

## iPeer Project

*Reinventing the STEM VET via Peer-assisted Learning and Innovative Pedagogy*



# Pedagogical methodology for Peer Assisted Learning with emphasis on peer-tutoring and cooperative learning



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Editor: *Vesselin Drobenov*

Authors:

- Vesselin Drobenov, The 40F.
- *dr. Tomislav Rozman, BICERO (editor)*

Design editors and integrators: Mateja Frangež Rozman

Title page design: BICERO

Logo design: VSI

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# Abstract

## **Purpose**

The purpose of the iPEER project is to enhance the educational experience of STEM Vocational Education and Training (VET) learners through the development and implementation of peer-assisted learning circles. These learning circles employ a range of methodologies, including peer-to-peer learning, peer tutoring, and innovative pedagogy. The project aims to expand the skills, knowledge, and values of VET learners, while also encouraging the use of new pedagogical methods and digital tools. A secondary goal is to reduce the rate of early leaving among VET learners.

## **Methodology/Approach**

The iPEER project employs a well-structured approach that incorporates various forms of peer-assisted learning such as study groups, peer tutoring, collaborative learning, and online forums. The methodology is further enhanced by integrating Bloom's Taxonomy and the European Qualifications Framework (EQF) to provide a comprehensive and effective learning experience.

## **Findings**

Early results suggest that peer-assisted learning, when structured properly, can lead to enhanced understanding of STEM subjects among VET learners. It also fosters social interaction, improves communication skills, and exposes students to diverse perspectives. Active and intended usage of innovative pedagogical methods and digital tools has also been observed to increase among participants.

## **Limitations**

Challenges include the potential for misinformation due to peer-based teaching and the complexity of managing group dynamics. Organizational constraints such as time and focus can also be limitations. Additionally, peer-assisted learning is not universally suitable and may not effectively serve all learner types.

## **Target Group**

The primary readership for this project includes young teachers, tutors, and VET providers who are interested in enhancing their educational methods and toolsets. It is also relevant for educational policymakers and stakeholders in the STEM VET landscape.

## **Practical Implications**

The iPEER methodology serves as a guide for educators and VET providers to implement peer-assisted learning effectively. By combining innovative pedagogy with traditional educational methods, the project offers a comprehensive approach that is designed to improve the educational outcomes for STEM VET learners. The methodology

also provides practical steps for the integration of digital tools and offers strategies to combat early leaving in VET programs.

## Introduction to methodology

The concept of learning from one's peers is far from new; it likely dates back to the earliest forms of communal or cooperative activities. While such learning has often happened implicitly, our focus here is on the explicit and intentional forms of peer learning. This type of learning involves individuals from similar social backgrounds, who are not trained educators, assisting each other in acquiring new skills and knowledge. Records documenting this practice go back centuries.

So what has evolved over the last quarter-century? Quite a bit, actually. **Traditional views saw the peer helper as a stand-in for a professional teacher**, following a straightforward model where knowledge is transferred from the teacher to the helper, then to the learner. These perspectives often suggested that peer helpers should be the top-performing students, who are most similar to professional teachers, and should act as a **surrogate teacher**. However, this setup tended to be less intellectually stimulating for the helper.

In more recent times, it has become evident that the dynamics of peer-to-peer learning differ significantly from those between a professional educator and a student. These differences come with their own set of pros and cons. The latest trend has been to **match learners with helpers** whose skills and knowledge are closer to their own. This setup presents cognitive challenges for both parties and allows the helper to benefit from the process of teaching, serving as a more relatable and credible example for the learner.

## Types of Peer Learning, Implementation, and Effects

The longest established and most intensively researched forms of peer learning are **peer tutoring** and **cooperative learning** (Topping, 2005).

Both peer tutoring (PT) and cooperative learning (CL) have been more extensively studied in educational settings than in other environments. PT involves clearly defined roles of tutor and tutee, with a strong emphasis on curriculum content and well-outlined interaction protocols. Participants typically undergo either generic or specialized training. Some PT approaches guide the interaction using structured materials, whereas others rely on predetermined interactive behaviours applicable to any subject matter. The terms "tutoring" and "mentoring" are often used interchangeably in existing research, which can create confusion. Mentoring refers to a supportive one-on-one relationship with a more seasoned individual in the same field, but not a direct supervisor. It generally



involves constructive role modelling, fostering higher aspirations, positive reinforcement, open-ended counselling, and collective problem-solving. It is usually focused on specific demographics and may span across different institutions.

Cooperative learning, on the other hand, is more nuanced than merely "collaborating." As Slavin, R.E. (1995) suggest it entails *structuring positive interdependence* toward a shared objective. This often involves the teacher outlining the goals, tasks, resources, roles, and rewards, and either facilitating or more directly guiding the group interaction. It typically involves heterogeneous small groups and may require prior training to ensure balanced participation and enhanced group synergy. While having all group members use the same information can stimulate cognitive conflict, it might also lead to within-group comparisons and feelings of inadequacy. To mitigate this, a "jigsaw" arrangement for information sharing can be employed (Buchs et al., 2004). Approaches combining group goals with individual responsibility usually yield higher outcomes. Unstructured CL can be problematic, sometimes resulting in inefficient or imbalanced work distribution within the group.

In early 1984, Bennett, Desforges, Cockburn, and Wilkinson discovered that children are often grouped together but primarily work individually. Interactions with peers constituted only a sixth of the time and were mostly irrelevant to the task at hand. Therefore, merely placing students together often does not suffice, particularly for those most in need. Spontaneous tutoring behaviours without training can be rudimentary (Bennett, 1987), often marked by limited questioning and insufficient error correction, along with inappropriate positive feedback. One significant shift over the past 25 years has been an increased focus on implementation integrity, emphasizing the importance of organizational variables in effective peer learning.

## **Organisational Variables**

If you're an educator looking to integrate peer-learning elements into your teaching strategy, there are several critical "dimensions" or organizational variables to consider. These factors will not only influence the effectiveness of the peer-learning experience but also determine how seamlessly it integrates into your existing curriculum. From classroom logistics to student pairing and digital tool integration, these variables can significantly impact the learning outcomes. Read on to explore these key considerations further.

Methods for peer learning (PL) can vary on at least 13 organisational dimensions (acc. Topping et al.):

**1. Curriculum content** – that is, the knowledge or skills or combination to be covered. The scope of PL is very wide and projects are reported in the literature in virtually every imaginable subject.

**2. Contact constellation** – some projects operate with one helper working with a group of peers, but the size of group can vary from two to 30 or more. Sometimes two or more helpers take a group together. PL in pairs (dyads) is more intensive – there is less opportunity to drift into token participation in a pair.

**3. Within or between institutions** – while most PL takes place within the same institution, it can also take place between different institutions, as when young people from a high school tutor in their neighbourhood elementary (primary) school, or university students help in regular schools.

**4. Year of study** – helpers and helped may be from the same or different years of study, and/or be the same or different ages.

**5. Ability** – while many projects operate on a cross-ability basis (even if they are same-age/year), there is increasing interest in same-ability PL. In this the helper might have superior mastery of only a very small portion of the curriculum, or all might be of equal ability but working towards a shared, deeper, and hopefully correct understanding. Failures in “Meta-ignorance” can be a problem – the helper doesn’t know that they don’t know the correct facts.

**6. Role continuity** – roles need not be permanent, especially in same-ability projects. Structured switching of roles at strategic moments (reciprocal PL) can have the advantage of involving greater novelty and a wider boost to self-esteem, in that all participants get to be helpers.

**7. Time** – PL might be scheduled in regular class contact time, outside of this, or in a combination of both, depending on the extent to which it is substitutional or supplementary for regular teaching.

**8. Place** – correspondingly, PL can vary enormously in location of operation.

**9. Helper characteristics** – if helpers are those who are merely average (or even less), all partners should find some challenge in their joint activities. Although the gain of the helped might not be so great, the aggregate gain of both combined may be greater.

**10. Characteristics of the helped** – projects may be for all or a targeted subgroup, such as the especially able or gifted, those with disabilities, those considered at risk of under-achievement, failure, or dropout, or those from ethnic, religious, linguistic, and other minorities.

**11. Objectives** – projects may target intellectual (cognitive) gains, formal academic achievement, affective and attitudinal gains, social and emotional gains, self-image and

self-concept gains, or any combination. Organisational objectives might include reducing dropout, increasing access, etc.

**12. Voluntary or compulsory** – some projects require participation, while in other helpers self-select. This can have marked effects on the quality of what ensues.

**13. Reinforcement** – some projects involve extrinsic reinforcement for the helpers (and sometimes also the helped), while others rely on intrinsic motivation. Beyond simple social praise, extrinsic reward can take the form of certification, course credit, or more tangible reinforcement such as money. Extrinsic reward is much more common in North America than elsewhere, and this has led to some debate about possible excess in this regard. The availability of extrinsic reinforcement can have effects on recruitment in voluntary projects, which might be good or bad.

## Peer-assisted learning. Peer-tutoring

### A Theoretical Model of Peer Learning

Consequently, the efficacy of peer learning is confirmed when it is well-organized and properly executed. Yet, the operative mechanisms underlying its success are not merely topics of abstract scholarly curiosity; understanding them holds practical significance. A comprehensive grasp of how peer learning yields its beneficial outcomes should equip both academics and practitioners to develop increasingly refined and effective peer-learning strategies. For an extended period, the theoretical foundation of peer learning was notably insufficient, often supported by traditional adages like "teaching is learning twice over." Over the past quarter-century, several researchers have undertaken studies that offer substantial contributions to the theoretical framework of peer learning. Nonetheless, an abundance of theories can prove to be more of an encumbrance than an aid to practitioners who are constrained by practical considerations.

Accordingly, Topping and Ehly (2001) synthesised existing research into a single theoretical model (Figure 1). This initially assigns some of the main sub-processes into five categories.

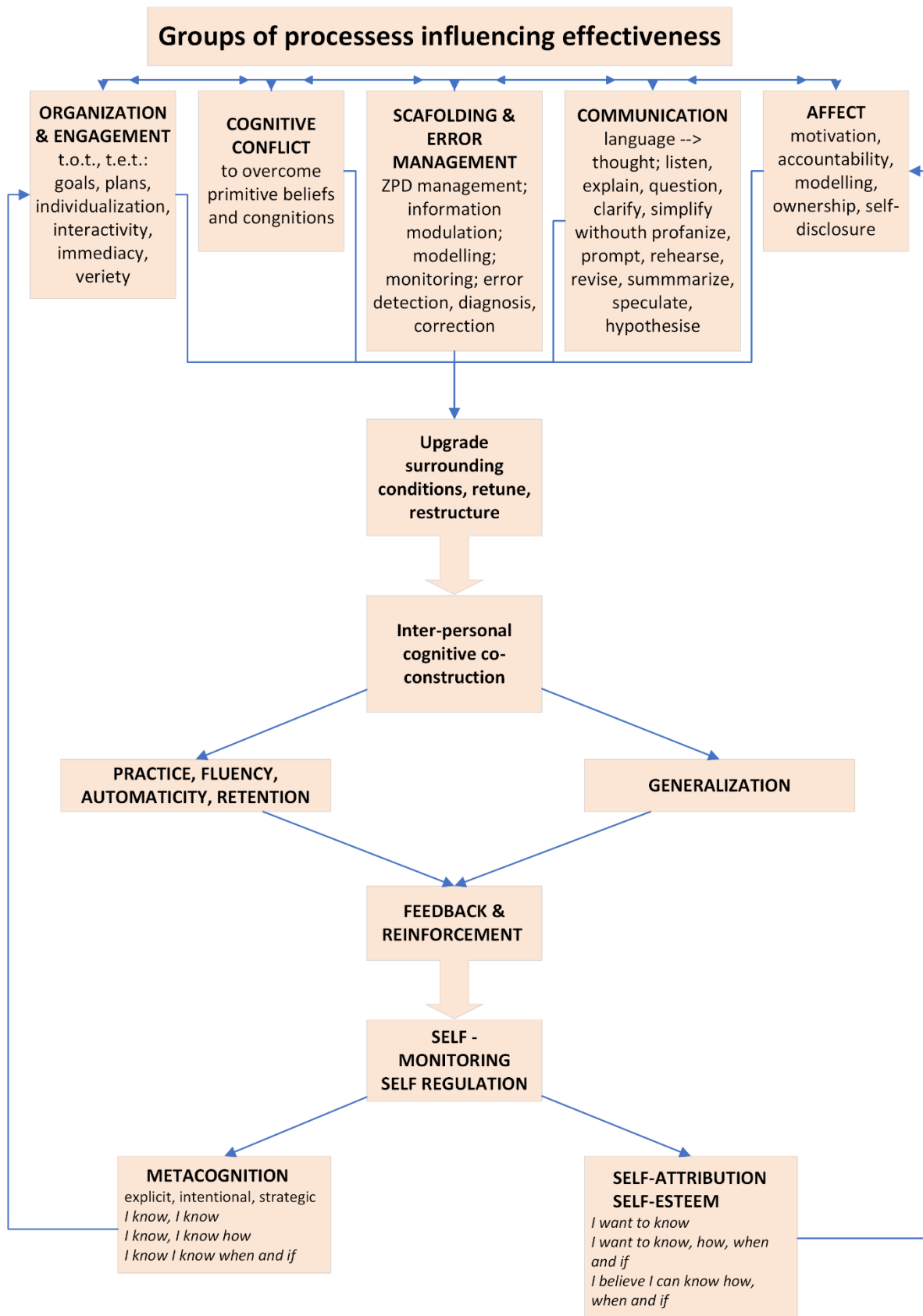


Figure 1: Theoretical model of peer-assisted learning / tutoring

The first of these includes organisational or structural features of the learning interaction, such as the need and press inherent in PL toward increased *time on task* (t.o.t.) and *time engaged with task* (t.e.t.), the need for both helper and helped to elaborate goals and plans, the individualisation of learning and immediacy of feedback possible within the small group or one-on-one situation, and the sheer excitement and variety of a novel kind of learning interaction.

Cognitively, PL involves *conflict and challenge* (reflecting Piagetian schools of thought, and necessary to loosen blockages formed from old myths and false beliefs). It also involves support and scaffolding from a more competent other, necessitating management of activities to be within the **zone of proximal development** of both parties (reflecting Vygotskian schools of thought, and necessary to balance any damaging excess of challenge). The helper seeks to manage and modulate the information processing demands upon the learner to maximise the rate of progress – neither too much nor too little. The helper also provides a cognitive model of competent performance. However, the cognitive demands upon the helper in terms of monitoring learner performance and detecting, diagnosing, correcting, and otherwise managing misconceptions and errors are even greater – and herein lies much of the cognitive exercise and benefit for the helper.

PL also makes heavy demands upon the *communication skills* of both helper and helped, and in so doing develops those skills. A participant might never have truly grasped a concept until having to explain it to another, embodying and crystallising thought into language – another Vygotskian idea, of course. Listening, explaining, questioning, summarising, speculating, and hypothesising are all valuable skills which should be transferable. The affective component of PL might also prove very powerful. A trusting relationship with a peer who holds no position of authority might facilitate self-disclosure of ignorance and misconception, enabling subsequent diagnosis and correction. The helper's modelling of enthusiasm, competence, and the possibility of success can influence the self-confidence of the helped, while a sense of loyalty and accountability to each other might help to keep the pair motivated and on-task. These five categories or sub-processes feed into a larger onward process of the helper and helped extending each other's declarative knowledge, procedural skill, and conditional and selective application of knowledge and skills by adding to and extending current capabilities (accretion), modifying current capabilities (re-tuning), and (in areas of completely new learning or cases of gross misconception or error) rebuilding new understanding (restructuring).

These are somewhat like the Piagetian concepts of assimilation and accommodation. This leads to the joint construction of a shared understanding between helper and helped – which is firmly situated within the current authentic context of application and adapted to the idiosyncrasies in their perceptions (i.e., is inter-subjective), so might not represent absolute truth, but forms a foundation for further progress. Subsequently, PL enables and facilitates a greater volume of engaged and successful

practice, leading to consolidation, fluency, and automaticity of core skills. Much of this might occur implicitly – without the helper or helped being fully aware of what is happening. Simultaneously or subsequently, PL can lead to generalisation from the specific situated example through which a concept is learned, extending the ability to apply that concept and its developmental variants to an ever-widening range of alternative and varied contexts in multiple communities of practice. As this occurs, both helper and helped give feedback to each other, implicitly and/ or explicitly.

Indeed, *implicit feedback* is likely to have already occurred spontaneously in the earlier stages. PL increases the quantity and immediacy of feedback to the learner very substantially. Explicit reinforcement might stem from within the partnership or beyond it, by way of verbal and/or non-verbal praise, social acknowledgement and status, official accreditation, or even more tangible reward. However, reinforcement which is indiscriminate or predominantly for effort risks over-weighting the significance of the reinforced concept in the network of understandings of the learner. As the learning relationship develops, both helper and helped should become more consciously aware of what is happening in their learning interaction, and more able to monitor and regulate the effectiveness of their own learning strategies in different contexts.

This development into *fully conscious explicit and strategic metacognition* not only promotes more effective onward learning, but it should also make helper and helped more confident that they can achieve even more, and that their success is the result of their own efforts. These affective and cognitive outcomes feed back into the originating five sub-processes – a continuous iterative process and a virtuous circle. As the PL relationship develops, the model should continue to apply as the learning moves from the surface level to the strategic and on to the deep level, and from the declarative into the procedural and conditional.

*Simplistic forms of peer tutoring, focusing on drill and practice*, seem likely to utilise only a few of the possible channels or sub-processes (typically only organisation, perhaps some communication, scaffolding and error management, practice, and reinforcement – fewer than half of the total possibilities). More elaborate and cognitively demanding forms of peer tutoring, such as *peer tutoring in thinking skills, complex knowledge teaching, teaching with storytelling* etc. aim to utilise all the channels, with both tutor and tutee operating and benefiting in every channel. This might be enhanced and assured by role reciprocation. The greater the differential in ability or experience between helper and helped, the less cognitive conflict and the more scaffolding might be expected. Too great a differential might result in minimal cognitive engagement (let alone conflict) for the helper, and unthinking but encapsulated acceptance (with no re-tuning or co-construction) by the helped. Of course, if the helper is older, more experienced, and therefore more credible, but has no greater correct knowledge or ability than the helped, then a mismatch and faulty learning might occur in a different way.

Teachers are likely to need to be particularly attentive to the channels in the lower and later parts of the model: *the development of generalisation, self-regulation, metacognition, and enhanced self-esteem and motivation; the progression from implicit to explicit, and from dependency on support to increasing independence; the shift from simple thinking to higher order and more abstract thinking, moving from the surface level to the strategic and on to the deep level, and from declarative knowledge into the procedural and conditional; and the completion of the loop, the joining of the circle, the acceleration of the dynamic spiral, for both helper and helped.*

### **Extension of Peer Learning to More Challenging Subjects**

Peer learning in schools originally targeted core skills areas, such as reading and mathematics. Where peer tutoring was deployed specifically for practice and consolidation purposes, this sometimes resulted in narrow “*drill and skill*” approaches. However, teachers became more *confident and trusting in children*, and slowly moved to use peer learning in a less mechanistic way and in more challenging subject areas. Peer learning extended to spelling and writing, and **then moved onwards to science** (Robert Slavin, 2014; Topping et al., 2004). Most recently, peer learning in thinking skills has shown compelling effects on cognitive modifiability. As peer learning began to take hold in college and university education, PL was increasingly applied to a very wide range of subjects, but also made its way to the middle school. **However, PL is still not well applied for VET subjects.**

## Peer-assisted learning. Cooperative learning.

Taking word from the Peer-tutoring we need again to highlight the work of Lev Vygotsky. Vygotsky's research highlights that effective learning is a collaborative endeavor. Oral repetition and explanation aid not only in reinforcement but also in advancing one's learning capabilities through interaction with more proficient peers. William Glasser quantifies this idea, stating that the majority of our learning comes from discussing, experiencing, and teaching others. Even though educational theories have evolved, the application in classrooms is still lagging. Numerous researchers, such as Robert Slavin and Spencer Kagan, have shifted from the traditional teaching model to cooperative learning over the past three decades.

Type of cooperative learning	Outline
<b>Complex learning, Elizabeth Cohen</b>	This ensures that tasks incorporate various multiple intelligence factors so that all members of the class may have an opportunity to contribute.
<b>Student teams (STAD), Robert Slavin</b>	Teams usually consist of four members who are mixed in gender, ability and ethnicity. The teacher presents the lesson, and then pupils work in teams to ensure that all members have mastered the objective. Pupils then take individual tests on the material, and scores are averaged for teams and compared with past scores, with teams rewarded for meeting certain criteria.
<b>Group investigation, Yael and Shlomo Sharan</b>	A problem solving approach which has four elements: investigation, interaction, interpretation and intrinsic motivation. It encourages higher-order thinking skills by comparing, contrasting and integrating a range of ideas, concepts and findings.
<b>Jigsaw, Elliott Aronson</b>	Each member of a group learns an essential part of a whole of a topic by working with a focus group and then helps the home group to combine the knowledge to complete the task.
<b>The structural approach, Spencer Kagan</b>	This incorporates setting up teams and then using structures or social interaction sequences, which enable the teacher to transform existing lessons into a cooperative format by using simple strategies. These strategies, or structures, are content-free mechanisms and widely transferable across the curriculum.
<b>Learning together, David Johnson and Roger Johnson</b>	This incorporates three types of cooperative learning (formal, informal and cooperative base groups) which should be integrated. Each cooperative lesson or activity should include the five essential elements (PIGS F). Lessons and classroom routines should be cooperative and make use of cooperative learning structures. The whole school should be organised in a cooperative team-based way. This results in the routine use of cooperative learning with teachers supporting each other in resolving issues and developing its use.
<b>Strategic co-operative learning, Dan Brown and Charlotte Thomson</b>	This combines cooperative learning and cognitive/metacognitive strategies for learning. Through use of multiple cognitive organisations of data, e.g. graphic organisers, cooperative learning becomes the platform for higher-order thinking.

Figure 2: Approaches to cooperative learning



## Cooperative Learning Explained

Cooperative learning is more complex than merely grouping students together. Essentially, it involves students collaborating in small groups to enhance their own learning as well as that of others. However, there's academic debate about the nature of rewards in this setup. This approach isn't dogmatic but rather practical. The core elements include:

- **Positive Interdependence:** In this setting, each student's input is crucial for group success, embodying the spirit of "all for one and one for all."
- **Individual Accountability:** Every student is responsible for their part, making sure nobody free-rides on others' work.

Apart from these, many researchers feel that interpersonal and small-group skills—both academic and social—are essential lubricants for cooperative learning.

### ***Why Different from Regular Group Work***

Cooperative learning differs from traditional group work as it necessitates structured tasks to ensure mutual dependence and individual responsibility. Traditional setups often have limited interaction between students due to an atmosphere of competition. To genuinely foster cooperative learning, there must be a shift towards collective goal achievement, a process that requires detailed planning.

### ***Teamwork as an Essential Life Skill***

The ability to collaborate is what sets humans apart and ensures our survival. Ironically, schools often emphasize competition over cooperation, affecting both students and teachers. Transitioning to cooperative learning requires an attitudinal shift in both classrooms and staff rooms.

### ***Creating a Learning Climate***

For a successful cooperative learning environment, a supportive ethos that celebrates diversity is key. Attention must also be given to language use and social-emotional needs. Various development materials, like "Excellence and Enjoyment: Social and Emotional Aspects of Learning," support this paradigm shift. Overall, the book aims to offer a comprehensive guide to implementing **cooperative learning, touching upon both cognitive and emotional aspects.**

## Outline of the Cooperative Learning Approach (Jolliffe, 2007)

- I. **Introduction**
  - a. Definition and Importance
  - b. Core Elements
- II. **Comparison with Traditional Learning**
  - a. Interdependence vs. Competition
  - b. Individual Accountability
- III. **Core Elements of Cooperative Learning**
  - a. Positive Interdependence
  - b. Individual Accountability
  - c. Interpersonal and Small-group Skills
- IV. **Differences from Regular Group Work**
  - a. Structured Tasks
  - b. Mutual Dependence
- V. **Importance of Teamwork**
  - a. Survival and Success of Human Species
  - b. Need for a Shift in Educational Paradigms
- VI. **Creating a Learning Environment**
  - a. Supportive Ethos
  - b. Importance of Language
  - c. Social and Emotional Needs

## Other forms of Peer Learning

While peer tutoring and cooperative learning continue to be the most prevalent and rigorously assessed methods of peer learning, alternative approaches have also emerged and gained traction. Regrettably, some of these novel forms have been adopted on a large scale without sufficient evaluation, leading to inconsistent implementation quality. A prime example is "**circle time**," which enjoys significant popularity among teachers and is widely implemented in UK elementary schools. Despite its widespread use, empirical evidence supporting its effectiveness has been lacking until recently, and when assessed, it was found to be no more impactful than untrained, instinctual teaching methods (Miller and Moran, 2007). Additionally, assorted types of peer mediation and befriending programs have been introduced, often with the aim of mitigating conflict and bullying. These interventions have produced results of varying quality and effectiveness, particularly given the predominantly descriptive nature of existing literature in these domains. However, there is robust evidence to suggest that children as young as four can be effectively taught problem-solving strategies, though additional educational mediation remains necessary.

### **Peer Counselling and Education**

Mediation and befriending programs may incorporate aspects of peer counseling, and although there is scant evidence, it suggests that peer counseling can be comparably effective to counseling provided by adults—though this is not a particularly rigorous standard to meet. Likewise, these programs could be viewed as including components of peer education, wherein peers furnish trustworthy and credible information about sensitive life topics, providing a space for informal discussion within a peer group setting.

### **Peer Monitoring**

An additional evolving field is that of peer monitoring, where individuals within a group observe and assess the appropriateness and efficacy of each other's behaviors. The academic literature has sporadically reported on peer monitoring focused on undesirable behavior, usually in settings that are challenging for adults to oversee. In more recent times, the concept of peer monitoring has broadened to include learning behaviors. This expansion is generally less controversial among participants and has been implemented across entire classrooms, yielding highly positive outcomes.

### **Peer Assessment**

The domain witnessing the most substantial expansion in both general application and empirical substantiation is peer assessment, which involves individuals within a group evaluating the learning outcomes or products created by their peers. Assigning learners the task to "mark," "grade," or quantitatively evaluate the work of their peers often positions them too closely to a teacher's role, leading to potential social discomfort and a tendency for assessments to converge around an "average" rating. Providing formative and qualitative feedback proves to be more cognitively challenging for the assessor but is generally more socially acceptable and offers greater utility to the individual being assessed. The mutual advantages of this approach have been comprehensively recorded, predominantly in higher education *as opposed to primary or secondary educational settings*, though the latter is on the rise. Peer assessment not only bolsters self-assessment but can also facilitate metacognitive growth.

# Planning and implementation framework.

## **Plan on the causes and the desired effects**

### ***Extrinsic effects***

When effectively designed and implemented, peer learning models like peer tutoring (PT) and cooperative learning (CL) tend to produce excellent outcomes. Empirical evidence substantiates that both PT and CL can lead to marked improvements in academic achievement within the subject area under focus. For CL, these benefits are observed for all group members, whereas in PT, both tutors and tutees stand to gain, contingent upon appropriate structuring. This observation counters the argument that peer tutoring could be unproductive for more advanced tutors, although the importance of proper organizational design must be emphasized. Furthermore, CL and PT also facilitate the development of ancillary skills such as enhanced social interaction and communication capabilities. While these secondary gains in affective domains, like boosted self-esteem, are harder to quantify and less consistently found compared to academic improvements, they offer substantial additional value without requiring extra resources. *Peer learning methods are also cost-efficient*; several studies have shown that these approaches deliver high-impact outcomes for a relatively low investment.

### ***Intrinsic Benefits***

Peer learning not only provides external academic gains but also cultivates various intrinsic skills that contribute to personal and intellectual growth. One such benefit is the honing of problem-solving abilities, as peer interactions often require the negotiation of differing viewpoints and the collaborative resolution of challenges. This experiential learning contributes to the development of an achievement-oriented personality, encouraging learners to set, pursue, and accomplish goals effectively. Moreover, peer learning enriches analytical skills, as participants learn to evaluate arguments, identify underlying assumptions, and synthesize diverse perspectives. These analytical skills are pivotal in distinguishing between correlation and causality, thereby facilitating a deeper understanding of complex topics. Peer learning also fosters the ease of hypothesis formulation. Being exposed to a range of ideas and viewpoints allows learners to hypothesize more creatively and critically, further enriching their intellectual capabilities. Therefore, the intrinsic benefits of peer learning go beyond the immediate academic advantages, offering long-term skills that serve individuals well in various life contexts.

## **Peer Learning in different environments**

Extensive research on peer learning has primarily taken place within educational settings like schools, where it is applied to an increasingly diverse range of student groups. For instance, peer tutoring has proven effective even with tutors as young as those in kindergarten or first grade. The practice is also gaining traction in higher education institutions like colleges and universities. These environments are relatively controlled, making them conducive to systematic evaluation. Nonetheless, the application of peer learning is expanding into various other environments. Some are more challenging due to long-term learning difficulties among the participants, such as adult education programs focused on limited literacy skills within domestic or community settings. Others involve settings characterized by high turnover and flexibility, such as voluntary organizations, after-school programs, libraries, and religious institutions. In some cases, learning is not the organization's primary objective, as observed in workplace training programs. Finally, some environments, like prisons, present their unique sets of interpersonal challenges for both the helpers and those being helped.

## **Peer Learning with Exceptional Learners**

While it may initially seem challenging for regular students to tutor peers with learning disabilities or other special needs, recent research has shown that students with educational challenges can also serve as effective tutors. For instance, studies have detailed successful reciprocal peer tutoring between typical elementary school students and those from schools catering to severe learning disabilities. Research has even shown that students with mental retardation can effectively participate as both tutors and tutees, covering a range of skills from academics to daily living.

The benefits are not solely academic; tutors, especially those who are disruptive, have also shown improvements in behaviour when they serve in this role. However, the effectiveness of cooperative learning strategies for students with emotional and behavioural disorders has produced mixed results.

Key findings suggest:

1. Students with special needs experience academic gains regardless of whether they are tutors or tutees.
2. Tutors may not benefit as much academically if the tutoring process doesn't present a cognitive challenge.
3. The benefits are enhanced when participants are carefully selected and trained.
4. Continuous monitoring of progress amplifies the advantages.
5. Participants often develop more positive attitudes toward the subject matter.
6. Improved social interactions outside the tutoring context are common.

7. Broader gains in attitude or interaction are less reliably observed.

## **Socio-Emotional and Transferable Skill Gains**

Even in initiatives mainly focused on cognitive or academic improvement, there may be ancillary gains in social and other transferable skills. Changes in attitudes towards school, instructors, subjects, peers, and oneself are also frequently observed. Such affective shifts are pivotal for the long-term impact and applicability of the learning experience, as they boost self-confidence, internal credit for achievements, and consequently, self-guided learning behaviour going forward. These elements contribute to building *educational resilience*, which can help students navigate less ideal learning conditions in the future.

For instance, in a cross-age peer tutoring program focused on reading across multiple classrooms, the majority of teachers noted improvements in student motivation, self-confidence, enjoyment, and social interactions during the tutoring sessions. A significant number also noticed that these gains extended beyond the tutoring environment, although these broader impacts were generally less robust. In a recent study on cooperative learning in science classrooms, it was discovered that improvements in cooperative learning skills foretold social advancements both within and outside the classroom setting. Classes that initially had low levels of social cohesion showed the most significant increases in this area, as well as in self-esteem, after implementing cooperative learning strategies. Direct peer tutoring of social skills has also been successfully employed with socially rejected students.

## **Information Technology and Peer Learning**

In recent times, advancements in information technology have increasingly intersected with peer learning in several distinctive ways. Initially, there has been *extensive exploration into remote peer learning within online communities*. **Stepping on those finding within iPEER we have been particularly focused on developing effective cooperative learning in both physical and virtual settings designed for distance education**. Even though within the iPEER framework we explored available and suitable methodologies it is worth to mention some additional and relevant aspects relevant to the integration of the PL in educational environment:

Specialized software, SaaS applications and other appliances has been engineered to facilitate the practical, but also the administrative aspects of peer learning, serving as a management information system for those overseeing or directing a program. This technological assistance becomes especially vital when dealing with complex, distributed peer learning settings that span multiple ages or institutions. Formative assessments supported by computer technology have been integrated into tutoring systems. This

ensures that both the individuals providing help and those receiving it benefit from regular, immediate, and relevant feedback concerning the efficacy of their collective learning endeavours. Lastly, attempts have been made to develop tutoring systems operated by artificial intelligence, and trained algorithms. While promising, these AI-driven systems still have progress to make before they can match the skill and adaptability exhibited by human tutors.

## **Embedding the System dynamics and the system thinking approach**

Integrating system dynamics principles into the concept of peer learning can provide a holistic and more sustainable approach to educational practices. In system dynamics, elements are not isolated; they're interconnected in complex loops of cause and effect, much like the roles of tutors and tutees in a peer learning environment. By understanding peer learning as a system, it becomes clear that it's not just a single teacher or student who drives the process but rather a network of interconnected individuals. As in system dynamics, feedback loops play a crucial role. Tutors benefit from the act of teaching, reinforcing their own understanding and skills, while tutees gain from personalized instruction. This forms a positive feedback loop that enhances the efficacy and impact of the learning environment for everyone involved. Moreover, peer learning also exhibits principles of accumulation, another key concept in system dynamics. The more a school invests in peer learning, the more "stocks" of benefits it accrues, from improved academic performance to essential life skills like effective communication and empathy. However, these stocks can be depleted if the "flow" of resources, such as committed educators or educational materials, is not maintained—highlighting the need for sustained investment and organizational planning. The system dynamics principle of delays is also relevant. The long-term benefits of peer learning may not be immediately observable but manifest over time, affecting not just academic performance but also the overall school culture. Such delayed effects emphasize the need for continued monitoring and adjustments, aligning with system dynamics' focus on understanding long-term trends rather than short-term events. Finally, integrating system dynamics principles can also help in recognizing leverage points within the peer learning system—areas where a small, well-placed effort can produce significant and enduring improvements. For example, training programs for peer tutors might be such a leverage point, increasing the efficacy of the entire peer learning program.

**In this merged perspective, peer learning becomes more than an educational technique; it becomes a dynamic system that, when well-managed, has the potential to become self-sustaining and continually improving, benefiting both individuals and the broader educational community.**

# PAL curriculum building

## Building a PAL program, class, group, or project: Before Start Assessment.

Before embarking on a PAL class, group or project or even start building a full comprehensive educational program, it is crucial to conduct a comprehensive assessment to gauge the status, aims, responsibilities, and various other factors that will contribute to the effective implementation of your initiative. This assessment uses a simple 3-point Likert scale to evaluate various aspects of planning and preparedness.

Aspect	Question
<b>Background</b>	What is the current situation and context in the curriculum?
	Why is this PAL action being considered now?
	Who is responsible for the action and who will lead it?
<b>Objectives</b>	What are the aims and objectives of the action for teachers / trainers?
	What are the aims and objectives of the action for students?
	What are the aims and objectives for the institution?
<b>Teachers</b>	Who will be teachers / trainers and how will they be recruited? Do you envisage <i>team-teaching</i> scenarios?
	What background and training will teachers require and how will this be provided?
	What sources for self-preparation for teachers are available, how they will prepare themselves and reflect afterwards?
<b>Students</b>	How will you engage with the students? What are the action specific aspects?
	What related prior knowledge and experience will students have already?
	What information and preparation will students require before the classes or interaction(s)?
<b>Interaction</b>	What will be the format of the interaction, and what resources are required?
	What would be a typical plan of activities / lesson plan during the PAL interaction?
	When and where will PAL interactions occur, and how will they be arranged?
<b>Evaluation</b>	What feedback will be collected from participants and how will it be used?
	How else will the project be piloted and evaluated?
	In case of complex knowledge teaching, are there any [model] academic hypotheses and how will they be tested?



Aspect	Question
<b>Institution</b>	Who are potential stakeholders in the PAL action?
	What are the staff time and funding implications of the action?
	How could the action be developed, and how might it affect the whole school / institution curriculum?
<b>Realisation</b>	What are the potential pitfalls or barriers to the success of the action?
	What are key points on the timeline for the action?
	What actions need to be taken to develop the action, and by whom?

After completing this assessment, consider areas where the evaluation score is low. These will be the areas requiring additional planning or resources for the effective execution of the PAL project.

### **PAL action or curriculum building key-aspects**

Recent years have seen much more emphasis upon equal-opportunity involvement in peer learning, engaging all members of the educational community without exception (as in class-wide tutoring). Interest in reciprocal tutoring has also greatly expanded, since this enables all involved to function as both helper and helped, avoiding any social divisiveness according to perceived ability and status, and offering a richer apprenticeship for future involvement.

When planning peer learning, the following aspects of organisation need to be considered, carefully arranged in the table below.

1. Context – there will be problems and opportunities specific to the local context.
2. Objectives – consider what you hope to achieve, in what domains.
3. Curriculum area.
4. Participants –
5. Helping technique –
6. Contact –
7. Materials – what resources will be required, and how will they need to be differentiated?
8. Training – this will be needed for staff first, then for helpers and helped.
9. Process monitoring – the quality assurance of the process must be considered.
10. Assessment of students – the product and the process should be assessed; consider whether any of this should be self and/or peer assessment.
11. Evaluation – you will need to find out whether it worked.
12. Feedback – this should be provided to all participants, to improve future efforts.

PAL specific aspects	Tips and advises
<b>Define and assess the context</b>	There will be problems, but also opportunities specific to the local context, and learning environment.
	SWOT-like analysis may become a handy tool for planning.
<b>Learning objectives</b>	Consider what you hope to achieve, in what domains.
<b>Define curriculum area</b>	The resources needed, and the timeline
	What methodologies can be employed?
<b>Consider participant engagement and experience</b>	Who will be the helpers, who will be the helped, and how will you match them?
	Do you need a special time and tools for building the group? And what about in an online or blended environment?
	There will also have to be trainers and quality assurers.
<b>Helping technique</b>	Will the method used to be packaged or newly designed?
	Will you need dedicated time for research on helping techniques? Any specialized sources available?
<b>Ensure proper contact</b>	How frequently, for how long, and where will the contact occur?
<b>List the materials</b>	What resources will be required, and how will they need to be differentiated?
<b>Consider special training</b>	It will be needed for staff first, then for helpers and helped.
<b>Plan the process monitoring</b>	the quality assurance of the process must be considered.
<b>Assess the students</b>	the product and the process should be assessed; consider whether any of this should be self and/or peer assessment.
<b>Evaluate the action</b>	you will need to find out whether it worked.
<b>Provide feedback</b>	this should be provided to all participants, to improve future efforts.

## Building Peer collaborations – ground rules

These rules aim to embody the principles of equality, mutuality, as well as value and skill-building.

Rule	Description
<b>Equal Participation</b>	All students are encouraged to participate actively, ensuring that each voice is heard and valued.
<b>Mutual Respect</b>	Every student is treated with respect, regardless of any discrimination circumstances.

<b>Non-Judgmental Environment</b>	Maintain an open-minded and non-judgmental atmosphere to foster a safe space for learning and discussion.
<b>Confidentiality</b>	What is discussed in PAL sessions stays in PAL sessions, unless it involves harm to oneself or others.
<b>Commitment to Skill-Building</b>	Students are dedicated to not only enhancing their competences and special skills, but also other transferable skills like communication, leadership, and teamwork.
<b>Active Listening</b>	All students should practice active listening when someone else is speaking, to ensure mutual understanding and learning.
<b>Value Others' Opinions</b>	Appreciate the diverse perspectives and opinions within the group, as they add richness to the learning experience.
<b>Constructive Feedback</b>	Always give and receive feedback in a constructive manner. Critique the idea, not the person.
<b>Accountability</b>	Students are accountable for their own learning and contributions to the group's overall learning experience.
<b>Preparation</b>	Come prepared to each PAL session, having done any required readings or tasks, to make the most of the time spent together.
<b>Time Management</b>	Respect the time commitment of the group by arriving on time and staying engaged for the entire session.
<b>Goal-Oriented Approach</b>	Clearly outline the objectives for each session and work collaboratively to achieve them.
<b>Flexibility</b>	While goals are important, also be flexible in adapting to the group's immediate needs and dynamics.
<b>Shared Responsibility</b>	Each student shares the responsibility for the group's success and failures.
<b>Regular Check-ins</b>	Periodically assess group dynamics and the learning process, making adjustments to the ground rules as needed.

## Lesson (Session) planner

Following the above the recommend using the following lesson planner for creating and executing iPEER based interactions (course, lessons, sessions, actions, projects etc.)

Typical interaction structure Objective: Success criteria:	Year Group: Competence & Skill(s) TBA:
Title of the interaction	[Insert title here]
iPeer learning unit relationship	[Insert one or more of the learning units]
EQF level(s) Learning outcomes	[Insert EQF level(s)] [List all learning outcomes]
Lesson duration	[Duration in minutes]



Method & tool	In-class	Online	Blended	iPEER incl.
Human treasure hunt	+	-	+	-
Line-ups	+	-	-	-
Mix-freeze-pair	+	-	-	-
Two truths and a lie	+	+	+	-
Three-step interview	+	+	+	-
Round robin	+	+		+
Think-pair-share	+	-	+	+
Think-pair-square	+	-	+	-
Think-write-pair-compare	+	-	+	-
Timed talking	+	+	+	-
Paraphrase game	+	+	+	-
Twos to Fours	+	-	+	-
Team interview	+	-	+	+/-
Two stay and two stray	+	-	+	-
Doughnut	+	-	+	-
Rally table	+	-	+	-
Numbered heads together	+	+	+	-
Name games	+	+	+	-
Just like me	+	-	+	-
Sharing similarities	+	-	+	-
Group identity - team logo/banner/name/poster	+	+	+	-
Team hamburger or pet	+	+	+	-
One and all	+	+	+	-
Graphic organizers	+	+	+	-
The grid or the rubick	+	+	+	+
Diamond ranking	+	+	+	-
Talking tokens	+	-	+	-
Whiteboard share	+	+	+	-
Roving reporter	+	+/-	+	-
Flashcard game	+	+	+	-
Pairs check / Check and help	+	+	+	-
Discussion groups / Roundtable	+	+	+	+
Action learning groups	+	-	+	+
Debates	+	+	+	+
Peer teaching	+	+	+	+
Peer instruction	+	+	+	+
Peer review	+	+	+	+
Peer coaching	+	+	+	+
Teams	+	+	+	+

Method & tool	In-class	Online	Blended	iPEER incl.
Jigsaw	+	+	+	+
Fishbowl	+	+	+	+
Project passed learning - peer review	+	+	+	+
Social and emotional learning	+	+	+	+
Gestalt pedagogy	+	-	+	-
Mastodon	-	+	+	+
Google meet - breakout rooms	-	+	+	+
Chat apps (Shapchat)	-	+	+	+
Padlet	-	+	+	+
Jigsaw	-	+	+	+
Storyline	+	+	+	+
ComPAIR	-	+	+	+
Quizlet	-	+	+	+
Tynker	-	+	+	+
TimelineJS	-	+	+	+
Kumu	-	+	+	+
Elinkio	-	+	+	+
Teachfloor	-	+	+	+
Brainly	-	+	+	+
Google classroom	-	+	+	+
Kahoot	-	+	+	+
Jamboard	-	+	+	+

## In lieu of a conclusion – a regional snapshot

In a world forever altered by the COVID-19 pandemic, the educational sector has been one of the most impacted domains. The sweeping changes and the shift to remote learning have left a lasting impression on teachers, students, and educational institutions. The pandemic has exposed both strengths and weaknesses in our educational systems, and as we navigate the post-pandemic landscape, it becomes essential to re-evaluate our priorities and resources. This chapter aims to provide a short regional snapshot of the current educational landscape, addressing the real and immediate needs to support ongoing work in education. Drawing on survey data, we rated and examined the pressing requirements of teachers, schools, and the broader educational ecosystem in a post-pandemic world. This analysis was dedicated to serve as a guide for the curriculum development and repository focus, and to understand where resources are most urgently needed. By dissecting the needs on multiple levels—from individual educators to educational institutions—we hope to provide actionable insights that will aid in both immediate recovery and long-term sustainability.

The initial state of art assessment was conducted in all partner countries, namely Bulgaria, Germany, Slovenia, Spain, Portugal, Lithuania and Kazakhstan. A total number of 88 respondents were part of the survey, out of whom only 38 had the patience to take part in the full 35 questions survey. All participants in the survey have been selected either as VET teachers or as education related to the VET sector.

Below, a snapshot of the two of the key questions towards the VET sector; with some analytical thoughts.

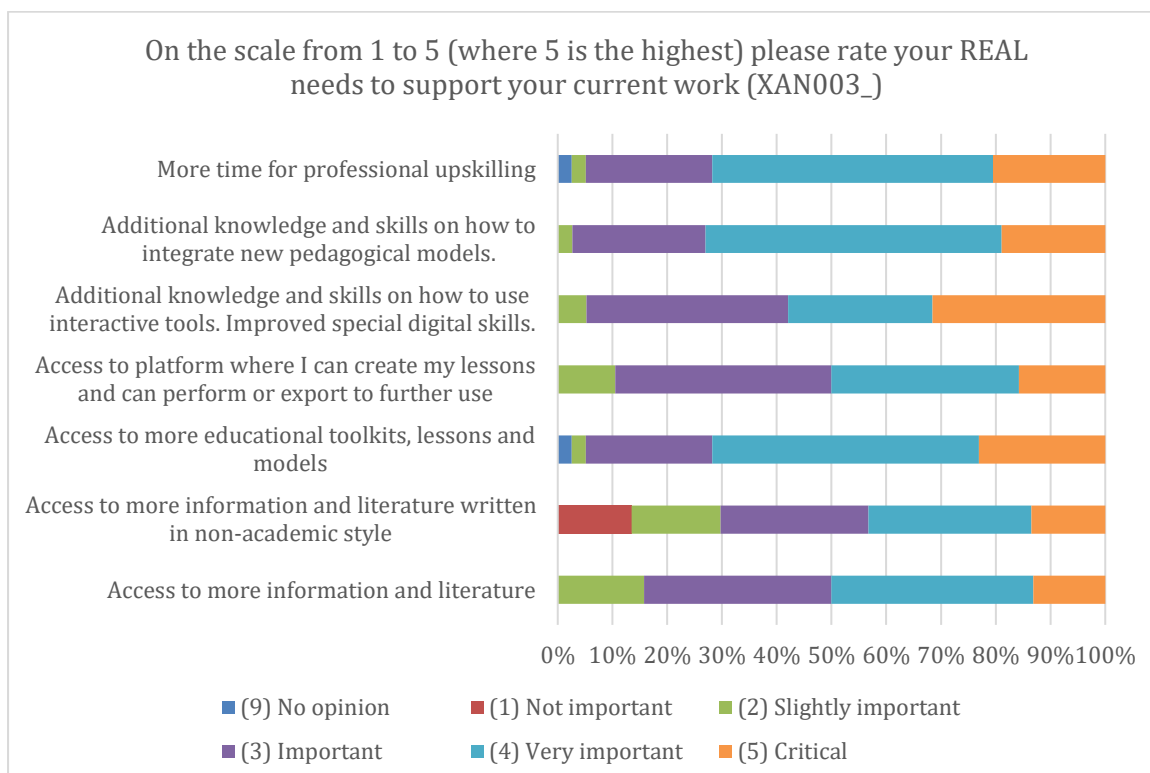


Figure 3: A diagram presenting the real needs to support the current teachers' activities (©iPEER; The40F, 2023).

It is clear that one of the most highly rated need is the additional knowledge and skills on how to use interactive tools, and special digital skills. Taking this into account our methodology and curriculum is extremely relevant, however, one could argue that the result may be biased due to the extensive EC campaign for digital skills improvement. More research towards the actual needs of the teachers in the VET sector in terms of pedagogical tools should be done. Furthermore, it is clear that almost none of the respondents feel deprived in terms of access to information both academic and trivial.



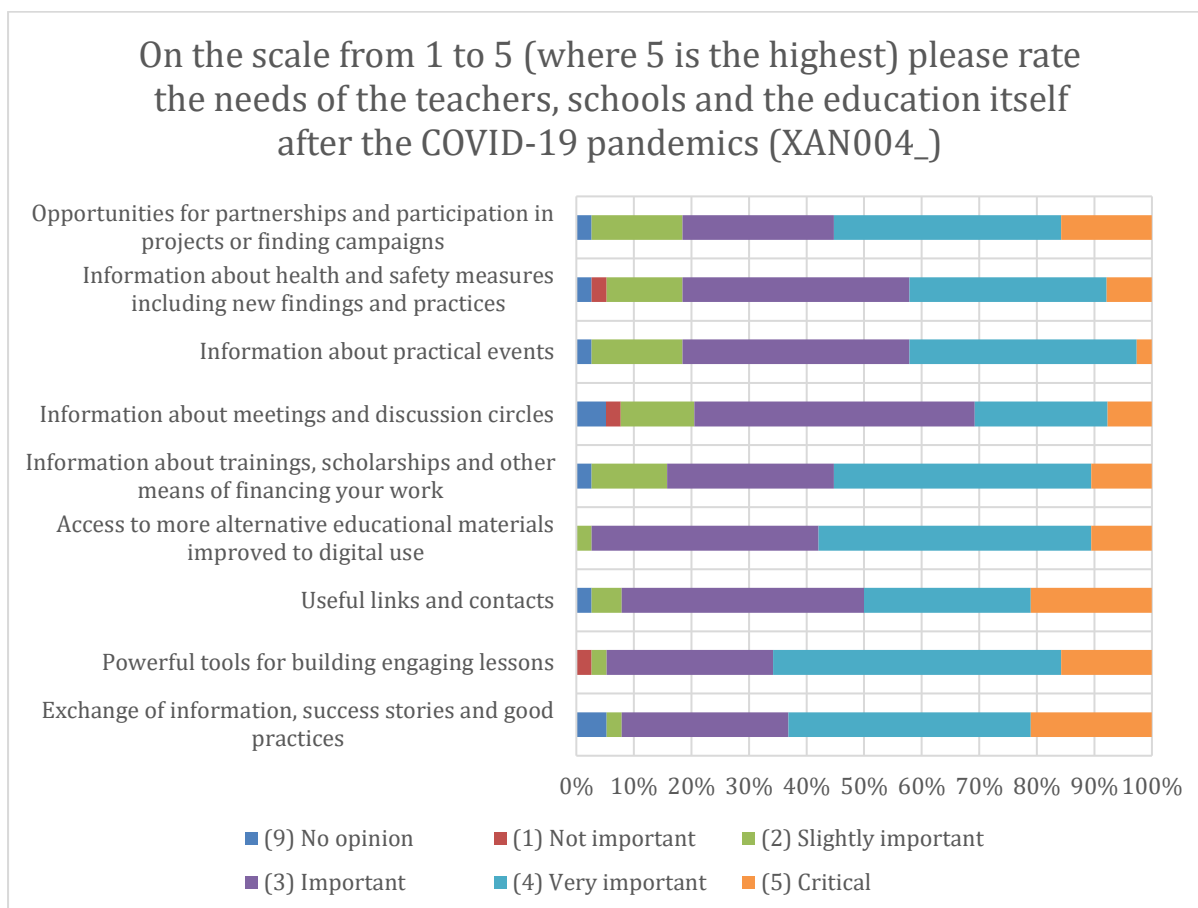


Figure 4: A diagram presenting the need of teachers, schools and the education itself after the COVID-19 pandemics (©iPEER; The40F, 2023).

The exchange of information, success stories and good practices can be named as one of the most highly rates deprivation both at individual and institutional level. However it is clear that the information about partnerships and about event and upskilling opportunities is not at scarcity at the moment.

<end of chapter>

## Annex I: Synonyms and specific forms of Peer Assisted Learning (PAL) from the literature

Peer supported learning	Supplemental Instruction (SI)
Peer assisted study	Parrainage
Peer assisted writing	Study advisory schemes
Peer teaching	Student teaching assistant schemes
Peer tutoring	Students helping students
Peer counseling	Student teaching / tutoring / mentoring
Peer assessment	Proctoring
Peer appraisal	Collaborative learning
Peer review	Learning cells / Student dyads

Note these are not necessarily interchangeable and some have other non-PAL meanings.

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