

# Boundary crossing in Teacher Education

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*Educators face increasingly complex problems that they cannot solve on their own. Collaboration with other stakeholders is needed and this requires boundary crossing and provides learning situations for those involved in the problem-solving process. This article summarizes the theoretical background of boundary crossing as a learning process, building on the experience of a project that aimed to support student teachers, teachers and other educators in complex problem-solving scenarios. The article draws on a range of examples to make connections between the theory of boundary crossing and real world problem-solving and learning situations.*

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## Introduction

The Covid-19 pandemic has had great societal impact. During local and national lockdowns across the world families were asked to stay at home. Many parents combined working at home with a new role as home-teachers as schools turned their programmes into various forms of digital education (Reimers & Schleicher, 2020). School leaders and teachers may have, at first, perceived this as merely a change of methods, but soon many other consequences emerged (Cleland et al., 2020). For example, infrastructure proved to be insufficient in many households; not all parents were competent or willing teachers at home, and some groups of children did not get sufficient input to acquire mother tongue language skills. Staying at home also had an impact on family relationships, sometimes even leading to conflicts. These wider impacts illustrate how problems that are, at first

glance, interpreted as things to be solved in and by schools, school leaders, and teachers, often require the involvement and commitment of a wider circle of professionals and other stakeholders. They also illustrate the need to cross boundaries to address the issues involved: boundaries between home and school, social and other support services, educators, teachers and parents. When professionals succeed in effective collaboration and in mutual professional learning through boundary crossing, they become more effective as individuals, as teams, and as organisations. Not only can professionals and the parents involved benefit from boundary crossing; so too can children who will experience education which is more coordinated, flexible and responsive to their needs.

This paper explores boundary crossing and how it can be useful in the professional learning of teachers. We suggest that many educational problems, like the challenges created by COVID-19 but even some that seem more straightforward, are actually wicked problems (Veltman et al., 2019) where the observed behaviour in school is only one part of a more complex and interconnected series of issues. Wicked problems in education typically require the collaborative effort of a range of people including educators, other professionals, parents and the wider educational community (for example, academic researchers). We start by exploring a wicked problem (presented as a vignette) identified by the ERASMUS+ project PROMISE (Promoting Inclusion in Society through Education). We then show what boundary crossing is and how it can be a useful approach to tackling wicked problems in education. We then draw on several successful examples of boundary crossing in practice to show that there is not one standard method for this and how other people and processes can help. Finally, we return to the example of the wicked problem and suggest some ways this could be addressed, informed by a boundary crossing approach. We conclude with suggestions for the development of competencies for boundary crossing that could be adopted by teacher educators to equip future educators with skills for professional learning throughout their careers.

### **Wicked educational problems – a vignette example**

The ERASMUS+ project PROMISE (Promoting Inclusion in Society through Education) has gathered and explored the use of professional dilemmas as resources for professional learning. Working with educators across sectors from primary to vocational education, the project has collected examples of dilemmas faced by

trainee and experienced educators and managers to explore the range of issues faced as a result of societal changes and increasing diversity across Europe (see Kools in this volume and Beaton et al., 2021). The dilemmas collected have been presented as a series of vignettes, and made available as professional learning resources via the project website ([promise-eu.net](http://promise-eu.net)). Vignettes have previously been used in educational research to analyse situations and support dialogues to derive insights and views in order to build an understanding of the dynamics of the practices described. Evidence suggests that these dialogues contributed to the professional development of the analysts, so what started as an analytical tool has also proved to be a valuable tool for teachers' professional development (Angelides & Gibbs, 2006). The PROMISE project aims to capitalise on the value of vignettes as a resource to support individual and collaborative professional learning for teachers across sectors.

Each PROMISE vignette can be regarded as a short story without an ending. They have been developed by teachers and teacher educators and each one provides an accessible, rich and challenging description of teaching practice. They present an issue or challenge for which there is no right answer or obvious solution. Some information about context is provided within each vignette, along with details of some of the choices and issues that a teacher or other educator facing the scenario may find themselves grappling with. Some include questions which refer to possible ways in which to develop professionally in order to acquire the competencies needed to tackle the problem; others refer to the boundaries one might cross in order to involve others together with whom the problem/dilemma may be more easily solvable, or with whom competencies may be shared and exchanged to bring solutions closer. By asking such questions the process of analysis of the vignette as well as the search for opportunities for boundary crossing and mutual learning are promoted.

The PROMISE vignettes are intended to be flexible resources for professional learning with which people can identify and to which they can bring their own perspectives in discussions in which solutions may be found (Jeffries et al., 2005). A PROMISE vignette is included in full below as an illustration of the type of wicked problems faced in practice:

“I am a teacher in special education. Our school offers education to pupils from 12-18, who have a low IQ (60-80). It is not so much about teaching them subjects, but helpingS them to find their way in society, maybe find a job. The pupils often have a low socio-economic background, broken families and other problems. Many of them are illiterate (and so are their parents).

Due to the Covid-19 outbreak in March 2020, all schools needed to close. This was a challenge for all teachers, but it caused severe problems for our target group. Other teachers switched to online lessons, but this is no option for my pupils. Many of them do not have access to a laptop, tablet or computer and IF they do, due to their illiteracy, it is very difficult for them to understand the instructions to participate in online teaching sessions. For these children, it is also difficult to work individually on tasks. I can only use the telephone and short messages to get in touch with them. I have to be very creative to find ways to reach and teach them.

The problem I encounter is that I am worried about my pupils, I want to be in contact with them, I want to help them. School used to be a safe environment for them, where they could learn and develop. I am worried about their situation, their development.” (promise-eu.net Vignette no. 12)

This vignette articulates clearly that the teacher is worried about the children they teach and wants to help them with their learning during the pandemic – something with which many educators will identify. The closure of schools was a challenge for all teachers, but it caused severe problems for students with special needs and their educators. Remote learning is clearly difficult for this group, both for practical reasons around access to devices and because of the individual needs of students.

The vignette reveals that being able to help is further complicated by the setting that the teacher works in: ‘special education’ for secondary-age children. There is no information about the location of the school but in most European education systems this means a school, classroom or unit that is separate from the corresponding ‘mainstream’ setting. The teacher hints at the kind of curriculum on offer in this setting and it is possibly one that is quite restricted and focussed on ‘life skills’. The discussion of IQ and of the curriculum suggest that they have a particular understanding of the purposes of special education. Addi-

tionally, the teacher notes that the children and young people in the setting experience other social disadvantages such as poverty and disrupted family situations, and typically have parents with low education levels. The elements of context that the teacher has chosen to highlight are the features that they consider to be the most important to the problem they are facing. The use of language is also indicative of context and may reflect local or national preoccupations or policy priorities.

This vignette provides an example of a wicked problem, something not easily solvable and not by this teacher alone. It is a situation in which parents play a part, in which technology plays a part, in which other professionals may be involved as well. For this problem to be addressed boundaries must be crossed. These boundaries are between professions, roles and contexts. Acknowledging these boundaries and adopting a boundary crossing approach may provide a way to explore and possibly address the problem and contribute to the further (professional) development of those involved.

### **A brief introduction to boundary crossing**

In the vignette above the emphasis is on one teacher and the learning and support they provide for their students. Boundary crossing is, however, relevant and powerful at various levels: for students, student teachers, teachers, teacher educators, school leaders and other professionals involved in education or related fields of work. Boundary crossing has been promoted in classroom teaching and learning but it is also applied in teacher professional development (Akkerman & Bruining, 2016). It has also been used as a framework from which to evaluate schools as organisations, to analyse to what extent schools offer learning environments promoting boundary crossing to enrich learning, and to establish inclusion and enhance the mutual understanding needed for that (Gerdes et al., 2020). Those who cross boundaries will cross and return, share and co-operate and when the process is facilitated well they will give and take, share and reflect, benefit mutually and eventually transform. In this article we focus primarily on boundary crossing in teacher education, reviewing underlying principles below and then applying these to examples.

There has been long-standing interest in the learning potential of boundaries or borders in education (see, for example, the work of Giroux, 1998, 1991, 1992; Engeström et al, 1995 or Akkerman & Bakker, 2011 for a summary). Underlying

this interest is the belief that difference creates an opportunity for learning and should therefore be considered positively rather than as a problem to be overcome. In the case of the diverse classrooms considered by Giroux (1992) for example, the difference in cultural background between students could be considered a resource for learning rather than a barrier to it (see also the idea of ‘funds of knowledge’ proposed by Moll & González, 2004).

Boundary crossing draws on Cultural Historical Activity Theory (CHAT) to explain how learning occurs at a boundary and the ways in which boundary crossing (and any attendant learning) can be mediated by key individuals (brokers) and artefacts (boundary objects). Boundary crossing situations are typically characterised by information-sharing across a boundary that may be geographic, cultural or professional (Akkerman & Bakker, 2011). Though they may occur spontaneously, the facilitation of such situations usually requires a ‘boundary object’. Boundary objects can include events or activities (where different people are brought together with a shared objective), resources (which can stimulate engagement of different people across a boundary) or sometimes actors (who use their insight from both sides of a boundary to make the path across more navigable for others).

Boundaries create the potential for learning but do not guarantee that learning will happen nor, as Akkerman and Bakker (2011) suggest, that the learning taking place in different boundary crossing scenarios is the same in nature or degree. They identify four learning mechanisms that can be triggered by a boundary crossing scenario (after Akkerman & Bakker, 2011):

1. Identification: the process of understanding the features of the different contexts separated by the boundary
2. Coordination: the process of integrating potentially different ways of working across a boundary
3. Reflection: the process of re-examining one’s own practices in light of exposure to something different
4. Transformation: the process of changing one’s own practices in light of exposure to something different.

Akkerman and Bruining (2016) note that these mechanisms should not be considered hierarchical nor should some of them be considered preferable or better than others. Instead, the context will determine what kind of learning is most useful and appropriate. In a study of a boundary crossing activity for trainee vo-

cational educators, for example, Cornelius and Stevenson (2019) found evidence that some of these mechanisms were experienced for most participants and some participants engaged in multiple forms of learning. However, other participants did not show evidence of any of the forms of learning. This reminds us that crossing a boundary alone does not guarantee that learning will occur.

Teacher educators wishing to harness the potential of boundary crossing for learning need to think carefully about the design and structure of boundary objects and who brokers are. A particular consideration is that boundary objects should stimulate productive dialogue so that identification, collaboration, reflection and/or transformation is possible. The PROMISE vignettes are designed to act as boundary objects and, along with associated tools and activities, to encourage productive and reflective dialogue (see [promise-eu.net](http://promise-eu.net) Professional Learning Tools). These can be used by teacher educators (acting as brokers) to facilitate boundary crossing experiences. In the next section, we explore other examples of boundary crossing in education and analyse their features before returning to the example vignette.

### **Boundary crossing in educational contexts**

Five examples of boundary crossing have been selected to illustrate the breadth of application of the concept in education. These five examples, all from European projects, are summarised in the table below, with more details provided in Appendix 1. Common themes and emerging issues are summarised to highlight some of the features and challenges of a boundary crossing approach in education.

	Purpose	Context	Boundaries	Brokers	Boundary objects	Outcomes	Issues/Lessons learnt
<b>1 Developing global educators</b>	Developing participants' skills and identities as global educators	Trainee vocational teachers in Scotland and Finland	Sociocultural, media and technological, vocational, pedagogical	Tutors	Activity tasks	Appreciation of different perspectives and practices, Some transformation of practice, but not for all participants	Reveals potential for differential experiences for participants, and some specific challenges for implementation
<b>2 Professional learning for digital practice</b>	Supporting the development of digital and mobile practice	Professional educators from three sectors in Scotland	Roles (student/educator), countries, disciplines, sectors	Peers – self brokered	Meetings, joint participatory research project	Significant changes and developments in practice and pedagogic approaches	Highlights the value of cross-sectoral collaboration for professional learning
<b>3 Inside out – outside in: Building bridges in teacher education through encounters with diversity</b>	Supporting student teachers' sensitivity to diversity of current educational communities	Student teachers from eight Universities across Europe learn and live together at 10 days Intensive Programme	Sociocultural, spatial, language, pedagogical	Tutors, peers in multicultural groups, self-brokered	Activity tasks, group processes	Learning about integration issues through awareness of the relationship to space	The value of experiencing diversity for educational enrichment
<b>4 Young entrepreneurs developing in action</b>	Preparing teachers to promote entrepreneurship	Students and teachers worked closely together	Disciplines, sectors, roles	Teachers, authorities, entrepreneurs	Specific assignments, requests, and	Students transformed into entre-	Students developed entrepreneurial com-



<p><b>5 Synergy between school education, heritage interpretation and competence development</b></p>	<p>among students</p> <p>Involving educators to make use of the wider city context as a learning environment for competence development</p>	<p>with people in the community</p> <p>A municipal policy to promote heritage education and learning</p>	<p>Formal and informal learning; sectors</p>	<p>University staff</p>	<p>challenges</p> <p>The monuments, buildings, fortifications, and city structure</p>	<p>preneurs, in the context of real life assignments</p> <p>Experiencing how people relate differently to things from the past differently, and reflection on these differences</p>	<p>petences. Teachers gained experiences in facilitating this</p> <p>When heritage is used as a context for learning children learn more easily and develop important lifelong learning competences while doing so.</p>
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Table 1: Boundary crossing examples in teacher education. (Sources: 1) Cornelius and Stevenson, 2019; 2) Cornelius et al. in prep; 3) Inside out – Outside in: Building Bridges in Teacher Education, 2018; 4) Yedac, 2015; 5) Lakerveld & Gussen, 2011).

The examples show boundary crossing occurring at various levels and in many ways. It occurs when students meet and talk; it happens when teachers cooperate. Boundaries are crossed when more subjects are included, when students of different backgrounds share thoughts, and when parents or members of the local community are made part of a (mutual) learning trajectory. In the examples in Table 1, we see teachers, other educators, ICT staff, heritage staff, entrepreneurs, peers from abroad all involved in boundary crossing – sometimes acting as brokers and other times becoming the beneficiaries of boundary crossing.

Some of the examples in Table 1 address the learning of teachers and teacher trainees through international collaboration (Examples 1,2,3), whilst others are aimed at student learning (4,5). The majority are grounded within a single education sector, but Example 2 spans sectors (further education, higher education and community learning and development). The cross-sectoral approach allowed participants to make meaningful contributions to discussions free of organisational hierarchies, expectations and restrictions. Example 5 also goes beyond a single sector and adopted an interprofessional approach, drawing together teachers, educational scientists and museum staff to develop new ideas for heritage interpretation.

All of the examples reveal that boundary crossing by teachers and trainee teachers results in problem solving and professional learning. Example 2, for instance, provided solutions to local problems through consideration of alternative perspectives. Example 5 shows that museum staff and teachers developed themselves and each other through teaching history, experiencing history and relating it to current events. Example 3 helped student teachers begin to better understand how different participants locate themselves within educational communities. This particular example draws on both boundary crossing and inside-outside theory (Relph 1976) as underlying frameworks.

Where student learning is the aim of boundary crossing, there is evidence from these examples of authentic and expansive experiences providing learning outside classroom walls and in new settings. Students have been challenged to deal with diversity and interact with wider communities of professionals to develop new competencies. Example 4 engaged learners with wider communities to develop entrepreneurial competencies and Example 5 involved museum staff and supported the development of lifelong learning competencies.

Akkerman and Bakker (2011) suggest that a boundary is a ‘sociocultural difference leading to discontinuity in action or interaction’ (p. 133). The examples in Table 1 identify several relevant sociocultural boundaries (including cultural, geographical, disciplinary, role and sector boundaries). Technology is an additional boundary noted in Example 1. In this example, participants were required to navigate technological differences to identify technology(ies) they could use to support communication with peers from another country. Pedagogy is also specifically noted as a boundary in Examples 1 and 3. Whilst differences in pedagogical approach might be regarded as a type of sociocultural boundary (see for instance discussions of signature pedagogies by Shulman, 2005), it could be argued that articulation of this difference highlights the need for common understandings of curricular issues and practice in different contexts to support teacher professional learning through boundary crossing.

The process of facilitating boundary crossing is a delicate matter in which, in a balance between trust and curiosity, learners feel tempted to cross boundaries. Whilst educators are brokers in all of the examples in Table 1, self-brokering is a feature of Examples 2 and 3. Wenger (1998) suggests that brokers play a complex role, involving translation, coordination and alignment between perspectives. Where self-brokering is a feature, participants were able to draw on their own experiences to support boundary crossing and these experiences were clearly valued as opportunities to facilitate communication and shared understanding. Such an approach may encourage autonomy and self-direction, but perhaps risks distraction from the purpose of a carefully defined task. However, self-brokering seems appropriate in the context of independent professional learning (Example 2) and the development of future teachers (Example 3) because it allows participants to develop skills and competencies for future boundary crossing experiences.

A wide variety of boundary objects are identified in the examples including physical objects – such as the city, photographs and sketchbooks (Examples 3 and 5); processes, activity instructions and assignments (Examples 1 and 4); events such as meetings (Example 2). Boundary objects can also be ideas and concepts which support boundary crossing, such as inclusive education, entrepreneurship or lifelong learning. Whilst conceptual objects are not articulated in the examples it can be assumed that these also play a role in supporting shared thinking, al-

though the meaning of such objects may require some unpacking to ensure that these are consistent across boundaries.

The examples in the table also indicate that boundary crossing may be challenging. In Example 1, problems were primarily logistical in nature, such as finding concurrent space and time within two professionally accredited programmes to allow collaboration to take place. This example also revealed the need to secure commitment to the boundary crossing process and to support and encourage communication and reciprocity between participants. Some participants cited time as a barrier to engagement and others reported delays and problems making and sustaining contact with partners. Maintaining effective communication across boundaries, specifically vocational and technological boundaries, was challenging and even insurmountable for some participants. In Example 4, it appeared to be more difficult to promote entrepreneurship among teachers than among students. Teachers were also reluctant (at first) to allow students the freedom to invent things, try things out; or be in touch with clients. This may have been a barrier to the initial development of the entrepreneurial competencies that the project was aiming for. Nevertheless, the project made a difference and students involved felt taken more seriously than ever before.

## **Discussion**

The examples above show the central features of successful instances of boundary crossing and demonstrate that the crossing of different types of boundaries may require different kinds of boundary objects and brokers. Clearly, this kind of learning can have powerful effects – such as the transformation of practice – but how can we, as educators, instigate or support this kind of learning? In this section, we return to the example of a practice dilemma, or wicked problem, from earlier in the paper and use the headings from Table 1 to structure a discussion of the problem and some possible ways forward.

### ***Boundaries***

In the vignette, several boundaries can be identified. Firstly, a boundary exists within the school between different experience levels of educators working there. There are likely other teachers in the same setting experiencing similar issues. The teacher indicated that they are an experienced teacher. Less experienced colleagues may have innovative ideas or different ways of thinking about practice is-

sues. Another boundary exists between different professional domains. The young people in the school may have other professionals that routinely work with them such as social workers, medical staff or IT staff. The school or the education authority may, for example, employ dedicated IT personnel who could provide insight and expertise into the technical aspects of learning remotely.

Another important boundary exists between school and home. The Covid-19 pandemic has forced education to take place at home when it would ordinarily take place at school. The vignette indicates that some parents face additional challenges which may make it hard for them to support learning. However, parents are an important source of information about their own children and can provide insight into what their child enjoys, finds difficult or frustrating and their wider emotional reaction to the huge changes that Covid-19 has caused.

Finally, there are cultural boundaries in the vignette. We don't know the location of the teacher but undoubtedly there will be differences in how remote learning in special education contexts is being organised in different countries around the world. The potential value of Covid-19 as a learning moment is that the effects are being experienced globally albeit tempered by existing structural features of educational settings (and wider social policy) and by governmental responses. This sort of information can be accessed through internet resources that link practitioners together (such as resource-based websites and discussion forums) and also through academic literature. There is an additional cultural boundary between those like the teacher, who has a particular way of understanding his/her situation, and others who would understand it differently. Earlier, we noted that the teacher mentions several contextual factors. This indicates that they think these are pertinent for understanding the problem and exposes some of their assumptions about practice, the learners and the setting. Not all other people, including other educators, will see the situation in the same way and sometimes it can be helpful to 'disrupt' these understandings of the status quo (Armstrong, 2017).

The vignette shows how boundaries have been destabilised due to Covid-19. Previous lines of demarcation between practices have become uncertain and there is an opportunity for questioning of identities and practices across boundaries (Akkermann and Bakker 2011) to support professional learning.

### ***Boundary objects***

Models of boundary crossing suggest that catalysts need to be present that make people cross boundaries. These should provide room for action, and a perspective of autonomy. Apart from triggering action and reflection, it is important that learners experience a kind of belongingness, as a sense of being in a process together (Deci & Ryan 1985).

In the vignette, there are several possible boundary objects. Meetings between groups of teachers and/or other professionals may serve as boundary objects and as could documents associated with those meetings such as meeting papers, curriculum outlines and lesson plans. For some of these boundaries, the extent of the common ground shared by those on either side may be considerable (e.g. in the case of teachers in the same school) but, for others, there may be little common ground (e.g. between parents and teachers). The boundary objects chosen should reflect this and sometimes co-constructing a boundary object can be a useful exercise to surface assumptions and create a productive way forward. In the case of the home/school boundary during the Covid-19 pandemic (as in the vignette), a co-constructed learning plan which parents and educators have developed may help to provide clarity on the aims of the educator and any limitations introduced by learning in the home environment (e.g. when activities are completed). To facilitate crossing a cultural boundary, resources such as websites, books or articles or activities associated with formal professional learning such as seminars, or assignment tasks could fulfil this role.

### ***Brokers***

Table 1 shows that some boundary crossing is self-brokered by individuals on either side of the boundary. In the vignette, self-brokering could work well to cross the boundaries within the school, between professional areas and between home and school. However, this requires a degree of knowledge of who is on the other side of the boundary and willingness on the part of those on either side of the boundary to collaborate on solving problems together. This self-brokered boundary crossing is perhaps most likely to happen when there is some existing relationship between those on either side of the boundary in question – perhaps through longstanding professional relationships. The move to widespread remote working has removed the informal gatherings between practitioners that were commonplace prior to Covid-19 in staffrooms or workrooms (Harris, 2020). These are places where practitioners may have previously raised their ‘wicked prob-

lems' for wider discussion and self-brokering may help to facilitate this important communication using other methods.

For the cultural boundaries in the vignette, several people could act as brokers. Crossing a cultural boundary can be self-brokered too but relies on existing networks, and there may be few people in the teacher's existing networks who can provide insight from a different cultural perspective. School leaders may have access to wider networks, but they too, may lack access to those who can provide insight from across a cultural boundary. Those involved in organising provision for a city or country may be able to broker this type of boundary crossing more successfully. Such professionals are often involved in strategic decisions about education and expected to draw on a wide range of evidence from other contexts. They may also have responsibility for organising programmes of training or professional development. By disseminating their work in a written form, authors of professional or academic publications can also act as brokers for the cultural boundary.

Who the most appropriate brokers are is heavily dependent on the situation. For all of these boundaries, boundary crossing could be self-brokered if existing relationships can be productively drawn on. In other instances, brokering is about creating links between those who are not ordinarily in contact – usually by using the existing networks of the broker or by drawing on power afforded to them in their role.

The vignette is an example of a wicked problem with no obvious solution. The discussion above considers how this problem might be framed as a boundary crossing opportunity to develop thinking, understand different perspectives and work with others towards possible solutions. Experienced professionals will have examples of wicked problems from their own experiences to draw on and explore but, for new and trainee educators, examples such as those provided amongst the PROMISE vignettes will help them explore practice dilemmas and develop confidence and competence for their own contexts.

## **Conclusion: developing competencies for boundary crossing**

This paper explores boundary crossing as a pedagogic strategy in a range of contexts. The examples discussed in Table 1 reveal that effective learning through boundary crossing requires buy in and commitment to the process, clear and open communication, a commitment to reciprocity, willingness to deal with un-

certainty and alternative perspectives, and the ability to reflect individually and collectively. These requirements can be supported by an effective broker, but need to become embedded as ‘competencies’ in an effective professional (see Walker & Nocon, 2007, for a useful discussion of boundary crossing competence). Initial teacher education can provide opportunities to develop these competencies to help educators grapple with the wicked problems they will experience throughout their careers. Teacher educators have an important role to play in this process and can facilitate boundary crossing by:

- preparing educators to face wicked problems in practice: explaining that these are common and promoting a collaborative stance towards solving them;
- promoting a view of education as a collaborative endeavour including many partners, all of whom have something to add;
- bringing people together to practice discussing – for example by creating ways for those involved in teacher education programmes to discuss wicked problems such as those in the vignette;
- bringing the perspectives of other professionals into the teacher education process using suitable boundary objects e.g written resources, visits;
- designing resources and activities that promote interrogation of assumptions since seeing from another perspective is crucial to the success of boundary crossing.

It is clear that educators face complex problems in their practice that they cannot solve on their own. Collaboration with other stakeholders is frequently needed and this inevitably requires boundary crossing. When professionals collaborate effectively and engage in mutual professional learning through boundary crossing, they become more effective as individuals, as teams, and as organisations. Professionals and other stakeholders involved benefit from boundary crossing; as do the children and students who experience education which is more coordinated, flexible and responsive to their needs.

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## **Appendix: Examples of boundary crossing in education**

### ***Example 1: Developing global educators***

Boundary crossing underpinned the approach to collaborative learning provided for trainee vocational educators in Scotland and Finland (Cornelius and Stevenson, 2018). To support the development of participants' identities as global educators an activity was designed to allow them to collaborate online in pairs and small groups to develop a lesson plan. The lesson plan was required to address a

practice challenge faced by the Scottish participant. A set of defined tasks (boundary object) and tutors (brokers) guided the process. The activity required learners to negotiate multiple boundaries – sociocultural, media and technological, vocational and pedagogical – and took learners through the stages of identification, coordination and reflection. Some transformation was identified as an outcome, but was not universally achieved. The activity was not without challenges. These were primarily logistical in nature, such as finding concurrent space and time within two professionally accredited programmes to allow the collaboration to take place. The project also revealed the need to secure commitment to the project process and support and encourage communication and reciprocity. In some cases participants cited time as a barrier to engagement and others reported delays and problems making and sustaining contact with partners. In a few cases maintaining effective communication across boundaries, specifically vocational (between disciplines) and technological (associated with systems for communication) was challenging and sometimes insurmountable. However, there were also successes. Participants reported enjoying the collaborative process and becoming more aware of their own and other perspectives on practice. The activity resulted in implementation of some innovative approaches in practice and the establishment of some useful professional relationships.

### ***Example 2: Professional learning for digital practice***

Professional learning can also benefit from a boundary crossing approach. Stimulated by participation in an ERASMUS+ strategic partnership project (Mobile Learning in Higher Education), educators from three sectors in Scotland (Higher Education, Further Education and Community Learning and Development) maintained contact as an informal community of practitioners seeking to develop their own mobile and digital practices. At the time of the stimulus event (a 2 week long Intensive Programme of project activity held in Portugal) some participants were students as well as professional educators, thus this example involved crossing boundaries between roles, sectors, disciplines and countries. Boundary objects were infrequent meetings which took place after the Intensive Programme and a joint participatory research project which aimed to explore the impacts of the Intensive Programme. This project, reported in Cornelius et al. (in prep) revealed that the cross-boundary learning community established supported experimentation, reflection, confidence and continued learning. The stimulus event facilitated the mechanisms of identification, coordination and reflection, and these processes

continued to be evident across the three years of the project, allowing participants to sustain and apply learning within their own contexts. The opportunity to see challenges from different perspectives (including different roles) and discuss challenges free from organisational norms and requirements appears to have been particularly helpful. For example, problems faced by one participant implementing a 'Bring your Own Device' strategy in practice were evaluated from organisational and student perspectives. Participants from different sectors were able to make meaningful contributions to the discussion free of organisational hierarchies, expectations and restrictions and this allowed a widening of horizons and thinking 'beyond the rules' (Clark et al. 2017). Participants reported significant changes and developments in their practice and pedagogic approaches three years after the Intensive Programme, suggesting that some transformation had also occurred. This example demonstrates the value of long-term boundary crossing as an approach to professional learning and shows that a cross-sectoral approach to the development of digital practice can help to reveal new ideas and approaches and provide solutions to local problems through consideration of alternative perspectives.

***Example 3: Inside out – outside in: Building bridges in teacher education through encounters with diversity***

Experiencing boundary crossing was an important learning process in an intercultural focused project in which student teachers learned together about inclusion and diversity. (Inside out – Outside in: Building Bridges in Teacher Education, 2018) In InOut project we brought together participants (student teachers, teachers and teacher educators) from eight different European countries for 10 days in an Erasmus+ funded Intensive Programme. Project mainly based on inside-outside theory of Relph (1976). Notions of insideness and outsideness can help student teachers to begin to better understand how different participants locate themselves within educational communities. Participants explored the physical space of the project through, for example, the use of drama, photography, sketch-books as visual diaries and deriving (boundary objects), and provide opportunities for student teachers to trial these pedagogical innovations in cross-cultural contexts beyond the formal boundaries of school. Through these activities the project aimed to build bridges through positive encounters with diversity and to support the cognitive, emotional and social learning of future teachers. The role of boundary brokers in the project is played by teacher educators on the one hand, but

readings and experiences are given at least as important a role in encouraging boundary crossings.

***Example 4: Young Entrepreneurs Developing in Action***

In a project on entrepreneurship tools were developed to help children engage in entrepreneurial actions. At the same time teachers were trained to promote this process. The project was part of a European project to promote entrepreneurship as one of the key competencies of lifelong learning. Students were challenged and facilitated to get in touch with people in the community to try to launch an activity for them that would add value to the community and that would be economically viable. All sorts of examples of initiatives were elaborated. Some children organised a market of things they produced themselves; others elaborated an assignment to organise once a year an exhibition in a local museum; again others launched a crowdfunding project to re-plant a lost forest in a dry area. The idea was to promote through teachers entrepreneurial competencies among students. In reality it appeared to be more difficult to promote entrepreneurship among teachers than among students. Nevertheless, the project made a difference and students involved felt taken more seriously than ever before. Teachers were reluctant at first to allow the freedom to students that would give them room to invent things, have try-outs; be in touch with clients, etc. Teachers worked with fellow teachers from other countries; they also had to cooperate with colleagues from various subject disciplines in school. At the same time they connected to, and met key players in the local community who would be willing to serve as clients in the pilot projects. The actual assignments/challenges were the boundary objects that triggered the creative entrepreneurial competencies of students. In this open environment including many players the students were left free to launch initiatives.

***Example 5: Making use of the historical and cultural context for learning***

A School is based in the historical centre of the city. The city includes a fortification from the middle ages, a cathedral, many old houses, museums and structures from various stages of history stretching as far back as the middle ages. The school and the local authorities wish to explore the possibilities of making optimal use of this rich environment for the learning and development of the children; for their social and cultural integration and for their engagement in the community and the sustainability of it, and of its treasures. Teachers together

with museum staff and educational scientists developed a city walk including learning tasks and assignments, to raise awareness among children of the meaning of the historical background, but also to raise issues for exploring matters of identity, the dark sides of the past, and the way people lived and how people perceive things differently each from their own perspectives. In the cooperation between teachers and museum educators new ideas were shared and elaborated on how to implement modes of heritage interpretation that allow children to develop competences for lifelong learning. In the mix of teaching about history, experiencing history and relating it to current issues, museum staff and teachers developed themselves and each other (Lakerveld & Gussen, 2011). The historical context itself was not the object of study, the historical context was used as a context for learning in whatever content domain reaching from languages, to arts, science, creativity, cultural awareness and expression, to technical issues.