BRAIN @ WORK

INFORMATION COMPETENCE AS BOOSTER
FOR PROSPECTIVE SCIENTISTS

2022

GUIDELINES FOR INSTRUCTORS

INFORMATION LITERACY IN A DIGITAL WORLD

Strategies and methodologies
to support instructors in the development
of problem-based learning environments

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Authors:

National Research Council (Italy): Ornella Russo, Stefania Marzocchi

Eurecat (Spain): Santi Fort, Laia Subirats, Laura Lopez

Riga Stradiņš University: Anda Rožukalne, Inga Znotiņa, Diāna Kalniņa

Smart Skills Center (Italy): Mario Rotta, Emy Prela

Universitade do Minho (Portugal): Dinis Carvalho, Rui Sousa, Daniela Castro Ramalho, Helena Macedo

Universitè de Liège (Belgium): Bernard Pochet, Mathieu Uyttebrouck, Marjorie Bardiau

Graphic design:

National Research Council (Italy): Debora Mazza

Revisions:

Studio Acta

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Glossary

CM	Community Manager
ECTS	European Credit Transfer System
ET	e-tutor
IB	Information Broker
IL	Information Literacy
MIL	Media and Information Literacy
SME	Subject Matter Expert
STEM	Science, Technology, Engineering and Mathematics
STI	Scientific and Technical Information

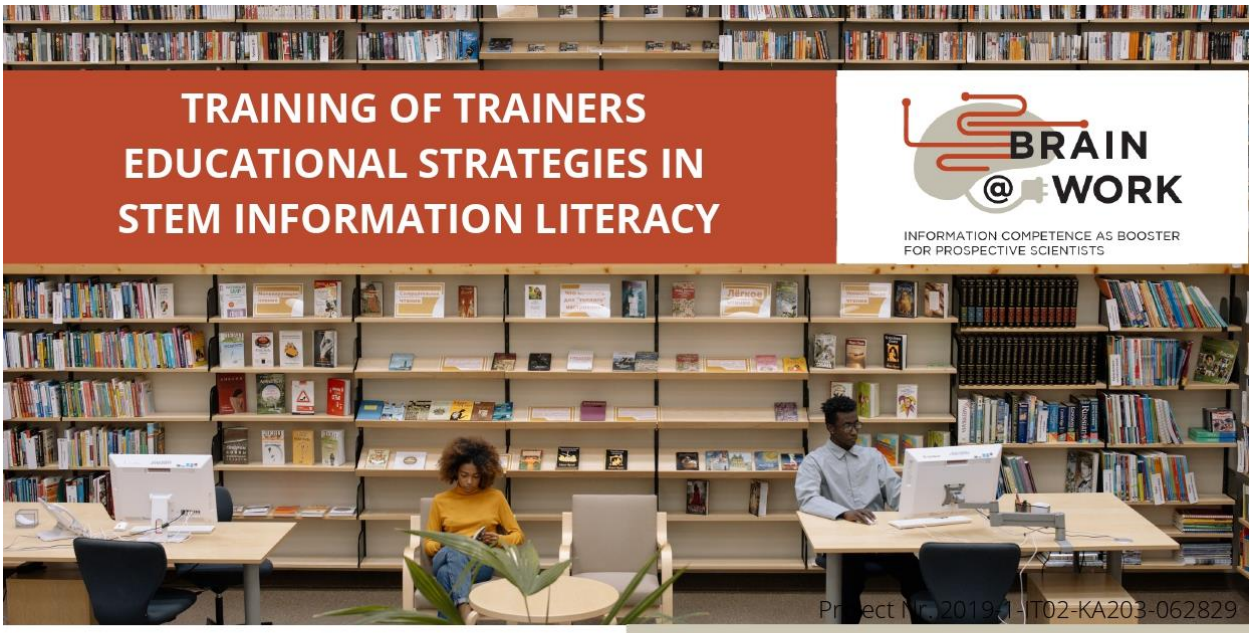
Introduction

The present work was carried out as one of the intellectual outputs of the project Brain @ Work, co-funded by the Erasmus + Program of the European Union.

The general aim of the project, which took place in the period November 2019 - June 2022, is to deepen the knowledge on how Information Literacy is applied to STEM disciplines in Europe and, consequently, to improve the training offer of the organizations participating in the project through the creation of a modular set of innovative learning units for researchers and students, current and future workers in technical-scientific sectors.

This publication has been designed for trainers with the aim of providing a guide to support those who want to use the proposed method and make better use of the model through the production of other learning units.

The publication is the result of an analysis of a complex background that we have re-thought to design an original learning environment more focused on the Information Literacy skills improvement. In this document we did an extended survey on theoretical frameworks to offer a wide range reference for our operational choices.



The course will train teachers or librarians to become coaches on the potentialities of Information Literacy for scientific studies.

Learning Outcomes

At the end of the course learners will be able to:

- evaluate if PBL as hands-on training methodology is adequate to their teaching purposes
- develop a learning unit applying PBL training principles
- acquire effective strategies to assess trainees' competencies

The course is free.
More infos and enrolment:
https://www.brainatworkproject.eu/training/

Target

Teachers, trainers and librarians in STEM disciplines

Language

English

Timing

8 hours workload divided in two sessions:

- February 22nd, 2022
  3-7pm (Rome time)
- March 8th, 2022
  3-7pm (Rome time)

The course is delivered online.

Learning materials

Participants are granted to the course platform to get access to training materials and references.

Contacts

biblio-education@area.bo.cnr.it

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Fig. 1 - Brain@Work Training of Trainers poster

Chapter 1: Background and evolution of the problem-based approach to competency-based education and information literacy

- *What can we do to renew teaching?*

- *How can we involve students more in teaching activities?*

- *What are the roles of information and communication technologies?*

Before answering these questions, it is necessary to understand how didactic paradigms are evolving according to the constructivist perspective.

A first hypothesis consists of trying to identify the principles on which to build a constructivist didactic. David Merrill, one of the most accredited international experts in the field of constructivist-inspired educational design, in several works tried to reasonably define the substantial convergence of various models and theories towards certain principles deemed essential in educational activities (First Principles of Education). According to Merrill, learning will be facilitated in direct proportion to the way some basic principles are explicitly implemented in teaching. There are five key components resulting from the comparative analysis:

1. Problem
2. Activation
3. Demonstration
4. Application
5. Integration

Merrill summarises these principles in a diagram (Merrill, 2002):

Fig. 2 Merril's diagram (2002)

The starting point is represented by the 'problem' (Problem). Learning is facilitated when:

- learners are involved in solving real problems;
- learners solve a progression of problems;
- learners are guided to an explicit problems comparison.

There are various types of problem situations: categorisation problems, design, interpretation etc. Jonassen, as we shall see, identifies 11. The second 'step', once the problem has been identified, is what is known as 'Activation'.

According to Merrill, learning is facilitated when:

- the student is oriented to remember, relate, describe or apply knowledge from relevant experiences that can be used as a basis for new knowledge;
- the student is provided with relevant experience that can be used as a foundation for new knowledge.

Be careful, activation does not mean evaluating the previous experience, but enabling mental models that can be modified or adapted to integrate new knowledge into existing knowledge. Asking students to fill in a pre-test of learning materials when they do not even know the course objectives can be frustrating. Even a brief reminder of background information is seldom effective.

Next, we will concentrate on the 'demonstration' (Demonstration)

Learning becomes easier when:

- students are explicitly 'shown' what needs to be learned (not just told);
- the demonstration follows the learning goals (examples and counter-examples of concepts, demonstrations for procedures, visualisations for processes) (Behavioural modelling);
- students are provided with adequate guidance, including orientation to relevant information;
- several representations are utilised and explicitly compared.

The fourth principle concerns the application (Application) of that which is learned.

Learning is facilitated when:

- students are required to use their knowledge to resolve problems;
- the student is able to categorise, generate tasks, elaborate assumptions;
- students try to actively foresee the consequences;
- the problem-solving activity is linked to the learning goals;
- the student is shown how to identify and correct mistakes, guiding them in an appropriate way.

Eventually, we should try to concentrate on integration (Integration)

Learning is facilitated when:

- students are encouraged to publicly showcase their knowledge or skills;
- they are able to think, defend, discuss and define their knowledge;
- they have the ability to create, invent and explore new and personal ways of using their knowledge.

Other approaches indirectly confirm the essential nature of some principles. Kearsley and Shneiderman (1998) and others talk about the effectiveness of teaching activities located in an 'engaged' learning environment, in which there are at least three elements characterised, summarised in the formula relate–create–donate.

The hypothesis is that we learn better:

- within a context of collaboration (relate);
- whether the activities focus on developing (created) projects;
- whether the focus is on the authenticity of the result, or whether the path produces reusable results or with practical feedback (donate), the final element which can play a fundamental role in motivating the learning group and thus, influencing its productivity.

'Engage', activate and involve, are therefore the watchwords of those who want to explore, through technologies, new teaching paradigms. Several indicators of highly involved learning situations are identified by a number of variables. We can say that the learning environment is 'activated' when:

- the requests and subjects covered are authentically related to reality, relevant to the interests of students and tend to be multidisciplinary;
- we should also focus on topics and instances that constitute 'challenges', with obstacles difficult enough to positively influence the motivation of students, but not so much to be frustrating;
- the tests are conducted constantly, during the educational activity, and are based mainly on actions in the social context of learning, for example demonstrations to peers or public presentations;
- the adopted teaching models assume a high level of interaction and continuous construction of meanings;
- the learning environment is collaborative, cross-sectoral, knowledge-building and problem-solving;
- working groups and activities are heterogeneous, flexible, compact and well organised;
- teachers radically change their attitudes and become guides and facilitators rather than knowledge distributors.

At first glance at these principles and models it seems that teaching based on problem-based or project-based methodologies can help us find an answer to our initial questions. However, we have to figure out what that is.

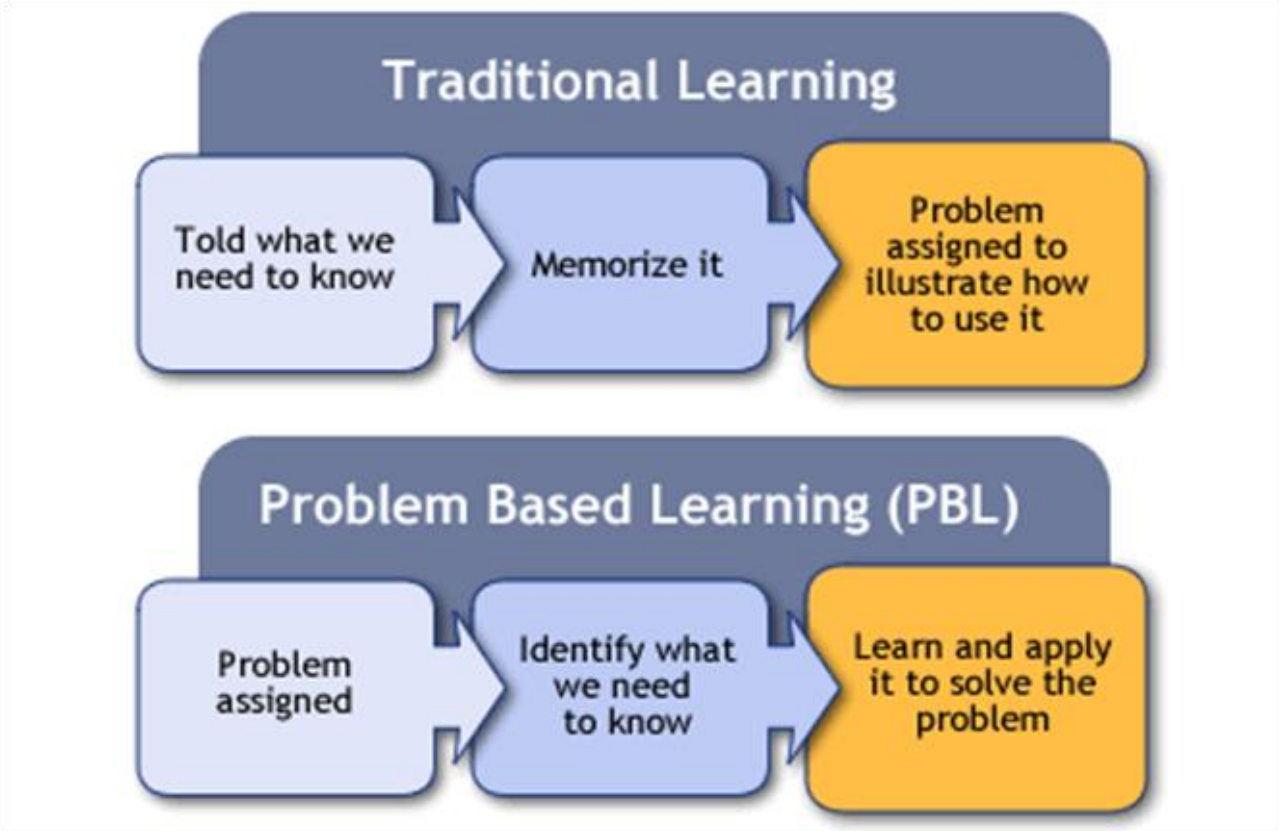

Fig. 3 Traditional learning and problem-based learning comparison

They are essentially similar or converging approaches, as the problem-based approach is also generally 'project-based'. In essence, problem-based learning (an approach originally practiced in some Canadian medical faculties and American law schools and later theorised and modelled by authors such as Barrows (1980), Woods (1996) and Jonassen (2008)) is a student-centred teaching method in which the identification and solution of a problem constitutes the initiation and development of the learning process. Project-based learning is a similar but more experiential approach, based on discovery and guided investigation (based on investigation) and oriented towards the active construction of products and projects related to the problem addressed, with obvious references to the tradition of active learning, from Dewey onwards, and the 'constructivist' approach. Nevertheless, we take similar principles and implement them by means of comparable procedures, paying constant attention to problem-solving and generally focusing on the systematic use of new technologies.

1.1 Problem-based learning

In problem-based learning (PBL), learners, grouped into groups, work together to solve a problem generally proposed by the teacher, learners have received no specific training about the problem in order to learn content and know-how, to discover new concepts actively (are learning themselves), driven by the needs of the problem presented.

The team's job is generally to explain the phenomena behind the problem and try to solve it in a nonlinear process. The process is led by the instructor as the facilitator.

When it was created in 1970, the Faculty of Medicine at McMaster University (Ontario, Canada) was the first to take advantage of this original approach, which has been a success and a reality for many years of pedagogical reflection. This example was quickly followed by the Rijksuniversiteit Limburg in Maastricht (Netherlands) and the Newcastle University in South Wales (Australia), also on the occasion of the establishment of their medical school.

PBL was developed in medical schools:

- in response to the practice of intensive teaching of the theoretical aspects of medicine to the detriment of patient contact;
- to replace classical teaching where the teacher is the only transmitter of knowledge, which is increasingly difficult to synthesise, and where the student is forced to absorb materials that he/she is unable to synthesise, does not always grasp the relevance;
- because the student's role is often reduced during classes in large classrooms to merely taking notes that take precedence over books and reference books;
- changing essentially summative appraisal practices that only measure memory.

In 1980, Barrows and Tamblyn described PBL ten years after its introduction at McMaster University. In 1985, Barrows advocated PBL as the preferred tool for clinical medical, basic science and engineering education. In the same year, Kaufman (1985) stressed the importance of integrating PBL for a primarily first aid-oriented curriculum (in medicine). van der Vleuten and Wijnen (1990) supported the systematic use of PBL throughout the higher education curriculum. Many publications described experiments and theorised the PBL approach. In 1993, Bouhuijs made a brief history of literature on PBL. It was noted in his literature review that the first book on PBL had been released.

After 30 years of using PBL in Maastricht, Moust et al. (2005) noted signs of erosion in the functioning of PBL. They raised the alarm about the excesses that has arisen in the use of PBL. Progressive changes meant that practice differed substantially from theory with a real loss of efficiency, primarily in the ability to synthesise and solve problems.

The amendments related to access to information, budgets (and hence staff cuts) and redefinition of content. The effects observed were:

- the size of the tutorial groups increased from eight to 10–19 students making it difficult to exchange and autonomously search for an answer to the problem posed. Their duration was reduced from 2 hours to 1 hour;
- the proposed reading lists were specific to each problem while PBL provides an overall list in which students must identify and synthesise the sources of information they need

to be aware of. Each student worked with the same information, severely limiting interaction;
- printed guides focused on content rather than methods. Tutors paid more attention to this content than to the problem-solving process. Lectures ('readings') were also geared towards knowledge transfer;
- overall, the duration of study was reduced. It went from 40 hours to 25 or even 20 hours per week;
- whereas it was the student who had to define the problem posed, gradually the tutor had taken over.

Discussions ('brainstorming') were limited or even eliminated. Students had less incentive to research, organise and structure information. They no longer had different perspectives. They suggested a few ways to bring a change of action back to the basic functioning of PBL:

- building learning communities, closer groups of students;
- better inform students about the basic principles of PBL;
- better teach students to learn autonomously;
- use a greater variety of learning situations;
- enhancing use of the IT environment in training;
- introducing new forms of evaluation.

This last point is crucial for effective training. Assessment influences students in their behaviours. More frequent evaluations, closer to the problems to be solved, will be more relevant to the objectives of PBL (Moust et al., 2005).

Antonia Scholkmann (2020) claims that 'each PBL variation must be seen as an inevitable and therefore enterprising further development of the PBL idea in specific temporal, local, cultural and individual circumstances'. Noble et al. (2020), after classroom observations and teacher interviews, observed that student autonomy, student cooperation and teamwork, subject integration, real-world connections and cognitively demanding work emerged as critical to PBL teachers' conceptions. The use of the term PBL is therefore still linked to the various dimensions that were initially identified.

For the BRAIN@WORK project, we adopted a PBL approach, while retaining the main principles of the model, although it is different from the original.

The problem remains the starting point of learning

The problem is going to be an actual problem that seems unstructured. If the problem is simulated, it must be as real as possible. Self-directed learning is primary, with students assuming primary responsibility for the development of information and knowledge. The use of various sources of knowledge and the use and evaluation of information resources will be essential to the processes. Finally, learning will focus on collaboration, communication and cooperation, and students will work in small groups with a high level of interaction.

Instructors will propose an open problem situation to learners. The data and constraints of the problem are such that its resolution requires students to use tools or concepts they do not

yet know. The goal is the discovery and acquisition of these new concepts. The training units set up a programme of activities and events.

The groups will be relatively homogeneous and three functions within each group will be occupied by the members:

- **the secretary:** takes note of important facts and ideas. Their work allows following the evolution of the work;
- **the manager**: supervises the time. They ensure the group does not spend too much time on one point and neglects others and works cooperatively with the facilitator;
- **the facilitator of training**: they must give the floor to the various members, making sure that everyone is involved in the discussion and listening.

Since this is blended learning, the operation will be adapted to the situation.

Group work starts from reading the problem. The group will try to detect new words, which will be the first track of research.

The trainer/tutor will be there most of the time to get the discussions back on track. He/she will ensure that all areas of discussion have taken place. Instructors/tutors are responsible for maintaining motivation and providing leads. Students will need to regularly search for information other than that offered and carry out investigative work.
In addition to the dispensing provided by the group to answer the original question, students will be evaluated individually to evaluate the acquisition of key concepts.

1.2 Project-based learning

The term project-based learning identifies a highly structured teaching methodology, based on problems, in which are emphasised both the analysis of the problem posed (as happens for example in case studies), and the concrete applicability of the suggested solution.

The substantial difference with PBL is the greatest focus at the design stage, which consists in seeking (usually in collaboration) effective and operational solutions to the initial problem, until the development of usable products and applications. This particular version of the problem-based approach then considers those aspects of constructivist philosophy that are more concerned with 'learning by doing' (Schank (1995), Papert (1991) and Resnick (2002), and the active involvement of students (Kearsley & Shneiderman, 1998.

The project-based method is, in any case, applicable to any type of problem whose solution may presuppose the realisation of a specific product

The project-based approach is generally based on the elaboration by the teacher of a structured work 'dossier', the essential elements of which are the description of the project objectives to be achieved, the definition of the problem to be addressed by the students, the teaching strategy to be implemented, the identification of the prerequisites required, the

description of the technological equipment needed to proceed, the initial provision of any useful materials or resources to better frame the problem and some planning tools.

However, over and above the correct structuring of the dossier, what really counts in this approach is the constant attention to the procedural aspect and the validation of the projects developed.

In e-learning, the simplest form of the project-based approach consists of research simulations sometimes improperly called Web Quest, which consists of the critical presentation of the results obtained by searching online for a certain number of resources relevant to a given problem.

1.3 Authentic learning assessment

The different techniques of evaluating students in a PBL curriculum present a challenge for those interested in determining the best approach. As with all teaching, we should carefully design any assessment at the end of the courses to match the intentions, contents as well as the teaching and learning methods of the course.

The assessment is authentic because the problem is authentic

The most important advantage of authentic learning is that it prepares students for the real world, where problem-solving and critical thinking skills are often used more effectively than traditional classroom learning. With authentic learning, students' activities correspond to the real tasks of professionals in practice as closely as possible.

Cognitive learning theory and the constructivist approach to knowledge acquisition support the need to use assessment methods that move away from passive student responses to the active construction of meaning. Students are encouraged to demonstrate, in a meaningful manner, what they know and are able to do. Authentic assessment refers to using creative learning experiences to test students' skills and knowledge in realistic situations.

Authentic evaluation should include real tasks, performance or challenges that reflect those of experts/professionals. Students should use the information in a way that reveals their level of understanding and assessment criteria should be understood by students from the outset so that they can self-assess their work by applying the criteria.

The latter part is where the headings are useful. Sections should essentially help students understand teacher expectations and make the score more coherent by clarifying unclear objectives.

The heading is a concise statement describing a competency to identify and explain specific expectations for a given performance and to indicate the degree to which predetermined objectives have been met. The rubric aims to educate and improve student achievement, so that students tend to go beyond just controlling their activities and knowledge.

In fact, it should not be forgotten that the rubrics are or can be used both as performance indicators, imputable to competitiveness-oriented evaluation tools, and as an indirect method of qualitative evaluation, which from the student's point of view can also assume a partial metacognitive value.

The pedagogical background of the use of rubrics allows us to verify what we have deliberately planned to teach and improve, and not only to measure. Two pillars upon which they are based are authentic task and friendly feedback about the task. Through them – embedded in the rubrics – the authentic assessment is presented as a true assessment through 'real' tasks that allow the teacher to understand if the students can consciously use what they have learned, in different situations, new or ever closer, approximately, to those of life.

The detailed description of the expected levels defined by Goodrich (1996), or the different levels of performance by McTighe and Wiggins (1999), allow defining a uniform set of specific criteria or indicators that will be used to judge the students' work.

Generally, the heading consists of a fixed rating scale and a list of criteria which describe the features of each rating on the scale. The headings are often accompanied by examples of products or performances designed to illustrate each of the scores. The clear and systematic definition of evaluation criteria, in addition to helping to clarify the system of social expectations related to the benefits required of students, is a fundamental step in the construction of a training path, both for teachers and students: firstly, because it allows them to have a criteriology on the basis of which to appreciate the behaviour of students, to establish a clearer communication with them and to direct their educational action-teaching; secondly, it allows them to have a clear direction of the training path and to have precise reference points on which to orient their performance, self-evaluate and confront themselves with the teacher and other students.

The main characteristics of a rubric, the general principles and the guidelines for creating it can be summarised as follows:

- a rubric contains a scale of possible points for evaluating work on a resume;
- a rubric must allow judges and performers to effectively discriminate between performances of different quality in a valid way (the dimensions to be evaluated and the different characteristics of each level of performance must be relevant, not arbitrary) and reliable (the scores obtained by the same judge at different times or by different judges at the same time must be consistent within reasonable limits);
- the descriptions of the expected performance used in the rubric should use a language that accurately describes each level of performance and its most relevant and qualifying characteristics;
- such descriptions should be generalisations drawn from actual samples of students' work;
- the most important points on the scale of the rubric are the description of excellent performance, taken as an exemplary model of reference, and the acceptability threshold, taken as a minimum condition of success;
- compatibly with the validity of the dimensions and criteria identified, the clarity and simplicity of the heading increase its level of reliability.

Examples of assessment tools are available in BRAIN@WORK Output 4 - Assessment tools for measuring IL acquired competencies.

Chapter 2: Librarian as a facilitator

2.1 The tutor in the PBL approach

The tutor plays a central role in facilitating the PBL process, guiding and supporting students while they 'learn to learn'. The most important skill of a PBL tutor is knowing when to intervene, but even more important when not to, in order to allow the group work with their own resources. This requires good tutoring training.

At the beginning of a session, the tutor ensures that everyone is familiar with the PBL method and background. He/she will help identify the basic rules, make a contract and explain to everyone involved what is happening and why. During the sessions, students need support in problem analysis and in synthesising relevant knowledge. They may misunderstand aspects of newly acquired information, use terms and concepts that are not fully understood, and may not recognise consistency in content. In this case, the tutor will assist the group to clarify the situation.

The role of the tutor is very different from the normal role of the professor. The tutor is a facilitator, in charge of guiding the students to identify the key questions in each case.

The tutor is a facilitator, responsible for guiding students to identify the key issues in each case

Students themselves have far greater responsibilities in PBL than in most traditional approaches to the teaching process, the tutor is not just a passive observer: he/she must be active during the learning process and directive only when necessary to assure that the group stays motivated and on target and that all of them will pick up main learning goals.

The tutor has to check the understanding, ensures the group achieves their learning goals, encourages students to ask questions and explain themselves, introduces the use of diagrams and drawings, fosters clinical reasoning and provides feedbacks. A good tutor must have good knowledge, complex competencies and attitudes.

2.2 The e-tutor

The professional profile of the e-tutor has changed completely since the beginning of the debate about e-learning. In the period 1993–1997, according to fundamental contributions by authors such as Mason (1992), Berge and Collins (1995) or Rowntree (1995), the e-tutor (more frequently called 'e-moderator') was described as an expert in mediated communication by e-mail, forums or chat. This approach concerns the 'vision' of e-learning in those years, initially considered as an opportunity to activate peer-to-peer communication and share thoughts on content: that model requires moderators with technical and communication skills, to avoid the

risk of ineffectiveness due to poor experience of e-learners in the use of computer and network tools. However, the real evolution started when research and applications began to inquire about the close relationship between the e-tutor role and the development of more complex e-learning models.

The emergence of learning strategies based on the informal or social approach (use of blogs and wikis in education; social tagging to share knowledge; social networking to improve skills) and the development of e-learning frameworks more oriented to explore and different ways to approach teaching and learning online in universities, schools, corporate or public companies and other scenarios, emphasised the need for a more articulated description of the role of e-tutors. Almost in a European vision, the research (Denis et al., 2003; Rotta & Ranieri, 2005) describes the e-tutor as an expert skilled in a wide set of 'functions' for use in supporting or managing online courses, according to the specific context, and the complexity of more and more dynamic instructional strategies set in e-learning projects. The original model by Denis (2003) identified 11 main functions to set up an 'ideal' e-tutor.

Despite the accurate articulation by Denis, and although similar suggestions are coming forward more and more from practitioners (Clark, 2006), it seems that no e-tutor (even a professional one with a lot of experience) can be skilled in all the functions identified in the Denis framework.

After this in-depth investigation, we can summarise an extended framework to describe the e-tutor's role with 14 main functions and related primary and secondary skill areas to be developed to improve the ability of the e-tutor in every function required.

2.2.1 Toward an integrated framework for the profile and role of a 'next generation' of e-tutors

New research has a double objective: explore possible new 'features' to set up a 'next generation' e-tutor, more updated than the profile encoded in learning organisations or international standards, and, at the same time, focus on a simpler framework to describe the e-tutor's role. Even the functional description just explained could be a good outcome after years of theoretical debate and practical applications. The e-tutor profile must be re-thought, because e-learning scenarios are quickly changing, toward a more complex set of instructional tools and educational strategies needed to get ready to learn effectively in a full knowledge society.

Firstly, we focus on the conceptual definition of '*e-knowledge*' (as a wider scenario than e-learning) and more in detail with regard to the profile of the so-called '*e-knower*', as an evolution of the profile of the e-learner, or '*virtual student*' (Palloff & Pratt, 2003). In his innovative contribution, Siemens (2006) demonstrates how Web 2.0 is deeply changing the relationship between personal learning needs and knowledge resources and how working in the 'knowledge ecology' will be important. The same themes were touched on in many other studies and papers (Anderson, 2007; Downes, 2006: 1; Rotta, in press). The core concept of all these is the revolutionary reversing from a learning paradigm based on the role of the e-tutor as a primary driver between learners and knowledge resources to an absolutely learner-centred perspective, in which every e-learner (or better, every e-knower) has almost complete control in a dynamic personal environment oriented to organising information, learning and knowing (Downes, 2006: 2), and the e-tutor (as with other professionals) focuses their action on a mere personalised 'Scaffolding' strategy. In this way, before identifying the new role of e-tutors in

their interactions with learners, we must first ask ourselves what it really means to be a good e-knower today (Pettenati & Cigognini, 2007). By comparing the literature and reflecting on those strengths, we can identify a set of emerging attitudes and skills to develop:

- ***searching***: the ability to effectively use search engines and develop search strategies to uncover specific online resources (Johnson & Magusin, 2005);
- ***knowledge hunting***: the ability to explore the Internet, browsing the resources from a serendipitous perspective and the ability to find the information needed even if it is hidden in the so-called deep Web;
- ***critical thinking***: the ability to compare knowledge resources for a better problem setting or to share them in a collaborative environment (Gokhale, 1995), and the ability to select the most appropriate ones for a subject matter or an objective, with particular attention to factors like accuracy, quality and coverage;
- **self-mentoring**: the ability to approach the learning process based on outcomes related to specific needs and to acquire new knowledge from prior knowledge, including the ability to improve performance in problem-solving (Reisslein et al., 2007);
- ***self-assessment***: the ability to analyse and assess how we acquire new knowledge (even through self-assessment), adjust the learning process and integrate it with other resources as required;
- ***managing knowledge***: the skills required for organising a personal information environment (Frand & Hixon, 1999; Gambles, 2001) or a knowledge base related to requirements and learning goals;
- ***interacting effectively***: the advanced communication skills useful to interact with knowledge providers, experts, colleagues and other learners, and the skill to do it both in peer-to-peer environments and structured ones;
- ***connecting and networking***: the ability to participate actively in social networks, discussion groups, learning communities and communities of practice, including the ability to contribute to the 'architecture' of participation (Anderson, 2007);
- ***re-mediation:*** the ability to decode multiple Internet languages (Bolter & Grusin, 1999) and to communicate and interact using different media;
- ***envisioning:*** according to various frameworks (Horn, 1998; Tufte, 1990), the ability to represent knowledge through images and diagrams (as in concept mapping, information mapping or other knowledge visualisation models), and the ability to read and understand visual knowledge.

This list could, of course, be incomplete, but it can be a good starting point for a thorough monitoring of the evolution of the e-tutor profile. We must ask ourselves how many e-knowers really have these skills or are already so qualified. Probably, there is a gap between the opportunities of Web 2.0 as a learning and knowledge scenario and the reality: e-knowers are not so ready to earn all the benefits of an egocentric perspective if we abandon them, even the optimists (as in the so-called O'Reilly paradigm) would firmly believe in the 'wisdom of the crowd', otherwise read as a power to be exploited (Anderson, 2007).

2.2.2 New 'functions' for advanced e-tutoring

In this way, we could also re-think the functional framework for the e-tutor's profile, adjusting some definitions or adding new functions more oriented to these scaffolding needs. For example, it appears easy to add a function we could call '*motivator*', widely described as a soft set of skills to improve the need of e-learners and e-knowers to be driven in their user-centred and process-oriented experience (according to several studies which focus on the relevance of the motivational role of the e-tutor, e.g. OTIS research or the ISEeT framework). We could also imagine more sophisticated functions not yet explored by researchers, according to many adult education frameworks on PBL (Wood et al., 1976; Hay & Schmuck, l993), peer-to-peer and self -assessed educational strategies (Bandura, 1997):

- the ***'media educator':*** a function to be used in supporting, envisioning and re-mediating needs of e-knowers, but also a well-studied instructional role to help learners in understanding multimedia communication and the specific languages of new media;
- the ***'discrete connector':*** a specific extension of community management skills, centred on the back-end actions needed to drive e-knowers into a more effective self-assessment of their own networking and communication abilities;
- the ***'serendipitous fellow':*** an advanced co-learning function integrated with information brokering skills, applied to the e-knowers' need to explore non-conventional resources on the Web and improve their discovery learning skills;
- the ***'problem setter':*** a specific and well explored function for use in problem-based and problem-solving educational strategies, the educational role of the e-tutor when helping a student identifying and comparing resources and points of view in order to solve a simple problem or more and more complex problems, such as case-study solution searching.

2.2.3 The role of the e-tutor in integrated personal learning environments

Clearly, e-knowers cannot gain real advantages by integrating all these approaches without effective support and goal-oriented scaffolding. In fact, most e-tutors are only involved in the formal field, supporting courses, assessing learning or conducting e-tivities. Thus, we must complete the framework strategically directing e-tutors toward a more integrated scaffolding. First, we can allocate e-tutors in all the areas of the integrated environment, focusing on the roles they can interpret in such a scenario. In this way, the conceptual framework appears to be almost complete, so we can easily track the e-tutor's core actions with reference to the different areas in which the e-knowers interact. In this way, we can identify a new vision of the e-tutor's strategic role from a perspective we could dare to call 'learning3' (beyond the learning 2.0 paradigm).

The main action to consider as essential is ***e-counselling***: e-knowers must be supported and recommended to identify all their learning needs and find an integrated solution using a mix of formal, informal and social approaches. Therefore, the e-tutor will help them do this, focusing on problem creation, gap analysis, problem-solving, monitoring and evaluation. The main function of the e-tutor in this activity is exactly 'responsible for education', although many new skills need to be developed, especially those related to the problem setting, the assessment

of learning processes and the systemic approach (useful to suggest integrated solutions to e-knowers, considering their expectations and possible outcomes).

The strict e-tutoring activity in the field of the formal approach is more like the 'traditional' role of the e-tutor, analysed in depth by the literature and explained above. This activity is very important in all its functions, which generally involve the content, process and facilitation of metacognition. However, from a wider point of view, e-tutoring also helps e-learners set up and organise their learning environments according to their individual needs.

E-tutors must work with the constant flexibility required to 'adapt' the courses selected by e-knowers, by integrating the standardised format generally set by providers, planning and managing the alternative learning activities. Consequently, management skills, instructional skills and specific attitudes must be improved.

The role of ***e-brokering*** is quite innovative: the main function is as 'resource provider', according to its extended definition. Specialised e-tutors involved in this area need to improve technical skills to work effectively with personal information environments (including the ability to programme intelligent agents for data mining); they should develop strong skills in knowledge management and a semantic approach to Web resources, also working with multilingual thesauri, ontologies and information mapping tools. It is certain that e-knowers will also need to be helped to survive the new information overload 2.0 (Rotta, 2008) and find effective resources of confirmed quality. Therefore, this area of action will soon evolve towards a new professional profile (Johnson & Magusin, 2005), with the dual skills present in both educational strategies and a librarian's background. Finally, e-networking actions, although they may seem like a primary set of established skills, are radically different from those expected in a traditional role of e-moderator in communities and social networks. The social approach of e-knowers in their integrated learning environments can only be flanked by the discrete touch of a specialist e-tutor, but not directly driven (because of the nature of social networking 2.0 itself, and because of the self-regulated organisation of professional communities or communities of practice). Thus, the core functions of e-tutors in this area cannot be so related to mediated communication or conferencing inside communities and networks, but rather to the 'e-tutoring' and 'e-mentoring' roles toward e-knowers. As an e-networker, the e-tutor is an independent third party who moves between the e-knowers and the networks in which they are interested or involved. They help e-learners choose a more goal-oriented approach towards their learning (or professional) needs; through drawing the architecture of their active participation; motivating them to share expertise, information, problems and more, so they can gather useful resources and construct new knowledge. This may be a very difficult role to play, and it is also difficult to limit it within a solid framework. However, as we will see, it could be partially resolved through the integration of the actions of e-counselling, e-brokerage and e-tutoring.

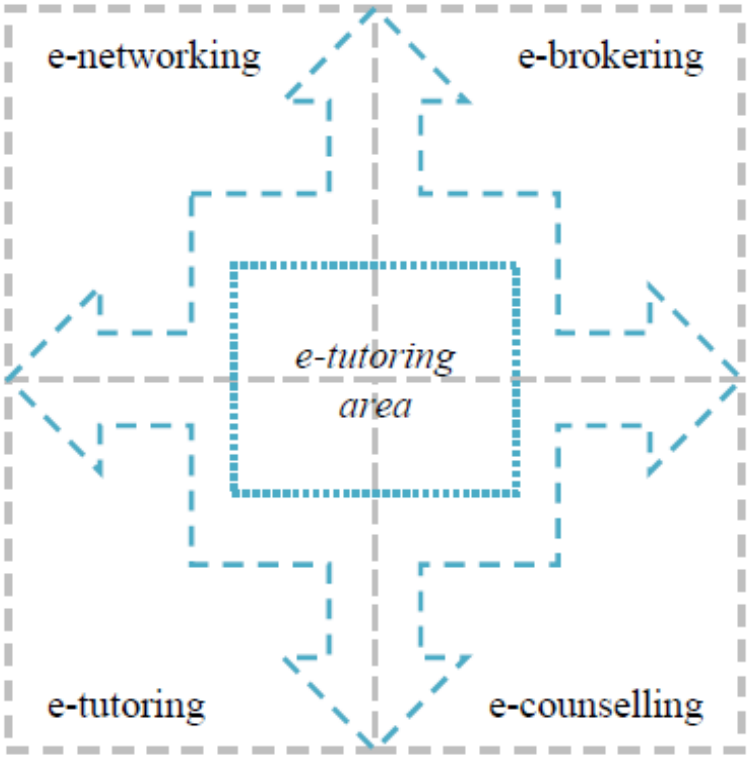

Fig. 4 E-tutor's core actions

[See Annex 2: Interaction design agenda for the professionals]

Chapter 3: How to design a new learning unit

3.1 How to design an authentic problem

What does 'problem' mean? What features does a problem need to have to lead to authentic learning? How should a problem be built?

There is no clear and univocal definition in the literature of what a problem is. The response varies from one epistemological model to another. However, the identification and construction of the starting problematic situation is the crucial phase of PBL methodology, as well as the most delicate since the outcome of the learning process depends mostly on this stage.

The introduction to the problem aims to 'place' the student in a realistic learning context where he/she is invited to practice and develop specific knowledge and skills and transversal skills. The problem must activate the most relevant concepts and principles of a given content domain and allow the student to connect abstract knowledge to real-life situations where it will be applied.

As already noted, Barrow defines the problem as situations or tasks in professional practice that require a solution, we do not yet know or when we are not able to choose from different possible options.

In more concrete terms, the problem must be described in such a way that the following conditions are met:

- present the problem situation at the first meeting with only the necessary and pertinent information;
- encourage the free survey of students who must be able to carry out the activities they consider useful and decide what additional information they need without being limited or forced by a series of hypotheses;
- give a precise role so that students can understand the role expected of them.

The starting point is the correct identification of the 'problem' as a pretext and at the same time is the object of the learning process. Jonassen (2008) says that a problem can be described based on at least four factors:

- degree of structuring;
- complexity;
- relation to the context (abstraction/specificity);
- dynamism.

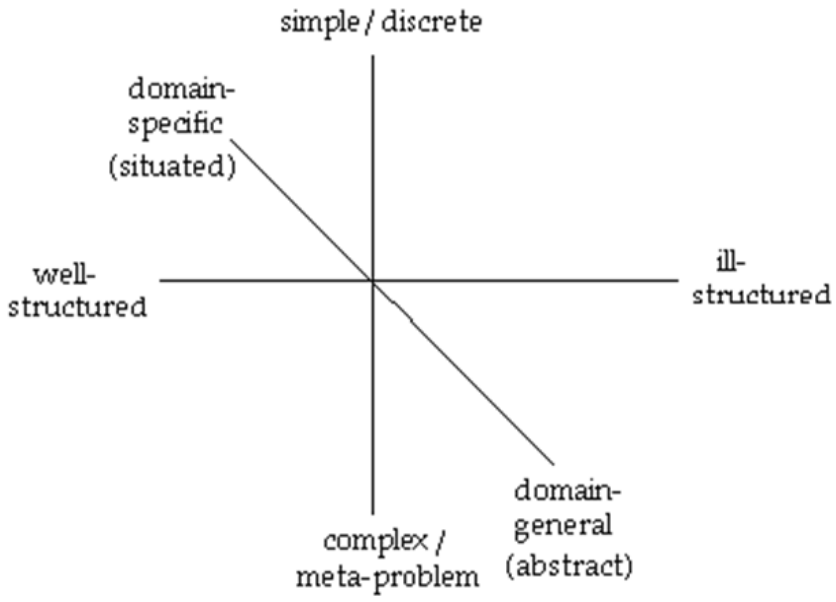

Fig. 5 Problem structure

In essence, a problem can be placed within an ideal matrix and will tend to be more or less well structured, more abstract or more located, more or less simple or complex.

Each problem may vary in its degree of structuring, openness and complexity. A problem is open when different and alternative solutions can be adopted.

Well-structured problems are the simplest ones, such as those arising in formal education, and have the following characteristics:

- present all the elements of the problem;
- include a limited number of rules and principles;
- are organised in both predictive and prescriptive ways;
- have correct and convergent answers;
- have a well-defined resolution process.

Unstructured problems are more authentic and have the following features:

- there are many alternative solutions;
- targets are vaguely defined, unclear and binding;
- there are multiple evaluation criteria for potential solutions;
- there are multiple solution paths.

Jonassen (2008) identified 11 categories of problems, according to the degree of structuring, complexity and possible relations with authentic contexts:

- Logical problems
- Algorithmic problems
- Story problems
- Rule-using problems

- ☐ Decision-making problems
- ☐ Troubleshooting problems
- ☐ Diagnosis-solution problems
- ☐ Strategic performance
- ☐ Case analysis problems
- ☐ Design problems
- ☐ Dilemmas

Logical problems are substantially abstract and difficult to anchor to authentic reality. A classic example of a logic problem is the Rubik's cube. Above all, they help develop reasoning skills. In this type of problem it is not possible to transfer a solution to formally analogous problems.

Algorithmic problems are among those that can be encountered or set up more easily at school: this category includes all problems whose solution involves the definition of a formalisable procedure, with control cycles, from the solution of an equation to the setting of a computer program. These are mostly abstract but well definable problems.

Narrative problems (story problems or word problems) are similar to algorithmic problems but the problem definition is anchored to reality based on a story to be faced or solved where you need to apply a controlled procedure, sometimes complex, even considering that it is necessary to semantically decode the story that poses the problem in order to deal with it correctly.

The problems related to the use of rules (rule-using problems) are those whose solution, not unique, depends on the way in which the rules given are adopted and combined: an example are card games, and in the educational field, research and selection of information on a topic on the Internet to organise a library or newsletter. They may be anchored to the real world with relative ease and complexity on average. They have no predictable results.

Decision-making problems are those where you have to choose an option from different alternatives based on a set of criteria. They can be used as an approach in many disciplinary teaching areas (from history to environmental education), typically anchored in real life, of varying complexity and with a defined outcome.

Problems related to an error or a failure to be solved (troubleshooting problems) are the most common and closest to the reality of everyday life: a machine doesn't work, what should be done? The complexity of the solution may vary, the approach involves constant attention to diagnosing errors and evaluating (sometimes experimental) alternative possibilities.

Diagnostic problems (diagnosis-solution problems) are similar to control problems on errors and faults but while in the previous the goal was to identify the solution to repair the fault or correct the error, the diagnostic approach presupposes the comparison of a multiplicity of data, as is the case, for example, in the identification of a disease. The result is equally defined, but the problem is typically more complex and the solution requires the development of a strategy. They are easily settled into the real world.

Strategic return is the commitment necessary to address that category of problems where many variables must be evaluated and compared in real time or with strong constraints in order to make decisions aimed at the implementation of a strategy, as happens, for example, in flight

simulators or traffic control systems. Typically anchored in the real world, these are complex, poorly structured and formalisable problems, the solution of which implies the possession and control of data, information and know-how.

The case analysis problem is one of the paradigms of the PBL approach. It was born in the legal field, simulating trials or court cases to accustom students to seek documentation and evaluate possible solutions. It applies to various scenarios and according to Jonassen (2008), paradoxically, it cannot have a direct connection with reality while maintaining total authenticity (that is, the case can be invented but absolutely probable). Generally, case-based problems are poorly structured and can lead to multiple processes and solutions.

Design problems are among the least structured and one of the most complex. These are typically complex problems, linked to the real world, whose solution is strongly oriented towards the design or search for a solution with wide margins of freedom of action, such as setting up a newspaper or an advertising campaign.

The 'dilemmas' are real and everyday problems that imply a selective choice between two or more alternatives. Apparently similar to decision-making, they are actually less structured and may lead to undefinable or definable outcomes. Dilemmas often involve political, social or ethical choices, and involve an evaluation of the consequences that require a strong capacity for criticism or control.

By analysing different models and scenarios, the basic postulates of the teaching of constructivist inspiration clearly emerge. These may be summarised in at least a few key implications:

- active participation of learners in solving real and real-life problems;
- the learner's centrality within the learning environment and the learning process;
- a constant focus on problem-solving and collaborative design;
- the use of new technologies as an essential element in resolving the problem encountered and producing shareable results;
- the change in the teacher's role, who becomes a facilitator of the learning process and guides the inquiry and discovery processes.

Apart from the essential principles and elements, however, it is necessary to define sustainable procedures and methods for implementing such a teaching method. There are many possible approaches, but a substantial convergence towards these elements is recognised in all models.

3.2 How to define the e-learning environment

The e-learning environment that we have implemented and experienced consists of three main phases preceded by a preliminary phase, to be performed before the beginning of the course, and a further phase, to be performed after the end of the course. We also have two special areas of the learning environment, one for resources where essential tools for communication between participants are collected and another called the 'tutor's fitness room'

where tutors can work by sharing comments on how the course is going and addressing critical issues in a coordinated manner.

In addition to these two special areas, according to the PBL paradigm, there are three main steps and each one is an asynchronous step accompanied by a live session:

- Posing the problem;
- Setting the problem;
- Finding a solution.

Live sessions are recorded, so that they can be made available for participants, and they correspond in the course to the last day of a step, before passing to the following step.

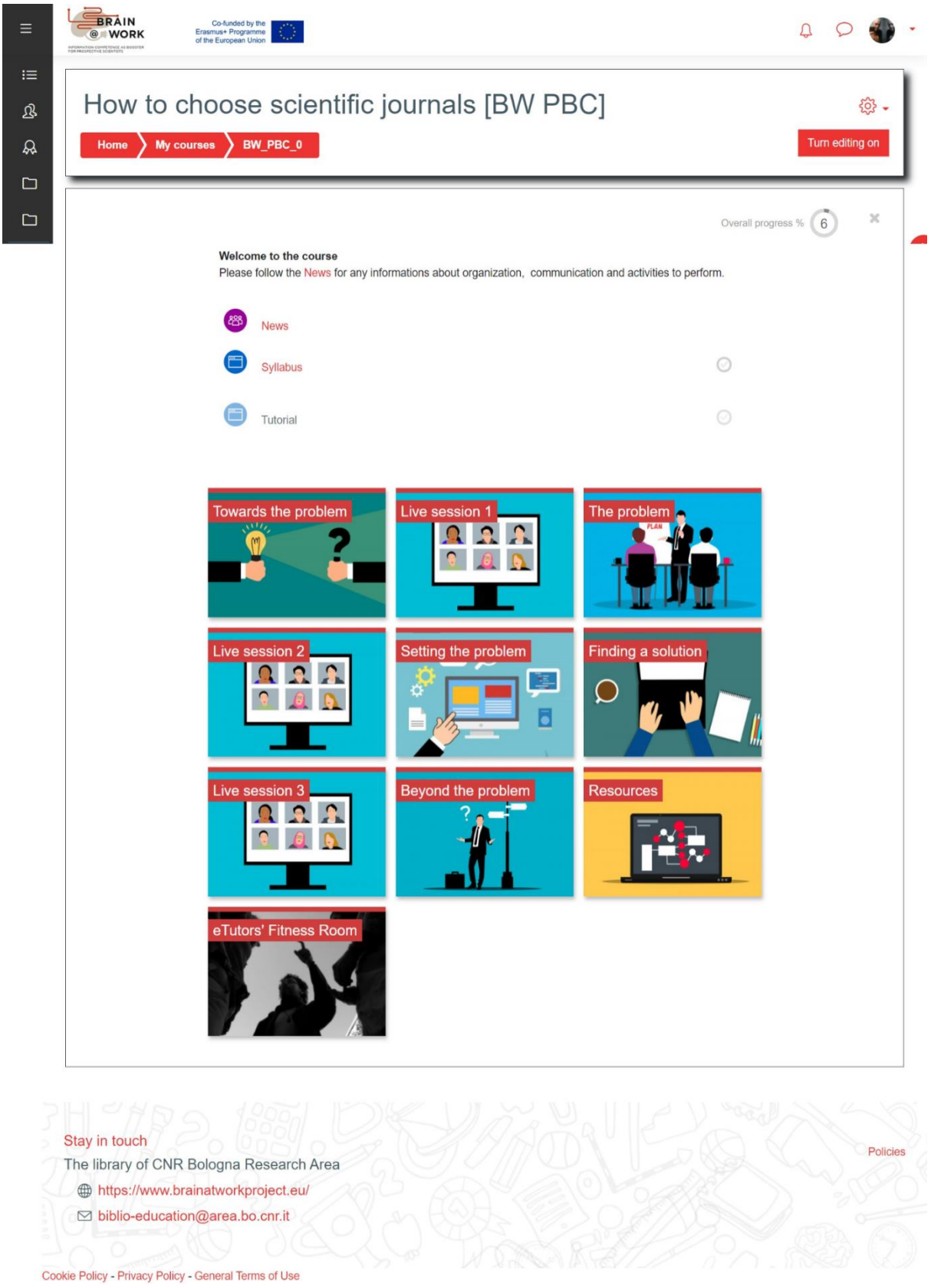

Fig. 6 BRAIN@WORK e-Learning platform

The preliminary and final phases include a self-assessment test to be used before and after the course in order to observe progress in the development of skills. Based on a rating scale, participants are invited to self-assess their skills or abilities, assigning a value of 1 to 4.

Step 1 - ENGAGING PARTICIPANTS. The preliminary step also includes a game for self-presentation called 'Spark e-tivity': a simple choice of five images 'if you were a book', 'if you were a city', 'if you were a fiction character', 'if you were a discovery' and 'if you were a scientist'. The result of this activity gives us interesting information about the profile and the attitudes of the students, and we can use this information to identify different roles in the teams (leader, spokesperson). Immediately after the game we can divide participants into groups and give them the procedures to join the teamwork.

Step 2 - POSING THE PROBLEM. This step contains one of the core contents of the course, the problem. It is explained as a situation to which the student can identify, recalling the problem as real and personal and for this reason the student can feel more involved in the research of a solution. We choose to realise the problem as a video, where characters are really similar in age and interests to the young researchers our course is addressed to. In fact, the problem must be as close as possible to the point of view of the trainees as well as realistic and concrete to stimulate their participation. This is an essential step for the problem-based process and for the model: an important part of this model consists of posing the problem in a realistic way, which can recall to the participants something very similar to their usual working or studying situation. A significant part of the success of the following steps depends on the possibility we give trainees to identify with the problem situation, so the plot and the quality of this video are fundamental.

This step includes brainstorming in teams using two collaborative tools:

- the '*collaborative journal*', the space where students elaborate their solution to the problem. In this space, each group can show which process, resources, etc. they used, elaborated and shared to arrive at the solution to the problem. It is interesting to notice the differences among the proposed solutions due to the different composition of the groups, the specific interest of the individual participants, their age and experiences. There is no a priori right solution, but there are many points of view where the problem can be observed so there are many possible, also unexpected, solutions.
- the '*glossary*' where participants can add some definitions with the aim of building a common reference.

Step 3 - SETTING THE PROBLEM. This is an analytical phase, where participants continue implementing the collaborative journal stimulated by some activities carried out by instructors: questions, additional contents to reflect about specific topics, e-tivities (see Annex 2) to scaffold students in their learning process by encouraging critical thinking.

Step 4 - FINDING SOLUTIONS. Participants are guided in presenting their solutions – the output of the collaborative journal – through, for example, a template which makes the assignment clear. It can be a mindmap, a list, a scheme, a presentation, a drawing… which will be evaluated by instructors using a rubric (see Annex 2).

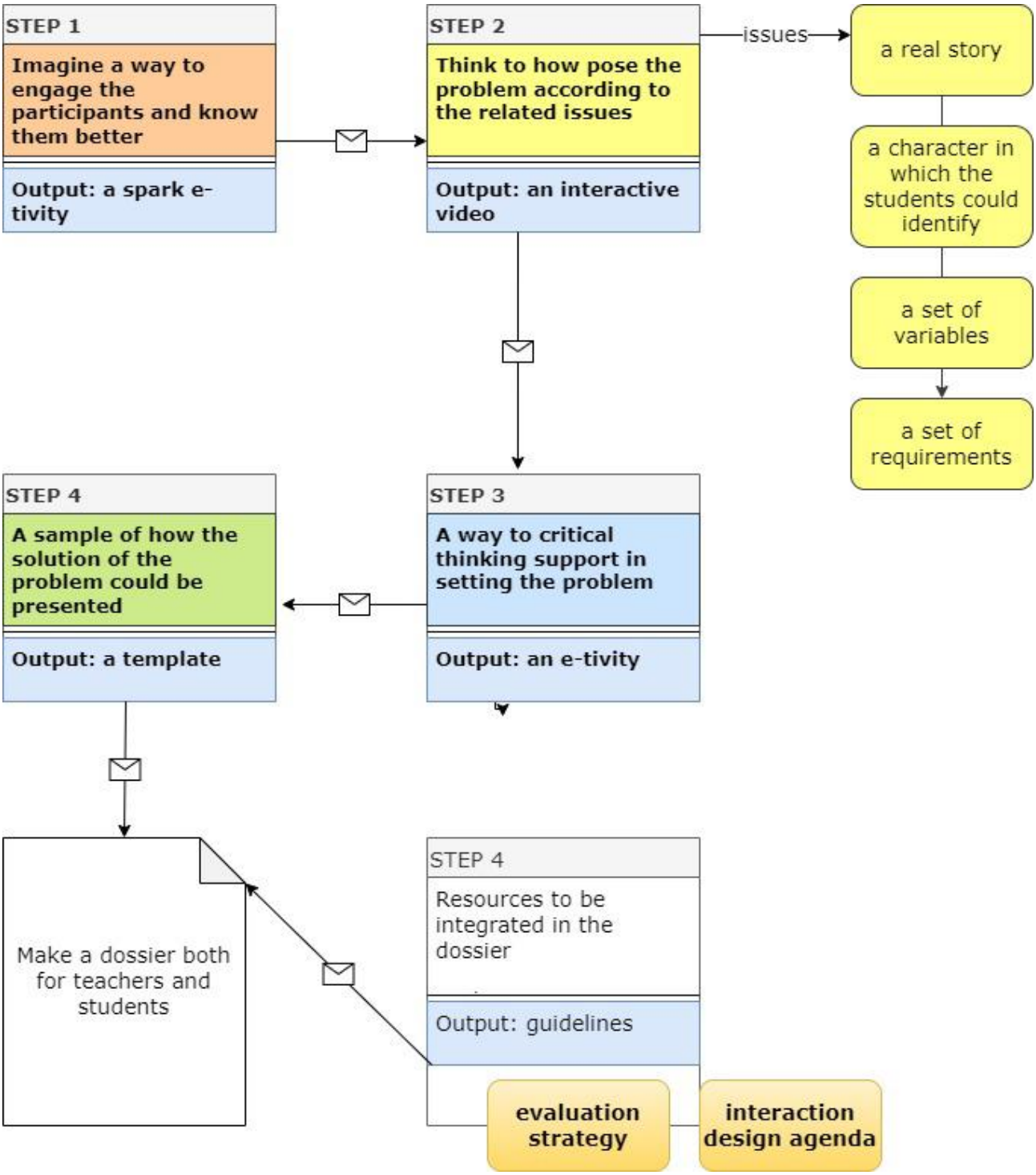

Fig. 7 Example of the structure of participant involvement

The production and implementation of a course is based on a rough model and a predefined layout. The model is based on a specific and appropriate format, with organisational variants of the learning environment that depend on the design of each single course or homogeneous group of courses. Some model elements are already set up and do not require any additional action from the content expert. Other model elements, even if they are present, still require additional action or contextual changes.

For example:

- Blocks located to the right of the workspace, which may vary depending on the course content and may or may not include items such as: random glossary entry, online users, calendar, upcoming events, recent news, search forums or other, based on specific needs linked to the design solution adopted.
- The **checklist**: this is a metacognitive tool that should help participants to reflect on the path to follow (in this case it is a sort of reminder) and strengthens awareness of the skills to be acquired or consolidated. It should be reset from time to time based on the structure and objectives of the course.
- The **knowledge base**, a place to systematically collect the readings, links, reports and documents deemed appropriate to propose to the participants to deepen certain topics or verify statements and suggestions. There are no particular constraints in the management of this section, except for a couple of general suggestions:
    - avoid being redundant or excessive (it is always better to point out a few well-selected and coherent resources, rather than suggesting materials of excessive 'weight' compared to the duration of the course and the expected commitment);
    - always be clear in reporting, highlighting in the title all the useful information to enable participants to understand what exactly it is, specifying, if possible, the type of resource reported, the format, any access priorities and commitment required.

The ***template*** is therefore purely indicative. The priority action to be implemented is to design and develop a ***sequence of e-tivities***, that is, a sort of 'script' of educational events linked according to logic and based on a strategic vision of the role of the training process in relation to the identified competence objectives. In comparison to this regime, which may vary considerably from one course to another, here are some general tips:

- In a course that requires a commitment of eight hours, you can assume sequences ranging from a minimum of *three to a maximum of six e-tivities*; in the design phase it must be considered that each e-tivity is based on an 'object' Moodle (forum, wiki, diary, test, task, database ...) and some of these objects, by their very connotation, imply greater commitment: it is therefore necessary to increase or decrease the

number of activities to be included in the sequence, considering how demanding the objects through which they are to be implemented.

- More generally, it should be ensured that, beyond the predetermined sequence, each e-tivity can in turn maintain a certain 'self-consistency', as taught by all leading scholars who have dealt with this design method. At the same time, we must avoid redundancy by varying the types of e-tivities planned and entrusting their management to various Moodle objects.
- Each e-tivity should be introduced by a **title** (if possible, captivating, able to stimulate curiosity and always keep motivation high), followed by a **subtitle** showing the type of activity to be carried out and the related commitment required. In W-PROFs it is also more desirable to number the titles in order to clarify that 'steps' are closely related in a certain logical order.
- The individual activities must contain all **the information needed** by the participants to understand exactly what they are expected to do: relying on the principles of **Web writing** in this case could be of great help.

It is up to the content expert to elaborate, in a coherent and creative way, the sequences of events and actions they consider most appropriate based on the available materials, or the motivations based on which they will propose and activate a course. Typically, the preliminary production of a synthetic design sheet is required for this type of course.

3.2.1 The e-tivities

The term 'e-tivities' comes from a contraction of "learning activities" and is linked to the essential contribution of Gillian Salmon (2002) on the role, figure and actions of the e-tutor in 'active' and/or 'collaborative' learning scenarios. Salmon defines e-activities as 'a reference model for increasing the active participation of individual students or students interacting in online groups'.

There can be several actions and strategies, sometimes quite simple, sometimes more complex:

- small pieces of information available as a stimulant, challenge, task or problem (known as 'sparks');
- online activities that require a participant to post or submit contributions (tasks, exercises, etc.);
- time to interact or participate, such as responding to messages from other topics during a discussion;
- a summary or feedback developed by an e-moderator;
- instructions or guidelines to complete or participate in an online activity.

They can be considered useful options to intervene in motivational, relational, organisational or communicative criticalities that may emerge in a learning path, according to the sequence summarised in the so-called 'Rowntree curve'.

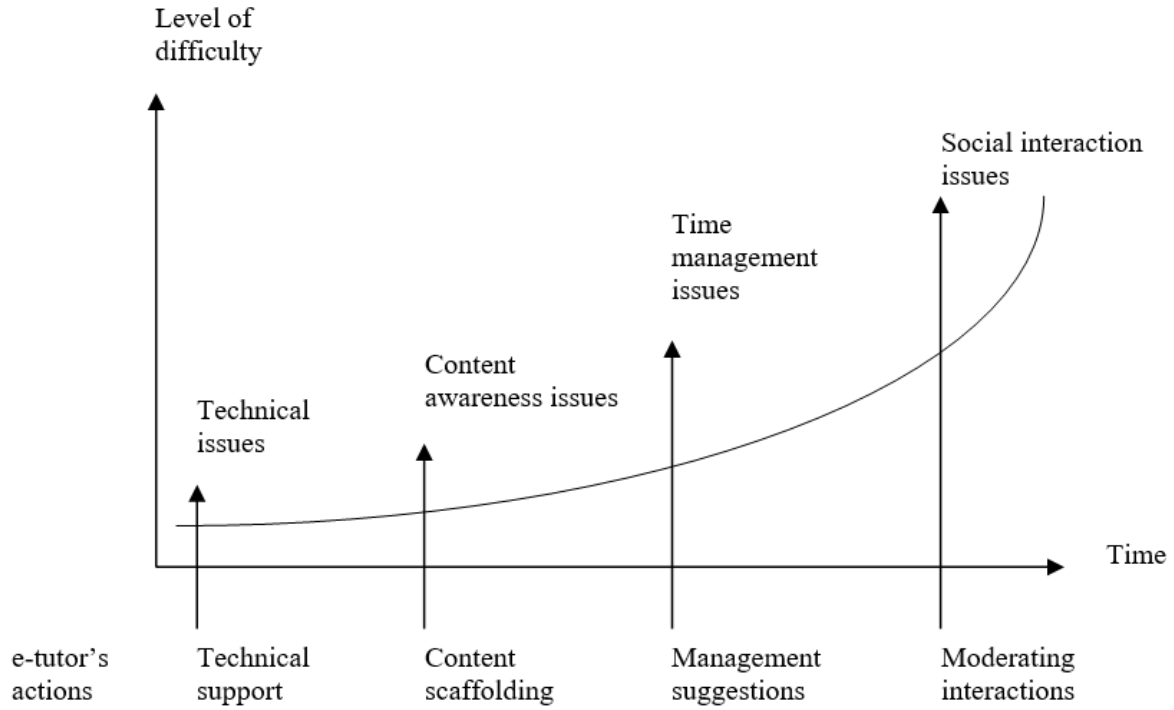

Fig. 8 Rowntree curve

However, e-tivities cannot be considered separate actions and are not equivalent to learning objects, with which they may sometimes be mistakenly confused. Rather, they are elements of a strategy of motivation, involvement and focus on partial teaching objectives, within a broader vision of the educational path.

To set up an e-tivity correctly, you can prepare a simple form: in the form you should briefly describe the e-tivity to be developed, briefly identifying the partial objective (purpose), the required task (task) and the methods of response and/or reaction.

Some simple guidelines:

Pay attention to the relationship between the partial objectives of the individual e-tivity and the general objectives of the path in which it falls.

- ☐ define the procedures for assessing the results achieved;
- ☐ restrict the proposed activity so that students can clearly see the benefits;
- ☐ consider repeatable and reusable activities;
- ☐ imagine activities and situations that help students share, dialogue and interact horizontally;
- ☐ be attentive to the pace of work and the proposed schedules, both from the point of view of the students and regarding the work of the e-tutor;
- ☐ develop reusable types and templates of repetitive messages, such as invitation and summary messages.

A good e-tutor plans the e-tivities that they intend to introduce in a path using tools such as a Gantt chart, also useful for grasping the difference in complexity between the various programmed e-tivities and monitoring their administration. Here is an example.

Settimane		1	2	3	4	5	6	7	8
e-tivity 1									
e-tivity 2									
e-tivity 3									
e-tivity 4									
e-tivity 5									
e-tivity 6									

Fig. 9 Example of e-tutor e-tivities plan

In more detail, it is possible to enter into the merit of the management of discussions and interactions through the preparation of models, matrices or diagrams aimed at contextualising and connoting the possible interventions of e-tutors with respect to the general structure of each e-tutor scheduled activity.

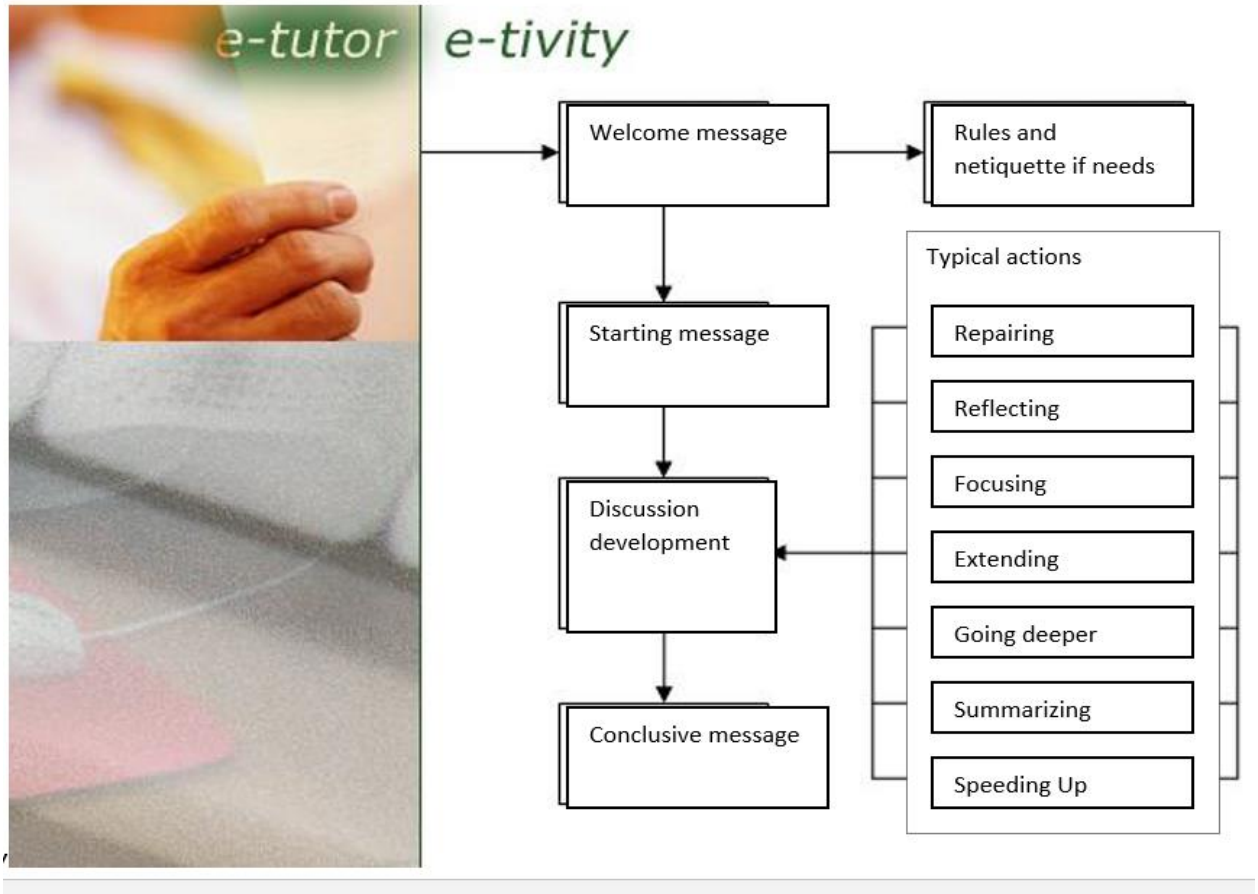

Fig. 10 General structure of e-tutor scheduled activity

The e-tivities fall within the 'proactive' and 'indirect' actions of the e-tutor, or in the context of strategies oriented towards organisational, methodological-didactic and social support in which the e-tutor takes on the role of guide, animator and moderator.

Overall, it can be said that they represent the most significant effective action of the e-tutor, one of the few through which it is possible to intervene in the process by anticipating its criticalities and directing it towards defined objectives.

3.2.2 Types of e-tivities and related tools

It may be useful to define and implement some functional activities for scaffolding the participants through the various phases of the course. There are various types of activities that can be implemented in the platform, especially thanks to plugins that allow the learning environment to be interfaced with external experts or consultants. Let us briefly see some:

A. Tools for generating interactive audiovisuals: Starting from how the introductory video is made.
B. Type variants of assessment tests: in particular, there are two types of variants to the classic multiple-choice or true-false tests based on numerical calculation:
    a. The first is a set of assessment tests based on a playful approach.
    b. The second is represented by assessment test exercises of a higher level than the basic standard.
C. Finally, various tools can be identified for commenting, annotating or making a background, image or other graphic elements interactive so that they can be explored.

Although it is clear that different types of activities can be planned in relation to the problem to be addressed, each type of activity is better suited to be placed in definable situations, which can then become part of these teaching methodological suggestions.

Type A tools are particularly suitable if and when the support action to be carried out for participants involves introductions to general purpose scenarios in definable contexts, as well as in all stimulus-reinforcement actions that involve a narrative approach.

Type B tools are used for formative and summative evaluation tests with additional performance-related applications for advanced level tests. The game-based tests are functional for motivational support and can easily be used as 'sparks'.

Type C tools are extremely versatile and particularly suitable for documenting, facilitating or suggesting forms of inductive and deductive reasoning, without forgetting the exploratory component that is particularly suited to the problem-based approach.

3.3 How to design and manage an asynchronous interactive learning environment

In these guidelines, we cannot analyse and report a full overview of the trends in modelling and designing online courses. However, even in brief, we can represent, by a simple infographic, the main evidence-based areas on which both researchers and practitioners are keeping in touch. As we can see, between the two areas in more intense development (the Massive Open Online Courses MOOCs and the social approach), the models' and methodologies' trends suggest two lines of evolution: the first is mostly focused on communication, graphic design and interactive autonomous solutions (micro-learning, gamification, VR/AR), the second (in which we can locate the PBL paradigm) is focused on information and interaction design. So, following the scheme, we can also locate the functions requested of the professionals involved in supporting the learners, almost according to a reasonable progressive approximation.

Fig. 11 The evolution of learning environments

The map of trends can be enriched as in the following samples, by which we can identify – even we must not forget the basic need of a scaffolding support – that in a PBL approach an effective learning environment design must provide and warrant the primary functions of helping participants in setting the problem, supporting the need of resources by information brokering and coaching the learners in time management. Notice that this does not mean that the other functions – moreover engaging and evaluating – are less important, but only that they

are an absolute priority in other learning design trends, while in environments oriented to problem-solving usually the participants have more motivation from the beginning and have a positive attitude to manage self-assessment and self-evaluation tools even without specific support. The third infographic shows how the areas of trending models, and the related functions can be grouped into four main blocks. That is the base of the learning design process to identify solutions to be applied in the learning environment and in the interaction design process, as described below.

The priority has been identified as the need for methodological support. Then, an organisational support strategy. Motivational issues have also been considered, and the need for specific support in the knowledge domain too, assigning to the figure of the e-tutor both the functions of process facilitator and subject matter expert.

The set of tasks carried out by the support professional profiles must be the result of continuous agreement between them, firstly to prevent redundant actions, but then to achieve the best impact of each action with little effort. Usually, professionals use a matrix to identify the most common actions based on their area of impact and the type of interaction.

Tab. 1 - Matrix of interactions

Proactive attitude (push)	Start a discussion on a bulletin board	Design and manage a live session	Launch some e-tivities	Update News and/or FAQs
	Send a warning about a deadline		Submit schemes and templates for collaborative activities	Report on completed activities
Feedback oriented attitude (pull)		Moderate a live session		Broker online resources related to a question posed by students
	Give feedback on students' demand	Summarise a discussion	Update resources according to participants' specific needs	
	Direct actions		**Indirect actions**	

Support profiles can use the matrix to balance their actions by avoiding giving the same type of support, instead of considering alternating direct and indirect actions and also proactive attitudes towards passive attitudes. Effective scaffolding consists of a sequence of all four possible actions.

3.3.1 The role and tasks of the e-tutor

In the course, without prejudice to the primary commitment of the Subject Matter Expert (SME) in the 'management' of the process (of which it holds the overview), the management of the interactions with the participants is entrusted to an **e-tutor**.

As already mentioned, the model does not distinguish between SMEs and e-tutors. The content expert assumes the role of e-tutor, which includes the following essential functions:

- *daily* verification of any requests for help: technical and methodological-organisational support function. Note: it is up to the e-tutor to call back the students who might use the opportunity to ask for help in an improper way;
- ***initial support*** to the participants on the conscious use of the **checklist** on 'things to do' (organisational and metacognitive support function);
- *daily* direct and indirect support **actions, receptive and proactive with respect to individual e-tivities and based on their characteristics;** it can be checks on the presence of comments, interventions in forums, posts in wikis or any other type of action foreseen by the didactic script: the e-tutor undertakes to produce a **synthetic report on the situation** *every morning*, in consultation with the expert for any actions to be taken *during the same day*;
- verification of the **completion** and **success** of any test or survey by participants and any support (if necessary, also motivational) for participants experiencing difficulties;
- verification of the **delivery** of any **tasks** assigned to the participants and any support (if necessary, also of a motivational type) to the participants in difficulty or late with respect to the scheduled deadline;
- *final* verification of the reports and the presence of all the conditions necessary to be able to issue the **certificate of participation** and any participation registers (log). This function is shared with the other professionals involved in supporting the course participants.

More specifically, the **e-tutor** has the primary task of interacting with the learning community regarding the management of discussions and related didactic activities. Here are some tips for setting up the e-tutor role correctly:

- **Proactive and anticipatory actions:**
  - Prepare the environmental introduction section by modifying the preset template. In the introductory section, the e-tutor should specify at least:
    - the general strategy they choose to adopt to animate and moderate the learning community and involve the participants in specific activities;
    - the basic rules of the possible interactions between e-tutors and participants and between members of the community, with possible references to timing, netiquette or other reference schemes.

- **Reactive actions linked to the progress of conversations:**
  - control the flow of *daily* conversation to understand whether specific cases emerge as deemed useful or appropriate to deepen by animating or moderating the same conversation or to develop through specific activities;
  - post a message *at the end of each week* in which you try to summarise what happened in the days just gone by, highlighting the requests that have emerged, the results of any activities carried out and/or other elements that will be considered useful to bring to the attention of the ongoing conversation.

- **Direct and recurring actions:**
  - Prepare and share an activity (e-tivity) *at the beginning of each week* to be proposed to the members of the learning community through streaming: activities of any type are allowed, as long as they are relevant to the *focus* of the learning environment and consistent with the characteristics, expectations and real possibilities of the participants. In principle:
    - the activities should be set up by applying the three essential principles that inspire the model: **active involvement** (engagement), **problematic approach** and enhancement of **the collaborative dimension**;
    - the activities must be inspired by principles of **sustainability** and foresee workloads compatible with the required timing and operational attitudes of the participants;
    - the activities must be **understandable** both in terms of the required task, in relation to the necessary procedures (which must always be made explicit) and in terms of their meaning regarding the evolution of the community.

- **Indirect actions on emerging instances:**
  - when specific instances arise from the conversation between members of the community (a concentration of messages on a topic of discussion that arouses interest or the spontaneous aggregation of a part of the community members on a collaboration hypothesis) it is suggested to intervene *within 48 hours* both by publishing specific contributions in streaming and proposing any additional activities to those already planned or while programming.

3.3.2 Information broker – role and tasks

The primary task of the **information broker** is to interact with the learning community in relation to the research and share resources needed for the community to address the issues of interest and reflection. Here are some tips for setting up the information broker role correctly.

Proactive and anticipatory actions:

- Prepare (in agreement with the e-tutor) the introductory section of the environment by modifying the preset template. In the introductory section the Information Broker (IB) should specify at least:
  - the general strategy they choose to adopt to enrich and organise the digital library and knowledge base, with possible references to the timing and reference frameworks that will be adopted.

Direct and recurring actions:

- Report *at least once a week* a potentially useful content to the community to be shared directly via internal messaging or specific blocks: typically, it could be a newly published book, a reference to a site, a repository or a blog, but also a quote, an image or a video.
- Enrich and periodically organise (as stated in the introductory section, but if possible maintaining a constant pace) the knowledge base (KB) or the structured collection of all the resources deemed useful to the community; it is organised as a database where each resource is described through a unique set of indicators and made available indirectly, usually in the form of a link to a source; represents the primary tool of the IB, which is the way through which the IB implements the inputs it intends to direct to the community: it should be updated daily if possible; the KB is in any case also the unstructured collector of contents directly or indirectly referable to the community, either because they are produced explicitly or implicitly by the community itself or by individual members, or because it is used by the community to carry out certain tasks or achieve specific objectives; it is organised as a set of files collected in folders and subfolders, named in such a way as to make the reference to the content clear and directly available; it represents how the IB defines and organises the output of the interactions through which the community evolves: it should be updated at least twice a week.

Note - A resource reported through a card inserted in the KB can also be made available later as a download file added in the digital library (the opposite, of course, would not make sense).

Indirect and/or reactive actions with regards to conversation trend:

- Daily control of conversation flow to understand if specific needs emerge on which it is presumed useful or appropriate to search, select and share resources directly through streaming; in that case, the identified resources should be shared *within 24/36 hours* of when the relevant instance takes shape in the conversation flow.

Community manager – role and tasks

The primary task of the community manager is to verify the consistency between the actions set and carried out by the e-tutor and those set and carried out by the information broker and the secondary task of indirectly supporting the e-tutor and information broker in continuous monitoring of the evolution of the learning community. In particular, the Community Manager (CM) shall:

- check daily whether the agenda defined by the e-tutor and the information broker has been implemented in accordance with what has been declared, notifying one or the other if any oversights should be found;

- verify if and to what extent the actions implemented by the e-tutor and those implemented by the information broker (both direct and indirect) are coherent and compatible with the methodological-organisational model and with the objectives of the course: if there are obvious dissonances or contradictions, the coordinator will warn e-tutor and IB of the problem encountered and will invite them to talk to each other (if necessary by calling a short synchronous virtual session) in order to make the adopted strategy more effective;
- check *daily* the content of the streaming and interventions posted by participants in ongoing discussions or planned activities to identify any emerging issues to be re-proposed to by the ET and IB if necessary (unless ET and IB have already identified the same requests in turn and acted accordingly…);
- check the general trend of *streaming, discussions and activities on a daily basis* to identify any evident gaps in commitment and participation on the part of users, reporting any *gaps* found to ET and IB so that they can act accordingly (avoiding in any case intervening directly with participants, with the exception of those who are clearly at risk of *drop-out*);
- contact *if and when necessary* the participants at risk of *drop-out* by submitting them a short questionnaire (prepared on a case-by-case basis) to detect and clarify the reasons for their detachment from the learning environment, reporting any useful information obtained to ET and IB so as to allow them consequently to intervene directly or indirectly, planning more adequate activities and/or modifying rhythms, partial objectives or other elements of the environment;
- check *every 10/15 days* [or in line with the minimum period of access to the environment by users established by the portal management policies] the logs of the participants and all other available monitoring data, to evaluate the presence or not of the conditions necessary to be able to issue a certificate of participation equivalent to the work performed by each participant.

3.4 How to design and manage live sessions

The guidelines cover:

a. Scheduling and setting up the live session;
b. Holding the session live (from the perspective of the teacher/expert trainer and potential co-facilitator);
c. The rules for using the various tools available and some useful tips for maximising their functionality.

Finally, the different steps to be taken are summarised in the form of a checklist.

A live session can be activated by users who have access to the system with a teacher/trainer/expert profile. The live session consists of a screen that opens in a browser tab by clicking on a launch button, active from the scheduled start time for the session and for the entire duration of the session. This screen is composed of:

- a streaming video window;
- an audio channel;
- a live chat;
- a sharing area that can be used both as an interactive whiteboard, to show content of any type (documents, images, videos ...), and a place to share your local screen, for example to show in real time how to use software or how you surf the net looking for information;
- some control menus for accessing various data, like attendees;
- several utilities are available to tenants and participants, including:
  - a counter to check elapsed time (visible by all);
  - a button to ask written questions as an instant survey (available to conductors);
  - a button to 'raise your hand' and ask questions to the conductor (available for participants);
  - a set of buttons available to the conductor to enable, as needed, the audio channel, the video channel or both for individual participants.

The set of these features must be managed effectively and consistently, since one of the fundamental principles that the webinar's host should respect is knowing how to maintain a steady pace within the available time frame, avoiding as much as possible the waiting times that tend to distract participants and, in some cases, can trigger additional distracting factors. In summary, the action of the e-tutor in a synchronous context is also based on a careful mix of interventions whose weight is exercised on different action plans. An e-tutor active in a synchronous learning environment can deliberately 'shift' the weight of its action to one side rather than another in relation to the problems that arise, and the difficulties manifested by the participants. However, the participants' difficulties are manifested according to a sequence that does not correspond to that defined in the 'curve' of Rowntree, but according to different rhythms, highlighting a trend that for each hour of live session can be schematised as follows:

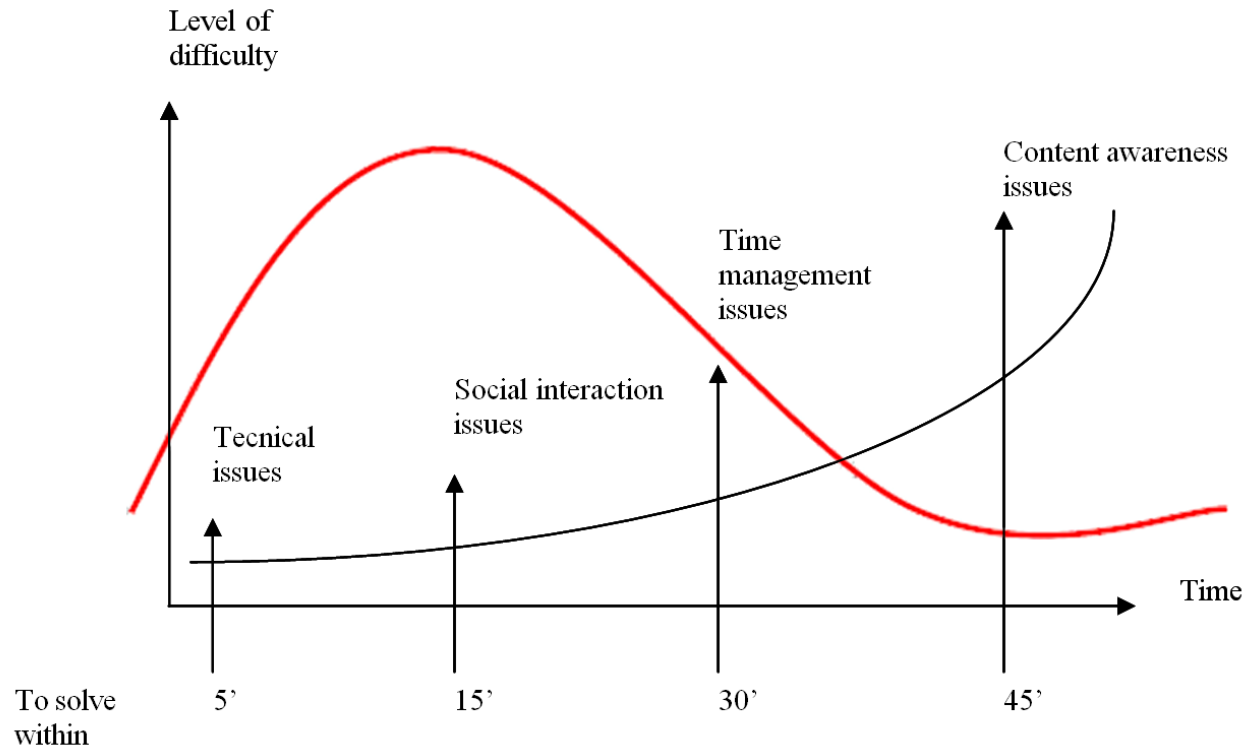

Fig. 12 Rowntree curve: the participants' difficulties during live sessions

The model was obtained from the analysis of didactic interactions in asynchronous learning environments, but it can also be easily applied as an indicative schema to understand what can happen in a live session, since the variables involved are the same: the ability to resolve the difficulty of the case by considering the time factor and the logical sequence. Any strategy useful to the e-tutor to properly interpret one of his essential tasks, the motivational support, can ideally be placed on the same reference scale. Rowntree (1995) points out that the inability to resolve the difficulties expressed in the diagram or the solution managed over too much time leads to attitudes of distrust and disinterest in the learning experience.

Generally, the literature on the need for online students to be motivated and encouraged emphasises the fundamental importance of timeliness of feedback (Mason & Weller (2000)). Collison (2000) also spoke of the need to maintain a growth rate, which is to pay particular attention to consistency, rather than acting impulsively or irregularly. If managing this complexity is difficult in an asynchronous mode, in a live session it becomes even more difficult, since in addition to the rhythm there is a need for intrinsic speed and compatibility with the limited time available.

Usually, the curve will have to be partially reversed, since, without prejudice to the primary and immediate need for technical support, it is clear that support for social interaction becomes a priority over organisational and cognitive support, which will tend to be placed in the last part of the session. We try to redraw the 'curve' assuming the waiting time/response in relation to the type of difficulty manifested by the students: it will be proportionally shorter than the nature

of the difficulty, its intensity and the moment it occurs. We propose therefore the Rowntree curve to the e-tutor, assuming the necessary average times in order to act effectively in relation to the various sorts of difficulty in a one-hour live session.

For these reasons, particular care must be taken in the initial configuration of the live session and the preparation of the webinar or lesson.

3.4.1 Programming and configuring the live session

Configuring the live session *before* starting the session is a fundamental step for its success. A live session can be programmed and configured through special tools. The conductors will eventually decide to supplement the guidelines with some useful tips to set an effective description and other useful tips.

After the live session is scheduled, it is necessary to configure the interaction environment by trying to comply with rules 1 and 2.

> **Rule 1.** All documents that could be used during the live session should be preloaded as required prior to the start of the session. Generally, if you are going to use slides, documents, images or other, it is good not only to preload them, but also to upload a few more to keep them as a reserve.

> **Rule 2.** Before starting the session, it is advisable to take a few minutes for some tools' technical tests. In particular, they should be tested, if possible, in this order: the correct functioning of the shared whiteboard, the correct loading of a video from YouTube or a preloaded file, screen sharing, audio and video. We remind you that, considering the Rowntree curve, the strictly technical problems of the participants should be solved immediately: it is therefore absolutely necessary to avoid having the technical problems of the organisation and the conductors also 'weighing' on the real time of the session.

3.4.2 Leading the live session: what an expert does

The expert (teacher or trainer) is responsible for conducting the live session and interacting with all participants on the topics in question. Here are some tips to play the role of expert correctly and effectively.

Preliminary actions (excluding those related to the programming and configuration of the session):

- ☐ Set up live session schedule:
  - ☐ the lineup must be clear and simple;
  - ☐ they should mainly highlight the sequence of key phases of the problem that will be addressed as a whole during the session, rather than the list of topics that will be addressed;
  - ☐ for a one-hour session, this should not include more than 5–6 points or steps.

Direct, proactive and recurrent actions:

- Design and implement the live session sequence:
  - the general cut of the session should be set by applying the three essential principles that inspire constructivist teaching models: active involvement (engagement), problematic approach and enhancement of interactions with participants;
  - sequence steps should be guided by sustainability principles and include explanations/actions compatible with timing and, if possible, with listening to participants' attitudes (preferably monitored at the beginning of the session using an instant survey);
  - a very short break must always be provided between one phase and the next, giving participants the opportunity to ask questions or ask for clarification;
  - considering that the time available is short and it must be considered that in live sessions some slowness is inevitable due above all to the misalignment of the users, we suggest a sequence articulated in 4–5 steps at most, according to a scheme that is illustrated in detail in the last section of these guidelines.

Actions related to interactions with participants:

- the interactions with the participants must be set considering two macro-variables:
  - *the number of participants:* the smaller the number, the more complex interaction hypotheses can be proposed, the higher the number, the more limited the interactions. For example, drawing freehand on the shared blackboard is a plausible hypothesis of didactic activity in a live one to one session (one participant only), but it is not possible (except with great caution and with very specific instructions) in a one-hour webinar with ten participants;
  - *the type of topic addressed:* in principle, the more the topic is of a theoretical type, the more it is necessary to value the dimension of direct interaction (e.g. stop after having explained a concept and ask if everything is clear); the more the topic is practical, the more it is needed to value the dimension of indirect interaction (e.g.: summarise an explanation by proposing an application exercise);

- Indirect actions in relation to any emerging instances:
  - Even if it is not strictly necessary to programme them, it is still necessary to think about how to react in the face of instances that may arise during the session, for example if more participants ask to deepen a reasoning just mentioned, leaving out the main trend. Essentially, it is necessary to prepare reserve material on all those ideas that could meet with a response of interest.

3.4.3 Leading the live session: what the co-host does

Each **co-host** is responsible for assisting the conductor in the management of some phases of the live session, through two typical categories of actions:

1. Observation and monitoring of interactions. This means:
    - ☐ follow the text chat flow to notify the host of any specific questions or requests that the host may have missed;
    - ☐ mark times by reminding the host of minutes and remaining transition moments from one phase to another.

2. Research and sharing of supplementary resources. This means:
    - ☐ search and upload any type of resource (slides, infographics, documents, images...) useful to answer questions asked by participants and on which pre-charged content is not available;
    - ☐ point out to the participants (usually at the end of the session) any useful resources to deepen or broaden the topic addressed.

3.4.4 Managing tools: rules and useful tips

The system consists of a set of integrated tools that can be used both together and separately. For each of the tools available, some rules of use are suggested, valid both on a technical and communicative-didactic level:

- ☐ Video window:
    - ☐ regulate the ambient light from which it is transmitted so that it is as diffuse as possible, in particular by avoiding grazing lights from the top or from the side;
    - ☐ check the framing of the handler: it should be well centred, if possible, based on the so-called 'American plane' (just below the elbow, arms visible) and preferably parallel to the head;
    - ☐ avoid moving too much or leaving the frame: a good conductor must show a constant mastery of the means of communication available at that moment.

- ☐ Live text chat:
    - ☐ check regularly to see if there are any specific questions or requests; unless there is a co-host who checks the chat according to the guidelines, it is good to take a look at the chat every three minutes;
    - ☐ at the beginning and end of the live session, add welcome and greetings also on the chat, in text form.

- ☐ Instant survey:

- do not use it more than twice in a one-hour live session, unless there is a co-host with whom you have agreed upon a strategy;
- use it above all to activate the foreknowledge on the subject of the live session or as a verification tool at the end of the session; obviously, it can also be used in the intermediate steps, as long as they are aware of the facts and within the framework of coherent didactic planning.

- Shared interactive whiteboard and its set of features:
  - use the whiteboard specifically, and for specific activities that involve the need for a whiteboard (for example, freehand drawing), for activities planned with a playful cut;
  - however, use the blackboard with caution and do not forget that drawing freehand or with the set of tools available is not so simple, unless you have a strong command of the input tool or, much better, you can use a graphics tablet or equivalent as an input tool.

- Screen sharing:
  - use this feature first of all to show the steps of a procedure in real time, or to activate a tutorial in real time showing how to use software for certain purposes; secondly, this opportunity can be used to view online navigation sequences;
  - DO NOT use this function to load and view documents or resources: if they are useful materials for the lesson, they must be preloaded on the system. In general, this type of functionality should only be used if you are sure to avoid unnecessary waiting times;
  - if you want to propose a collaborative activity, for example multi-hands work on a document, you can use this feature to share preloaded files on a shared cloud space.

- Sharing documents:
  - preferably share documents in PDF format;
  - avoid uploading too long documents or just share them only to introduce them, making them available in full for those who want to learn more or read up on them.

- Sharing presentations:
  - prepare presentations carefully and preload them before sharing;
  - try to configure the presentation screens considering the sharing area of the system and trying to make the most of its surface: consider for example that the video window and the chat already occupy part of the screen, so a presentation that is usually in a 2:3 scale ratio should be transformed into 3:4;

- in all cases, general rules for visual design and usability should be considered when preparing presentations.

- Sharing images or infographics:
  - it would be preferable to share images in JPG or PNG format;
  - always consider the size and scale ratio of the sharing area;
  - be aware to carefully choose the images based on the didactic use you intend to make of them: remember that there are illustrative, evocative, explanatory, problematic images, etc. and it is usually good to be aware of this;
  - remember that established good practices show that it is more effective in didactic communication if all or at least most of the images used are based on a homogeneous communicative register (for example, all photographs or all cartoon drawings);
  - in the case of infographics, where the scale ratio is almost always extreme, it is necessary to verify that the contents can scroll correctly on the sharing area, using alternative sharing methods, if necessary, for example screen sharing while scrolling through the infographic through a browser.

- Video sharing:
  - always try to share short videos, depending on the function they have in the didactic strategy you have decided to implement: introductory videos no longer than three minutes and informative videos between three and seven minutes;
  - consider that in a one-hour live session, considering the other actions that make up the 'script', there is reasonably room for no more than two introductory videos and one informative video;
  - if you intend to share recovered videos directly on YouTube, take care to preload them and check their settings: in particular, check the subtitle settings (to avoid them when they are not needed and view them when necessary) and the possibility of avoiding promotional inserts or starting the video only after bypassing the commercials before sharing it.

Conclusion

The aim of the project has a specific focus on a recurrent question in the research studies about this topic. The question concerns the reusability of a complex and dynamic model that seems to depend on several conditions and variables of a specific scenario.

Our research demonstrated that even from a well-structured model we can extract a balanced set of statements, instructions and suggestions that could be recalled in different scenarios and with different targets. This is possible because of three relevant issues:

- the problem-based approach as a way to face all kind of topics from the point of view of the problems that can be identified in it;
- the main focus of the PBL methodology is the organisational impact on all processes implied in solving the problem;
- the learning design process includes and emphasises the added value factors in e-learning as the primary role of participants' engagement, the collaborative approach and the interactions between participants and the three specific supporting roles.

Furthermore, apart from all the constraints, this model is open to integrations and adaptations. It is intended as a set of best practices to be reused in different contexts in a flexible but organised way.

A model is by definition that in which nothing has to be changed, that which works perfectly; whereas reality, as we see clearly, does not work and constantly falls to pieces; so we must force it, more or less roughly, to assume the form of the model

— Italo Calvino, Mr Palomar

Annexes

Annex 1. Templates for PBL dossier

A problem-based path is based on the development by the teacher or groups of teachers of a "dossier" of structured work, the essential elements of which have been identified on the basis of literature on the subject, not so much to direct teachers towards a specific teaching strategy or established practice of learning design, but rather in an attempt to identify levels of standardisation that facilitate the sharing of dossiers reuse, whose preparation can be long, tiring and relatively complex. A standard format usually includes the following elements:

a. identification of the expected duration for the implementation of the teaching strategy;
b. any indications to align the proposed teaching activity with regional or international standards;
c. description of the project objectives;
d. identification and definition of the problem that students will be asked to face;
e. details on the teaching strategy to be implemented;
f. identification of the necessary prerequisites (pre-consciousness, technological skills...), in order to carry out possible forms of alignment;
g. identification of the technological setting and the equipment needed to proceed;
h. any preliminary materials for teachers that will facilitate the students in the investigation, in the discussions and in the search for solutions;
i. a first selection of resources useful to the students to better understand the problem (and to activate any preconceptions...);
j. a reasoned list of other usable resources (Internet sites, any learning objects, books, newspapers, multimedia material...) that can stimulate children to carry out further research;
k. detailed planning of the work to be carried out;
l. the definition of verification tools, usually based on "rubrics" that identify various levels of problem-solving capabilities addressed;
m. a support strategies planning board that the teacher/facilitator can implement.

The dossier is usually supplemented by two guides, namely detailed instructions (both at the strictly operational level and at the level of teaching instructions) for teachers on the one hand and for students on the other. Beyond the correct structuring of the dossier, what really matters is the validity of the projects drawn up by the teachers and their ability to grasp the prerequisites and the essential implications of this approach, which, as we have seen, takes some principles (centrality and active involvement of students, enhancement of the

collaborative dimension, integration between problematising approach and design in solutions...) and requires constant attention to procedure.

Dossier for Students

<table>
<tr><td>TITLE</td><td colspan="2">a) A suggestive text able to immediately attract the attention of the student, if necessary, followed by an explanatory subtitle (when the project is proposed by the teacher).

b) Students are required to invent an evocative text that attracts attention (when the project is chosen by the teacher and the students, or when it is proposed by the students).</td></tr>
<tr><td>PROBLEM DESRIPTION</td><td colspan="2">a) General description of the problem (teacher).
b) The teacher can present to the students an idea, a food for thought for the choice of a project (teacher + students).
c) Students propose a working hypothesis to the teacher (students).</td></tr>
<tr><td rowspan="3">PROCEDURE

Main stages:

1. Planning

2. Development

3. Presentation</td><td>Planning, preparation and

work organization:</td><td>- selection of research sources
- (d/d+s/s) ;
- choice of the final support (d/d+s/s);
- division into groups (d/d+s/s);
- division of labour (d/d+s/s);
- organization of work according to the time available (d/d+s/s);
- preparation of materials (d+s/s);
- simulation of the types of communication interaction in synchronous and asynchronous mode (d+s).</td></tr>
<tr><td rowspan="2">Development:</td><td>a) in asynchronous mode:
- students carry out the activities (students);
- the teacher can monitor the activities (possible d+s).</td></tr>
<tr><td>b) in synchronous mode:

- processing of information and work (d+s/s)
- writing descriptive texts and/or a comment (d+s/s)
- vision on support (pc, poster)</td></tr>
</table>

	Presentation Setup:	After the teacher corrects the texts, students test and simulate the presentation.
	Presentation and evaluation:	- presentation and illustration of work completed; - group discussion about the work; - peer-to-peer evaluations; - teacher evaluation of each group's work and overall outcome.
ACTIVITIES AND TASKS	The teacher can decide whether to indicate in the form of a list the linguistic actions (activities and/or tasks) that the learners will have to implement the project *(e.g. making decisions, discussing in groups, negotiating, searching for information, taking photos, interviewing natives, orally exposing the results obtained).*	
COMMENTS AND SUGGESTIONS	Guidance that could be helpful in implementing the solution to the problem.	
USEFUL RESOURCES	A well-thought-out list of online content and/or other reference material (texts, documents, graphics). Attention! It is important that you do not immediately reveal all necessary resources to students. The search for supplementary and additional resources compared to those suggested by the teacher is in fact an integral part of the process and also represents a parameter of evaluation of the students' abilities.	

Dossier for Instructors

TITLE	The same as the one preset in the student chart, so that both cards can be easily matched.			
COORDINATES OF THE TEACHING INTERVENTION	- students' level of competence; - student profile; - type of participants (monolingual or multilingual); - linguistic and communicative needs; - time available.			
PROBLEM TYPES		WELL-STRUCTURED PROBLEM	SEMI-STRUCTURED PROBLEM	UNSTRUCTURED PROBLEM

	EXPLORATORY PROBLEM			
	TEXTUAL PROBLEM			
UNVERIFIABLE SKILLS AND COMPETENCES	Indicate what skills and competences are considered to be conducive to development (e.g. social competence).			
PROBLWM DSCRIPTION	a) General description of the PROBLEM. b) Idea, starting point for the investigation to be carried out in order to seek a solution.			
PROCEDURA	In case a) the teacher presents the problem to the participants:	- motivation / student awareness: the teacher can ask questions to activate the students' preconceptions; - the teacher can briefly explain what the solution of the problem will serve and how it can be applied.		
	In case b) teacher and students discuss research hypotheses			
	Work planning, preparation and organization:	- selection of sources (d/d+s/s) - choice of final media (d/d+s/s) - group division (d/d+s/s) - division of work (d/d+s/s) - preparation of materials (d+s/s) - simulation of the types of communication interaction which may occur **in synchronous and asynchronous mode** (d+s).		
	Conduct	a) **asynchronously:** - students perform the activities. (students) - the teacher can monitor the activities (possible d+s)		

		b) **in synchronous mode:** - processing of information and work done (d+s/s) - drafting of descriptive texts and/or comments (d+s/s) - choice of support (pc, poster)
	Set up of the presentation.	Teacher corrects texts and helps students with tests and simulations of the presentation, providing reference models if necessary.
	Presentation and evaluation.	Guidance on how to organize and manage the presentation and sharing of the results of the research carried out as e.g. whether to provide forms of evaluation among students (peer-to-peer), whether the teacher will have to express a differentiated assessment of the work of individual groups and/ or only a comprehensive assessment of the entire course and the results obtained.
ORGANISATIONAL AND LOGISTICAL INFORMATION	- instructions on how groups should be organized; - instructions on working hours and scans, instructions on how to change the schedule according to the progress of the process; - logistical indications.	
ACTIVITIES AND TASKS	The teacher indicates in the form of a list the actions that the learners will have to put in place to solve the problem (e.g. making decisions, discussing in groups, negotiating, searching for information, taking photos, presenting oneself, asking for information, interviewing natives, understanding a text, orally exposing the results obtained).	
USEFUL RESOURCES	The resources are already present in the dossier for the students. It is important to make a broader list so that teachers have sufficient material to supplement what is already available to students when needed.	
*(*d, d+s, s*) - ***d****= teacher, minimum degree of autonomy* - ***d+s****= teacher and students, the teacher helps*		

students towards autonomy *- **s**= students, students carry out the various actions independently*	

Annex 2. Interaction Design Agenda for instructors

The following table shows the actions expected by all the professionals involved in supporting the pilot course, and the expected reactions by students too. The table is based on the full organized model, in which the students could be supported by 3 different professional roles: an ET expert in the matter of the course, a CM expert in communication and interaction management and an IB expert in searching and retrieving information and resources to be shared.

In the agenda you can see all the sequence of the actions expected from each professional, following the related columns, otherwise verify what have to do, day by day, all the actors interacting in the course, following the rows. The agenda could be adapted to different scenarios, first of all if not all the professional roles could be set in the course according with a specific variable of every scenario.

Agenda day by day				
Step A. Towards the problem				
days	Actions by ET	Actions by CM	What the learners are expected to do	Actions by IB
0		Sending account data to all the learners, asking for positive feedback [email to all]		
			Give the requested feedback to the CM	Verifying the first access of every learner [background action on platform]
		Welcome message: introducing the staff, the methodology and the goals of the course		
1		Delivering the poll		
			Answer to the poll	

2		Delivering the spark "introduce yourself"	Answer to the poll	
3			Complete the poll	Elaborating the results of the poll and sharing them with the staff [sharing area of staff]
4			Complete the spark	Elaborating the results of the spark and sharing them with the staff [sharing area of staff]
	Adding a feedback on the results of the spark if needed	Giving feedback on the results of the spark [platform tool]	Complete the spark	Adding a feedback on the results of the spark if needed
5	Integrating/rethinking about the groups' components, if needed	First proposal to split the learners in n groups [sharing area of the staff]		Integrating/rethinking about the groups' components, if needed
WBN		Starting the webinar		
	Introducing the background and the context of the problem		Follow the webinar	
		Communicating the groups' members and introducing the tool to join the groups	Integrating/rethinking about the groups' membership, if needed	
			Join the respective group	
			Meeting of every group in the private room, if needed	Adding to KB a synthesis report of the activities of the module

Step B. The Problem				
days	Actions by ET	Actions by CM	What the learners are expected to do	Actions by IB
6		Communicating the start of the current step [message in News]		
			Follow the interactive video	
7	If needed, answering to the requests by learners or suggesting questions or resource about the topics of the matter [repetitive action code Sca/SME]		Follow the interactive video	Monitoring the works in progress and adding resources to the KB if needed by learners [repetitive action code Rep/KB]
8	[Sca/SME]	Monitoring the works in progress and giving suggestions for a better interactions and organization within the groups [repetitive action code Ver/INT]	Every group discuss the inputs about the problem and the related glossary definition	
9	[Sca/SME]		Every group discuss the inputs about the problem and the related glossary definitions	[Rep/KB]
10		Verifying the effectiveness of the interactions within the groups and suggesting adjustments if needed	Every group write their glossary definitions and report in the book the results of brainstorming	Adding to KB a synthesis report of the activities of the module
				Verifying and editing if needed the glossary and the book in progress

Step C. Setting the Problem				
days	Actions by ET	Actions by CM	What the learners are expected to do	Actions by IB
11		Communicating the start of the current step [message in News]		
12	[Sca/SME]		Follow the activity	[Rep/KB]
13	[Sca/SME]	[Ver/INT]	Follow the activity	
14	[Sca/SME]		Follow the activity	[Rep/KB]
15			Discuss the inputs, sharing issues and updating if needed glossary, book and KB [repetitive actions, by group, code Pro/TW]	
16	[Sca/SME]		[Pro/TW]	[Rep/KB]
17	[Sca/SME]	[Ver/INT]	[Pro/TW]	
18 (27settembre)	[Sca/SME]		[Pro/TW]	[Rep/KB]
19			[Pro/TW]	
20			[Pro/TW]	[Rep/KB]
21 WBN		Starting the webinar		
	Presenting content about the setting of the problem		Follow the webinar	

				Adding to KB a synthesys report of the activities of the module
				Verifying and editing if needed the glossary and the book in progress

Step D. Finding a solution				
days	Actions by ET	Actions by CM	What the learners are expected to do	Actions by IB
22		Communicating the start of the current step [message in News]		
23	[Sca/SME]		Follow the activity	[Rep/KB]
24	[Sca/SME]	[Ver/INT]	Follow the activity	
25	[Sca/SME]		Follow the activity	[Rep/KB]
26			Discuss about the solution of activity, by group	
27	[Sca/SME]			[Rep/KB]
28	[Sca/SME]	[Ver/INT]	Discuss about the solution of the problem, by group	

29	[Sca/SME]		Discuss about the solution of the problem, by group	[Rep/KB]
30			Discuss about the solution of the problem, by group	
31	[Sca/SME]		Discuss about the solution of the problem, by group	[Rep/KB]
32 (11ottobre)	[Sca/SME]	[Ver/INT]		
33 12 ottobre	[Sca/SME]		[Pro/TW]	[Rep/KB]
34 13/10			[Pro/TW]	
35 14/10	[Sca/SME]		[Pro/TW]	[Rep/KB]
36 15/10	[Sca/SME]	[Ver/INT]	[Pro/TW]	
37 16/10	[Sca/SME]		[Pro/TW]	[Rep/KB]
38 17/10	Supporting groups in the development of final presentation	Supporting groups in the development of final presentation	Develop a way to present the problem solving process and results, by group	Supporting groups in the development of final presentation
39 18/10			Develop a way to present the problem solving process and results, by group	Verifying and editing if needed the glossary and the book in progress
40 WBN		Starting the webinar		

19/10				
			Share the presentations, by group	
	Commenting the solutions and answering to any request		Discuss he solutions, if needed	
		Unlocking the assessment	Solve the assessment	Reporting to all the results of assessment

Annex 3. Technical indications for exploitation

IL for STEM Training Modules

Interactive Online Course Configuration and Technical requirements

All necessary templates to exploit the course are available in the Erasmus Plus Project Results Platform at:

https://erasmus-plus.ec.europa.eu/projects/search/details/2019-1-IT02-KA203-062829

Beware to the configuration of your platform!

The following requirements must be compliant on the local server to restore and activate the pilot course developed on the eKnow platform by SmartSkillsCenter.

LMS Platform:

- Moodle release 3.6 or more
- Custom themes by category available and configure d
- Language pack of each partner country installed and configured

Plugin and Add-ons (must be installed):

- Tiles [course format]
- Book [activity module]
- Checklist [activity module]
- Choice Group [activity module]
- H5P [activity module]
- Jitsi [activity module]
- Media Gallery [activity module]
- Questionnaire [activity module]
- Comments [block]
- ConceptMap [Question Type]
- Ordering [Question Type]
- Spreadsheet [Question Type]
- RecordRTC [extension for editor TinyMCE or Atto]

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