, even without an in-the-moment support from the mentor.

In terms of existing challenges and possibilities for technology support, the study identified a key issue around the difficulty to 'close reflection loops' within the interpersonal settings of client-counsellor sessions. In particular, fundamental difficulty in the counselling practicum lies in directly supporting reflection-in-action within the practice counselling session experience. The counsellor cannot step out of the role to ask the client if "they wouldn't mind going two questions back and taking it from there to try another way of framing it", as that would break the emotional realness of the situation. To limit impact of this mismatch between what is possible and what would be preferable, the curriculum in our case study (and the designed technology) focused on extending the experience beyond the practice session. Such processes so far relied on scaffolding students' reflection through 're-living' the coun-

[1] IPR draws on repeated viewing of a video recording of the session. The student in the role of a counsellor can stop the video at any time of their choice, often when they believe something important has happened. They are then asked a question from a list compiled by Kagan, using this as reflect aloud on what was going on for them at that time. If done according to the guidelines, this is a very long process – e.g., 8 hours of IPR for 1 hour of the videotaped session.

selling situations including various ways of engaging with the video replay, albeit mostly relying on pen-and-paper methods.

The designed technology took up this challenge to extend and deepen this reflection process through a custom made annotation tool. The aim was to allow for 'localised reflection' (tying comments to particular places in video), as well as bringing in client's reflection as a way to sense check and close the reflection loops. These then built on the reflective support structures such as the IPR to help counsellors to return as closely as possible into their experience within the session; reflecting on their assumptions at that time as well as identifying the reasons for the decisions, misunderstandings, or blunders in the session.

SEL in Primary education

The second case study focused on understanding the learning strategies and challenges of existing social emotional curricula in education; including review [36], interview study with experts [37], and user-centred design of a pilot system [38].

Overall, SEL curricula are part of universal prevention programs in education, so working with all kids in primary schools. Coming from a long line of evidence-based research (cf., [11]), such curricula are now in more than 44% of US schools [7]. The skills taught in SEL 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 skills for adult life, such as self-awareness, self-management, social awareness, relationship skills, and responsible decision making. The curricula depend on mostly in-class, scripted lessons delivered over longer periods of time (e.g., 20 minute lesson twice a week over the whole year). The learning strategies strongly rely on role-plays, in-the-moment coaching from an adult such as the teacher, and 'mental tools' [42].

Mental tools are simple cognitive or behavioural strategies designed to serve as an internal scaffolding that allows the learners to recognise and work with the naturally occurring situations as teachable moments: if working well, they provide a space to take a step back, reflect, and re-engage with the situation only after it has been processed. An example of such mental tool is the 'Turtle technique' [29]. The children are taught to 'withdraw into their shell' (by pulling their arms and legs close their body and closing their eyes) at specified occasions such as when they feel increasingly angry. This is followed by a relaxation phase, where specific muscle groups are tensed and released. Once this technique is mastered, children discuss appropriate alternative strategies for dealing with stressful situations, now that they are able to consciously reflect and react to them.

The aim is that—through the use of these tools—the children will re-interpret the on-going real-world situations as learning experiences and opportunities for applying the developing competencies. In addition, the mental tools serve as external triggers that can be tapped into by teachers/adults more broadly, if the child has not appropriated these fully. This points to the strong reliance on the social support structures provided by teachers/adults more broadly, which we turn to below.

As the role-plays and other scaffolded interactions are not seen as 'real enough', the curricula rely on complementing the in-class role-plays with appropriating everyday moments from the naturally occurring situations (such as instances of conflict or strong emotion in class/on the playground). This however brings issues with such natural situations lacking any explicit scaffolding (cf., the carefully designed safeguards in counselling practice sessions). As such, there is a strong risk of the situations becoming 'too real', overwhelm the student, and lead to the loss of the learning focus (such as getting into a fight rather than calming down). As such, out-of-lesson learning is still strongly dependent on coaching by an adult (teacher, school staff or parent), who provides the on-going cues, prompts and reminders needed by learners.

The key challenge is then in the lack of scalable techniques to get beyond classroom-based learning and support the in-the-moment reinforcement and scaffolding in everyday settings, as these are needed for the skills (and reflection support) to be transfered from in-class intervention to practice. To explore one possible solution, the technology probe in [38] aimed to provide a shared experience for parents and children together through an interactive story. A key part of the design was focused on facilitating the in-the-moment scaffolding role of the adult to help children reflect on the experience that the interaction generated.

HOW IS TRANSFORMATIVE REFLECTION SCAFFOLDED IN SEL?

We now apply Schön's reflective practicum as a sensitising concept to understand the reflection processes underpinning learning across the two SEL contexts, by emphasising two key aspects: first, the focus on understanding what constitutes 'right sort of' experience for the learners; and second, the interplay between different scaffolding structures within the practicum that then generate such experiences.

Through this discussion, we suggest that the reflective practicum serves as a useful sensitising lens to help us dissect the reliance of SEL curricula on carefully facilitated sets of experiences for learners as well as identify the strategies through which reflection is scaffolded across the two settings. The resulting framework then prepares ground for the next section proposing how such analysis can inspire and guide future HCI work in this area.

Characteristics of the 'right sort of' experience

One of the key arguments in Schön's work is that only the 'right sort of' experiences can be expected to lead transformative reflection. For example, the 'right experiences' within the architectural studio were seen as act of *"reflective designing"* [32, p79] : a combination of (1) the students' active involvement with a particular design case they struggle with, such as sketching a solution to a design problem; (2) with their reflection scaffolded by the in-the-moment support from the mentor; and (3) doing so in a 'safe space' where experimentation was encouraged and effect of failure low. In other words,

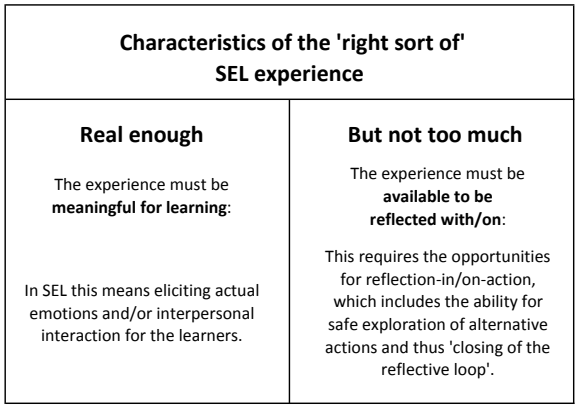

Figure 1. Characteristics 'right sort of experience' in the SEL practicum.

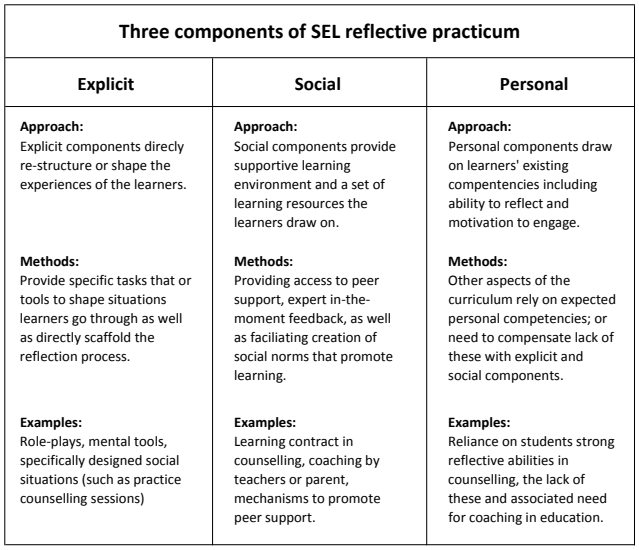

Figure 2. Three components of the SEL reflective practicum

it was the experience of grappling with a design problem that felt hard to do, coupled with access to scaffolding such as the mentor's in-the-moment feedback that allowed for reflection as part of the experience, while knowing it is embedded in the low-risk 'virtual world' of the curriculum.

Applying this analytical concept to the SEL learning, we argue there are similarities between such 'real-enough but not-too-real' experiences that Schön draws out and the SEL contexts: In particular, we propose that the 'right sort of' experience in SEL can be then characterised to include an element of tension between (i) eliciting emotions and/or experience of interpersonal interaction that feel real, but at the same time (ii) not too overwhelming so that it can still be approached with a learning mindset and reflected upon.

We see this 'real-but-not-too-real' quality as fundamental to what Schön describes as the *virtuality of the curriculum*. In the architectural studio that might mean that a 'failed' design leads to an enlightening design crit session with the mentor rather than a loss of money and customers. Analogously for SEL, such virtuality might for example suggest that if one learns about dealing with conflicts—and thus must experience, to some extent, a real conflict with another—both parties preferably understand this is a learning situation, done for the purpose of competency development, and will not generate hard feelings regardless of the outcome.

We can interpret the SEL curricula as aiming to resolve this tension between real-but-not-too-real experiences by *careful balancing of the emotional strength of the experience* for the learners. As shown within the case studies, this then means generating or appropriating situations where the learners themselves experience actual (rather than pretend) emotions or interactions, while preventing the emotional strength of these experiences from spinning out of control (and thus losing the learning qualities of the experience). One example of such careful balancing embedded within the structure of SEL curricula can be seen within the counselling practice sessions (cf., [37]). On one side, the emphasis is placed on discussing personal issues in the peer-client experiences in order to create a 'real' counselling scenario. That is, the mentors make clear that very little can be learnt unless the peer-client is willing to talk about matters that emotionally affect them, giving the peer-counsellor the chance experience and work with situations that are emotionally real for the client. On the other side, however, extensive care also goes into how these sessions are scaffolded and perceived by the participants to ensure the learning goals of the generated experience are kept. This includes multiple mechanisms that reinforce the learning focus at various points, such as the learning contract of 'being here to help each other', the immediate post-session debrief, the use of reflection processes such as IPR, as well as the availability of mentors should the 'issues get out of hand'.

In highlighting the 'real-but-not-too-real' experiences, we need to clarify what 'real' means in the reflective practicum context. In line with the strong focus on learners' experiences, we suggest it is the notion of *perceived realness* which is key here: what matters is if the emotion or social interaction 'feels real' to the learners rather than whether the experience has been staged or naturally occurring. For example, if one wants to learn to self-regulate, then the essential feature of the learning experience is a strong enough emotion so that controlling it becomes an issue. While appropriating moments of stress in the real-world, such as everyday conflicts within the classroom, is one possible option, a well made horror-game can provide a similarly real feeling of stress and pressure for the learner, albeit in actuality completely staged. In the architecture training, the students need not work on designing houses that will be built; instead what matters is that the assignment creates meaningful design choices to be solved.

Overall, across both domains the aim was to always work with the 'most real' situation that can be still grasped as a 'teachable moment', rather than being swept away by it. The next section discusses how such 'right sort' of experience is then generated through the learning structures of the practicum.

Three scaffolding components of reflective practicum

Schön's analysis highlights how the reflective practicum comprises a range of structures that all contribute to facilitating learning experiences for students. For example, Schön argues how the architectural studios have *"evolved their own 'rituals', such as master demonstrations, design reviews, desk crits, and design juries"* [33, p43] within which the crucial coaching role of the mentor is embedded. In other words, the reflective practicum can be seen as an interplay of different types of components, all working together to generate the 'right experiences' for the students and scaffolding their reflection on these.

So how does this view map onto the empirical observations of the two SEL curricula? Similarly to the settings described by Schön, the 'right sort' of experiences did not appear 'automatically' in neither the SEL in education nor counselling curricula; instead, a number of specifically designed curricular components scaffold experiences and the associated reflection process. We unpack the characteristics of such components within SEL case studies into the *explicit components* in the practicum (i.e., the 'rituals' such as projects, design crits or demonstrations), the *social components* (i.e., in Schön's setting mostly the role of the mentor), and the *personal components* (i.e., the competencies of the learners that are utilised by the practicum). Moreover, this distinction will further help think about the possible role of technology as part of reflective practicum. Figure 2 provides a summary diagram of these three components and their relation to the characteristics of the SE learning experience.

Explicit components

We propose that the role of the explicit components can be interpreted as directly re-structuring/shaping the experiences of the learners through tasks or specific 'tools' to scaffold reflection. For example, tasks such as the role-play vignettes in education, the counselling practice sessions, or a design crit in architecture provide boundaries on which experiences can arise for students. Similarly, reflection tools such as the IPR process in counselling or mental tools in education structure particular ways of working with the experience and mediate how learners relate with the world. As such, explicit structures include both shaping the situations through which experiences are generated, but also providing explicit scaffolding processes to facilitate grasping of these through reflection.

Social components

In contrast, the role of the social components can be seen as to provide a supportive learning environment and a set of social resources the learners can draw on as they proceed with the training. This might include establishing specific norms (such as the learning contract in counselling) and access to expert in-the-moment feedback and peer support. Specifically, strong social structures play an important role in creating a safe practicum space in which the other training components are embedded. This includes the expectation that the interaction will be seen through the learning lens, i.e., understood and supported by others as 'learning material'.

Personal components

Finally, the personal components correspond to the learners' internal qualities that are crucial for the learners' grasping of the experience. This includes the students' motivation to actively engage with and learn from their experience, as well as their existing abilities to reflect-in/on-action. For example, the practice sessions within counselling curriculum strongly rely on the presumed abilities to reflect that the students are expected to develop earlier (over the first year of the course).

DESIGNING FOR TRANSFORMATIVE REFLECTION IN SOCIAL-EMOTIONAL LEARNING CONTEXTS

We argue that the lens of the reflective practicum can serve as a guide to designers aiming to develop a technology-based system for transformative reflection, in the context of SEL.

Building on the understanding of how reflection is scaffolded in existing curricula, we suggest a two step process: The first step offers a set of questions aimed to help understand characteristics of the 'right sort of' experiences that are likely to be conducive for transformative reflection. The answers to these can inform the initial design brief to be taken to the next step. Second, we propose that the three curricular components (explicit, social, personal) highlight possible roles that technology might play in scaffolding the selected experiences. In particular, these aim to translate the strategies used in the (non-technological) curricular components into plausible directions for technology scaffolding.

Step 1: Reflective experience space

This set of sensitising concepts highlights the decisions and considerations that the designers might find useful to take into account when scaffolding transformative reflection in the SEL context.

— What constitutes a 'real-enough' experience? —

The three questions below emphasise what we see as core aspects of the tension between experiencing a strong-enough emotion/interpersonal situation while keeping the reflective focus needed for learning.

Q1: What characteristics make the experience 'real-enough'?

This question aims to help the designer explicate what are the *"essential features of a practice to be learned"* [33, p170] that will make the experience seem 'real' for the learner. Given that SE competencies are normally embedded in complex social settings, it is important that designers unpack the minimal set of features that are essential for a meaningful learning experience (at the learner's competency level). For example, as mentioned earlier, in learning to self-regulate it is the strength of actual emotion perceived by the learner that is important – this is regardless of whether this is triggered by a scary movie, a recollection of a memory, or a real-world event such as a conflict with a significant other.

Q2: How 'real' should the experience feel?

We noted above how the curricula endeavoured to create the 'most real' situation possible that still allows for a learning focus rather than being swept away by emotions. Thinking of experiences as being positioned along a 'perceived realness

continuum' is useful in understanding the type of experience and the associated learning trajectory the system/intervention aims to facilitate. Again we note that it is the 'felt realness' that matters, rather than whether or not the experiences are directly embedded in the real-world settings.

Q3: How much balancing support should be available
We saw how the existing curricula carefully balance the perceived 'realness' of the experience through multiple mechanisms, such as adding (or removing) scaffolding to structure the experiences or facilitate the reflection process that the learners should go through around these. This emphasises the focus on the mechanisms of transferring the learnt competencies from in-class or otherwise externally supported context to real-world unsupported situations by reducing the balancing support available to learners. This highlights decisions such as whether the aim is to transfer a competency mastered in one context to another (i.e., helping the learners to develop abilities to react to situations that are otherwise still 'too-real' for them), or the focus on creating a safe space with plenty of support where the initial seeds of competencies can be created.

— What are the challenges to reflection? —

We saw from both case studies how several inherent characteristics of SE experiences can make reflection-in/on-action difficult for learners. In particular, we emphasise the danger of *emotional entanglement*, the implications of *intangibility* of some SE competencies; and more broadly the inherent challenge *in closing reflection loops* as exploration of various responses to the same situation is often not possible. The extent to which each of the three challenges is relevant for a particular SE competency can markedly differ. However, if present, they might imply the need for additional scaffolding to support reflection and mitigate the effects.

Q4: Is emotional entanglement likely?
We discussed the danger of particular experiences becoming emotionally 'too real'; so real that the learners become entangled in the emotional states and lose the learning framing necessary for reflection-in/on-action. If this is the case, the existing curricula can provide an inspiration in how this can be mitigated through balancing the perceived realness of the experience through the support components. This might include providing the learners with in-the-moment scaffolding from a mentor or mental tools to be triggered in these situations, as well as recording traces of the key aspects of the experiences in order to facilitate reflection on the 're-lived' experience.

Q5: How directly visible/tangible is the process of 'doing'?
We saw how many of the social-emotional competencies are ephemeral and intangible. This makes them hard to model effectively for the teachers and similarly difficult to grasp for the learners. For example, the experience of being 'self-aware' has some visible implications (such as being congruent in what one does and what one says), but the process of 'becoming self-aware' as well as the work that goes into it remains hidden. If this is the case, additional scaffolding might be needed to help learners both 'see' what the mentor does as well as make their own reflective processes more tangible.

Q6: How easy is it to close the reflection loops?
Social-emotional situations can be a highly continuous flow of action, and thus do not allow for exploration of multiple possible responses within a single situation. As such, it may be difficult for students to 'close the reflection loops' quickly enough to understand how their current behaviour works/doesn't work, and what might be the alternative approaches. Under such circumstances, this suggests the need for the practicum to either generate multiple highly analogous situations if that is possible; or provide scaffolding to extend the reflection phase beyond the situation itself (such as the reflection processes around video-playback in counselling).

— How are the experiences achieved? —

The case studies point to two main approaches through which SEL curricula facilitate the 'right sort of' experiences for the learners: The first corresponds to setting up of a particular situation that is likely to **generate** such 'right' experiences. Examples are the role-plays in education or the practice counselling session in counselling. The second relies on providing support so that the learners can **appropriate** real-world situations into the context of the curriculum, such as the coaching expected from teachers or parents within the SEL in education, or the supervision model in counselling. In effect, this re-interprets otherwise unsolicited experiences into teachable moments.

These two approaches can be interpreted as bringing complementary benefits and challenges: Generating the experiences allows for good control and on-task support for the learners, but might struggle with eliciting real-enough experiences once the learners pass beyond a certain competency level. For example, recall the need of education curricula to move beyond role-plays. In contrast, aiming to appropriate real-world moments requires the curriculum to be much more opportunistic and presents difficulties in providing the necessary scaffolding for reflection and balancing emotional realness within the real-world settings.

Step 2: Technology design space

Seeing the questions from the previous section as leading to the design brief, this section illustrates how the reflective practicum can help unpack the design space for scaffolding the selected experiences. We structure such discussion independently for explicit, social, and personal practicum components, as each of these suggests particular mechanisms to scaffold the 'right sort' of experience for the learners, and thus also the prospective roles for technology systems.

— Explicit components —

The explicit components directly re-structure and shape the experiences of the learners through tasks or specific 'tools' to scaffold reflection. Looking across the case studies, we propose that these components can be further interpreted as addressing three possible roles: (i) structure tasks or social interactions to generate particular experiences; (ii) provide mechanisms to appropriate real-world experiences as teachable moments; (iii) directly scaffold the reflection process. Each of these then suggests a particular role for technologies

in support of transformative reflection in SEL, as well as underlying strategies and mechanisms that could be incorporated into technology-based systems. We discuss each briefly below.

R1: Generate emotional/interpersonal experiences
Both SEL in education and counselling relied on highly structured tasks that helped generate experiences for learners. These might have taken the shape of simple vignettes and role plays, as well as the intricate structure of practice counselling sessions. This points to the potential technology might play in facilitating emotional/interpersonal experiences such as through interactive media [3] or games (both on screen [5] and virtual/mixed reality systems [15, 30]). For a specific SEL example, the system developed in [38] used an interactive animated story to scaffold a particular emotional situation for the parent and child to work with.

R2: Appropriate the naturally occurring experiences
Components helping to appropriate naturally occurring instances as teachable moments were present in both counselling and educational settings. Such components supported learners in identifying the teachable moments (e.g., that one is becoming angry), balancing the emotional realness of the situation (e.g., through in-the-moment scaffolding such as triggering particular mental tools), or making it available for reflection later (e.g., video recording in counselling or working with recollections in education). Each of these aspects could be addressed by the emerging wearables and other UbiComp technologies: sensor-based systems could help identify key situations as well as trigger self-regulation strategies (e.g., [27]), as well as collect traces that create 'time-windows' into the experience for future reflection.

R3: Directly scaffold the reflection process
While the previous two strands focussed on facilitating access to the underlying experience, this strand of explicit components aims to scaffold the reflection process on that experience. Both education and counselling curricula relied on tools that emphasise or problematise particular aspects of experience (such as the IPR questions), as well as providing structured ways of working with traces to revisit and 're-live' the underlying experiences. The implications for possible roles of technology are for example by thinking about systems that can deepen the link between reflection and experience in one of two ways: by embedding the reflection scaffolding into the experience itself (e.g., through a bio-feedback object that is incorporated into self-regulation strategies learners use to facilitate closing reflection loops quickly); or through extending the possibilities to work with a trace of an experience post-hoc (e.g., [37] facilitates reflection through making the reflection work visible and closely tied to the underlying video).

— Social components —
The role of social components is to provide a supportive learning environment through enabling a set of social resources the learners can draw on as they proceed with the training. In contrast to the explicit components, the focus of social components therefore shifts from directly affecting the learners' experiences to providing support to others who support the learning. In particular, the common strategies across SEL curricula can be interpreted as either supporting 'in-the-moment' coaching, as exemplified within the education settings; or the more diffuse set of social norms that promote (or at least do not impede) reflection and learning processes from situations that happen in the space (such as the learning contract in counselling). This suggests two example roles for technology in this space:

R4: Scaffolding mentors' scaffolding role
The scaffolding role of the mentor is a key component across both SEL contexts. The emphasis is then on the need of mentor's own competency through which they model and facilitate reflection-in-action. This suggests potential for technology to *scaffold this role for available-but-untrained mentors* (such as parents); as well as providing support so that *mentors become more effective* such as through streamlining the scaffolding process. For an example of the former, the system developed in [38] was deliberately designed to support parents with prompts and questions to structure their interaction with children. For the latter, [37] provides mentors with tangible record of students reflection with the aim of making it easier and quicker to provide in-depth feedback during a one-on-one session with the student.

R5: Support establishing learning culture and peer support
The analysis of both SEL contexts has highlighted the importance of the social support grounded in learning culture (whereby instances of interpersonal/emotional behaviour are seen as material for learning) and direct peer support in doing so (e.g., to deliver feedback or participate in generating of teachable moments). We argue that while such social norms and support are beneficial for any learning, they are of particular importance for SEL, where most teachable moments require the presence and interaction with others. Prior work in HCI suggests that technology could facilitate such social support both within existing peer groups (such as the research around designing for social-support in behaviour change technologies, e.g., [8,26]), as well as connect networks of strangers together around a single cause (such as the Koko application [24] using crowdsourcing to help reflection process based on strategies from Cognitive-Behavioural Therapy).

— Personal components —
The personal components correspond to the learners' internal qualities that are crucial for the learners' grasping of the experience. This includes the students' motivation to actively engage with and learn from their experience, as well as their existing abilities to reflect-in/on-action. As such, we see these as much harder to directly affect by technology than the other two sets of components. In fact, limitations of personal components in the target user group might suggest the need to compensate for these through explicit/social components, such as the reliance on coaching (social) and mental tools (explicit) in SEL in education.

R6: Supporting motivation to engage
That said, we see opportunities in technology-based systems to facilitate motivation to engage for the users: for example, gamification elements have been shown to be successful to increase motivation in other contexts [9, 35]; and there might be potential for technology-based short-term interventions that

reduce internal barriers to action, such as those building on mindset interventions [25, 43].

DISCUSSION: MOVING BEYOND SEL CONTEXTS

This section aims to extend the argument by illustrating how aspects of reflection scaffolding similar to those described by the reflective practicum framework in SEL can also be seen in other HCI work. As an example, we discuss three otherwise unrelated HCI projects, coming from areas of diabetes management [21], healthy eating behaviours [26], and romantic relationships [41] [2].

We suggest that the reflective practicum framework proposed here provides a language to revisit these studies, helping to identify similarities in the underlying design strategies through which reflection is scaffolded in their localised contexts. Moreover, we conjecture that such similarities in successful designs could reflect shared mechanisms through which transformative reflection might work across domains. That is, similar to how Schön's observations of the learning process across architecture, engineering, consulting or music [32, 33] can be translated to social-emotional learning contexts, we argue that these are applicable to a range of other areas that aim for transformative reflection.

In line with the key features of the reflective practicum, each of the three systems is designed to deliberately scaffold particular experiences for users, incorporating active engagement with these as the crucial part of the design for reflection:

- ⋆ In MAHI [21], the users are newly diagnosed diabetes patients, enrolled in an educational program helping them manage the new limitations. The MAHI system helped patients capture key measurements (glucose level) associated with what happened (photos of meals) and most importantly engage in sense-making on this experience, with asynchronous feedback from the educators. The authors draw out how this 'articulation work', scaffolded by the system, led to deep reflection and, over time, marked shifts in how patients viewed and understood the implications of their actions [20, p121].
- ⋆ Community Mosaic [26] is designed to help underprivileged communities eat healthy food. The design was driven by a strong collectivistic focus, with the users asked to take photographs and descriptions of food they are preparing to inspire others in the community to eat healthier. Parker draws out the notion of 'reflection-through-performance' as the underlying design principle: she showed how the act of crafting a message for the 'unseen audience' served as a strong scaffolding for reflection, making the participant go through a process of looking at their behaviour from the 'others' perspective.
- ⋆ Finally, the Lover's box by Thieme at al [41] examines how a digital artifact can scaffold reflection for partners in new romantic couples. The design combined a physical artifact (a wooden box) and video messages that participants create for each other, with the support of a video artist. The authors argue that the 'principal vehicle for promoting reflection was the creation, exchange, and sharing of video messages', further mediated by the interaction with the video artist, who served as a crucial 'component of the reflection system'.

Each of the designs can be interpreted as a combination of explicit, social, and personal components, providing similar mechanisms for the scaffolding of experience and reflection as in the social-emotional contexts: for example, the design of the 'task' in MAHI—linking the measurements and food logs with personal annotations—helps users appropriate particular experiences as teachable moments they can reflect on (explicit), while providing specific instances for modelling and support from the mentor (social). The system then relies on the strong inherent motivation of the participants who struggle to accommodate their newly diagnosed illness; and supports the development of their competencies to reflect on and make sense of their experience over time (personal).

Overall, these observations suggest that even if these authors do not reference each other, work in different contexts, and use different design strategies, seeing their work through the reflective practicum lens can point to similarities in the underlying design strategies through which transformative reflection is accomplished. As such, these systems can be interpreted as providing additional exemplars of practical instantiations of the strategies underlying reflective practicum, further populating this design space.

CONCLUSIONS

This paper draws on the combination of Schön's reflective practicum and two SEL case studies to argue how the process of transformative reflection is carefully scaffolded (rather than just triggered by data) in two well-established training settings. Using the core aspects of the reflective practicum as sensitising concepts, we abstracted the strategies and curricular components that provide such scaffolding, and suggested a framework of questions and roles for technology that might guide designers in designing for transformative reflection in SEL. We argue that this design framework could be also used in contexts beyond SEL, emphasising the need to move past *triggering reflection on data* and toward *scaffolding reflection within experience* if transformative reflection is to arise.

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