Journal of Physics: Conference Series

PAPER • OPEN ACCESS

Distance Learning and Multimedia Teaching Education: E-Laboratory Activities during Covid-19 Pandemic

To cite this article: Oriana Fiore *et al* 2022 *J. Phys.: Conf. Ser.* **2297** 012003

Distance Learning and Multimedia Teaching Education: E-Laboratory Activities during Covid-19 Pandemic

Oriana Fiore[1, a], Maria Giuseppina Adesso[2, b], Roberto Capone[3, c]
[1] *Liceo P.E. Imbriani,Avellino, Italy*
[2] *Liceo Da Procida, Salerno, Italy*
[3] *Università degli Studi di Salerno, Italy*
[a] *email: orianafio@gmail.com*
[b] *email: mapinadesso@gmail.com*
[c] *email: roberto.capone@uniba.it*

Abstract. During the COVID-19 pandemic lockdown, Italian schools and Universities were closed. In this scenario, teachers, in order to continue their work, had to manage the didactics by themselves, carrying out Distance Learning, thanks to the technology support. Nevertheless, teachers had some methodological and technical difficulties. This situation required the re-planning of some physics contents, trying to include laboratory activities, too. A teachers' training was organized in order to support the teachers both for effective and meaningful use of ICT and to carry out some laboratory activities in Distance Learning mode. The training aimed to investigate leading technologies relevant to physics teaching, the competencies that a physics teacher has to acquire to use digital technologies, and the effective approaches to develop these competencies. The course was organized into four webinars, timing 10 hours. Teachers became confident with ICT for communication, sharing, and documentation. Moreover, teachers approached the IBSE methodology, as modified by adding a further *E-laboratory* phase to the 5E cycle, promoted by Bybee, by planning a learning chunk, including a laboratory activity in synchronous e-learning mode. 20 High School Physics teachers were involved in the training.

1. Introduction

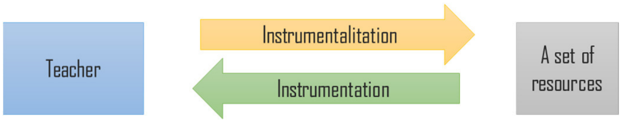
Since March 2019, because of the Covid 19 pandemic, schools and Universities have been suddenly closed, in many countries and people have been forced to lockdown, being deeply impacted at the emotional and affective level.

Teachers, students, and researchers were faced with new educational challenges to move forward in learning and educational research. Teachers have become, often with a sudden improvisation, real task designers [1]. The social distance has led to redefining some teaching areas, specifically the space-time organization of lessons and educational ethics. From this point of view, changes in teaching and educational design were necessary because of Distance Learning (DL) [2], as also UNESCO [3] recommended. It is essential to plan *in situ* to consider the context variables more carefully and to understand and propose the methodologies and the educational actions that were more appropriate for the students in this emergency. On the emotional, creative, narrative, and communicative side, the challenge was to organize a learning activity that could generate a situated and socially accepted educational practice. Information and communication were only carried out through the net. A complete metamorphosis of thinking and acting, particularly in education, was required: new balances between static and dynamic resources, between using and designing teaching resources, between individual and collective work [4]. Specifically, ICT has become the main teaching resources for teachers-students, teachers-teachers, and teachers-researchers communication, sharing, and documentation.

Nevertheless, teachers must be confident with ICT and competent to use them in the teaching-learning process. Moreover, the Physics teachers have to include laboratory activities, too. Therefore it is necessary to re-plan lab activities in an e-learning mode. The teaching methodologies have to be also modified in order to include the e-lab activities. The authors retain that teachers' training is needed to plan and experiment with a laboratorial Physics activity in synchronous e-learning mode. Here we show a teachers training, with 20 Physics in-service Teachers, at high school, in South Italy. The training was organized in four e-lessons (time, 2,50 hours each), in synchronous mode, by using the GSuite platform.

2. Conceptual framework

The used conceptual framework starts from the idea of Rabardel about instrumental genesis [5]. This process works both ways: the affordances of the resource/s influence teachers' practice *instrumentation process,* as the teachers' dispositions and knowledge guide the choices and transformation processes between different resources (the *instrumentalization process).* Teachers develop their particular schemes of use with some resources (artefact), thus obtaining an instrument (Fig. 1):



resources + schemes of use = instruments

Figure 1. Instrumental genesis

In this paper, "scheme" is in the sense of Vergnaud: "A *scheme* is a stable organization of the activity of a given subject for a given aim. This stability is reached along various situations corresponding to the same aim: a teacher meeting a new situation (characterized by a new aim) can mobilize and adjust existing schemes or can develop a new scheme" [6].

Starting from the general idea of instrumental genesis, Gueudet and Trouche [7], together with Birgit Pepin [8], developed a different theoretical framework, the Documentational Approach to Didactics (DAD), where some resources, with renewed schemes of use, become documents:

Resources + schemes of use = documents

In the instrumental genesis, it is possible to distinguish between artefact, which is available for use, and instrument, developed by the teachers/students, thanks to specific schemes of use.

Whereas, in the DAD, the idea of instrumental genesis [5] has been used to argue the documental genesis, i.e., a development process of a document [8]. Therefore, there is a dialectic nature in the interaction between teacher and resources in the DAD processes, combining instrumentation and instrumentalization [9], thus producing a document. A document, developed from a set of resources, provides new resources. The documentational approach is particularly pertinent to viewing the 'use' of resources as an interactive and potentially transformative process.

The authors agree with Adler's idea of "thinking about a resource like suggests the verb 'resource', to the source again or differently" [10]. Resources have the potential to feed and renew the teacher's activity [11] and support his/her commitment to teaching.

It is possible to distinguish three different types of resources: material curriculum resources (e.g., textbooks, digital curriculum resources, manipulable objects, and calculators), social resources (e.g., a conversation on a forum), and cognitive resources (e.g., pictures and/or theoretical tools used to work with teachers).

Recently [12], the DAD model has been updated due to the emerging digitalization of information and communication. Because of the spread of mass media and ICT in learning/teaching processes, there was a further need to design new resources for teaching.

Here, the renewed Documentational Approach to Didactics (DAD) [12] has been used as a conceptual framework in order to understand teachers' professional development by studying their interactions with the resources they design, organize, use and share in/for their teaching, thus producing effective documents.

By using the DAD lens, the authors focused on the following research questions:

Q_1) Which resources have to be preferred to realize Physics laboratory activities in e-learning mode?

Q_2) Which documents may be organized, with appropriate usage schemes, starting from the resources identified in the previous research question, to provide effective teacher training, also in FAD mode, in the perspective of long-life learning?

3. In-service teachers' training course

The training course has been organized in Distance Learning in Synchronous Online Learning (SOL) mode [2]. Twenty in-service Physics teachers at a Scientific high school in the South of Italy attended the course.

The course has been set in four webinars, each 2,50 hours duration:

Webinar 1: Approach the GSuite and analyze its potentialities, mainly in virtual classroom management.

Webinar 2: Discussion on teaching methodologies and ICT integration in the introduced methodologies. Focus on IBSE, 5E model [13], by introducing the E-laboratory (evolution to the 5E +1E model). Checklist of Apps and their use in different contexts.

Webinar 3: Planning an educational segment (learning chunk) using the technologies and the most appropriate methodology.

Webinar 4: Sharing an activity carried out by the trainers with the students in a virtual classroom.

The GSuite platform hosted the course. Specifically, a course on the Classroom App has been created, where all the documents and resources have been shared. In contrast, GMeet has been used for synchronous activities, Google Forms has been used to ask some tasks to the teachers and open some discussions, and Gmail/Calendar has been helpful for communication.

3.1. Webinar 1

Teachers have carried out an entry test (created by using Google Forms and shared on Classroom) in order to know their basic ICTs' competencies and skills. Specifically, the learning platform they used during the Covid emergency.

An analysis of their answers shows almost all the teachers use Gmail in their daily activities. All the teachers used App to communicate in a synchronous e-learning mode with their students. From the analysis of the answers, it results from they used: WeSchool (21%), Zoom (4%), Microsoft Teams (12%), GSuite (61%), others (2%).

During the first webinar, to have a common ground-state, the Gsuite tools were discussed, specifically Classroom, GMeet, and Google Forms. Moreover, simulations of creating and managing a Classroom course have been carried out, including synchronous and asynchronous activities. At the end of the webinar, the teachers became confident with creating a course, sharing documents, links, and Google Drive resources, creating homework, and sharing the screen or a window.

3.2. Webinar 2

Since the 1920s', Dewey [14] outlined that teaching/learning methodologies should be active, i.e., focused on the students. There should be a reciprocal relationship between student and teacher, and the teacher should be a guide rather than an information dispenser.

In Webinar 2, "Google Forms" has been used to investigate the teachers' main active learning methodologies generally used in laboratory activities.

By analyzing their answers, it appears that most of them use learning by doing [14], cooperative learning [15], and problem-solving [16].

Nevertheless, as the National Research Council (NRC) outlined, the active learning methodology well suited to laboratory activities is the Inquiry. NRC defined Inquiry as "a step beyond science as a process, in which students learn skills, such as observation, inference, and experimentation. The new vision includes science and requires that students combine processes and scientific knowledge as they use scientific reasoning and critical thinking to develop their understanding of science. Engaging students in Inquiry helps students develop" [17].

A debate was followed, mainly focused on Inquiry, specifically the Inquiry Based Science Education (IBSE), as Driver [18] introduced.

The authors suggested IBSE in the 5E Model [13], [19], as a methodology to be used in laboratory activities.

This model is based on 5 phases:

1) Engage: The teacher creates a "surprising" scenario, taking care of all details to highlight the main characteristics of phenomena to be analyzed. According to TEMI's idea [20], [21], a mystery might be included in the script in this phase. It is well known that mystery creates expectation, astonishment, and curiosity, and we agree that necessity may be the mother of invention, but curiosity is the mother of discovery. Thanks to a mysterious scene, students are engaged and discuss "what is *interesting* in the observed phenomenon".

2) Explore: students "explore" by themselves, organizing specific experiments to verify their preliminary idea and trying to discover "*what is happening*". The teacher is simply a moderator in this phase and the next one.

3) Explain: students try to explain the main results of previous experiments. They make some hypotheses and create a simplified model of the reality, just searching for an explanation to the question "*what is causing it?*".

4) Extend: it's probably the most exciting phase because students acquire *skills*. The guide question is "*what is similar* to previously discovered phenomena?". They apply the results of previous experiments in different interest areas. Multidisciplinary and interdisciplinary activities are expected in this phase. The 5E model is circular, so new instances of Engage could arise from each Extend phase.

5) Evaluate: the education path has to be evaluated by fitting tasks in all the phases and final experimental requests or questionnaires.

In this model, students are involved in "re-discovering" natural phenomena in the world around them, these phases being strictly connected to Galileo's scientific method. Moreover, these phases reflect mental steps that scientists and common people follow when acquiring new knowledge and new skills by organizing data, planning hypotheses, and verifying solutions.

Nevertheless, the discussion still arises, "How to use this methodology in an SOL mode?", "How to integrate the ICT resources in this 5E model?"

The authors suggest adding a further "E" phase, namely the E-Laboratory phase, where the teachers, in a synchronous e-learning mode, help the students to set up a "scientific laboratory" in their rooms, also realizing some instruments by themselves, just by using simple and low-cost materials that they may find in their own houses. In this phase, as in a "Cooking course", the teacher builds his instruments with the students in a synchronous mode. In Fig. 2, a scheme of the "5E +1E" IBSE model is shown.

Moreover, the ICT has to be effectively included and integrated in each phase, both for communication/sharing and specific Physics App. For example, some apps may be used in the Explain/Extend phases to explain/introduce (new) contents and Explore ones as "virtual lab".

In all these phases, Internet has been used in agreement with the "Declaration of Internet rights" (2015), art.2 "right to Internet access", where it is specified that all the users should have the same effective "instruments" to use it (i.e., a net, a device which may be connected to the network, and the competences to use them). The primary devices useful for a lesson are tablets, laptops/PCs, smartphones, and the web. Moreover, a Physics teacher could use a graphic tablet to better communicate with students.

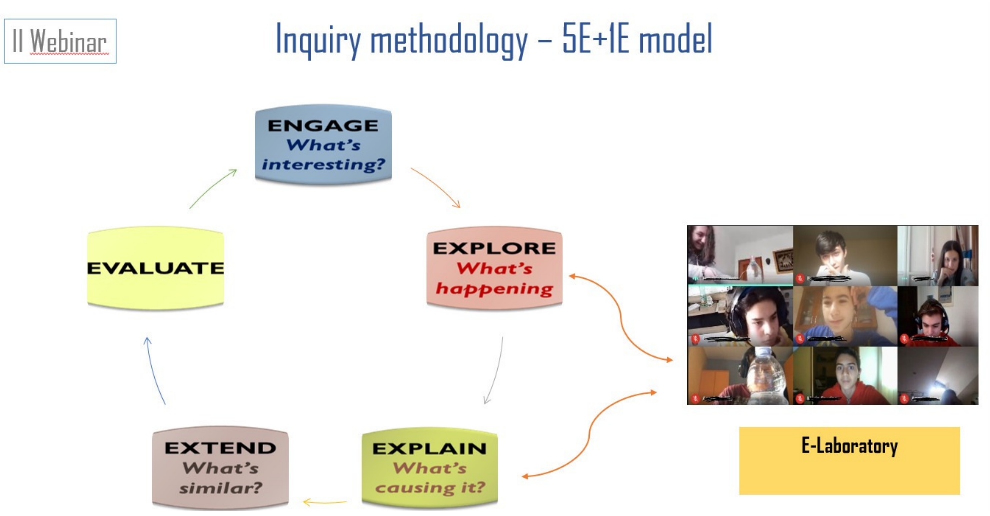


Figure 2. Inquiry-Based Science Education, 5E Model (Engage, Explore, Extend, Explain) with a further E (E-Laboratory)

3.3 Webinar 3

In this webinar, "students-teachers" were asked to plan a learning chunk, including a laboratory activity in a SOL mode, according to IBSE 5E + 1E, using ICT resources (material, social, cognitive).

A learning chunk is a learning segment that has to be detailed planned; it includes a brainstorming (about 5 minutes), some short explanation (about 10 minutes), an activity (time depending on the type of activity), feedback (15 minutes) and conclusion (5 minutes).

In order to help teachers to plan a learning chunk, we guided them throw some steps.

First of all, we invited each teacher to realize a Reflective Mapping of Teachers Resource System, RMTRS [22], following some indications of researchers: they had to organize their resources in material, cognitive and social ones, distinguishing the digital resources from the no-digital ones. Their RMTRS maps have been shared in the classroom.

A discussion followed about their RMTRS and, after the debate, they were asked to re-organize the RMTRS, taking into account the suggestions of all teachers and researchers.

In Figure 3. an example of RMTRS before (a) and after (b) the discussion is shown.

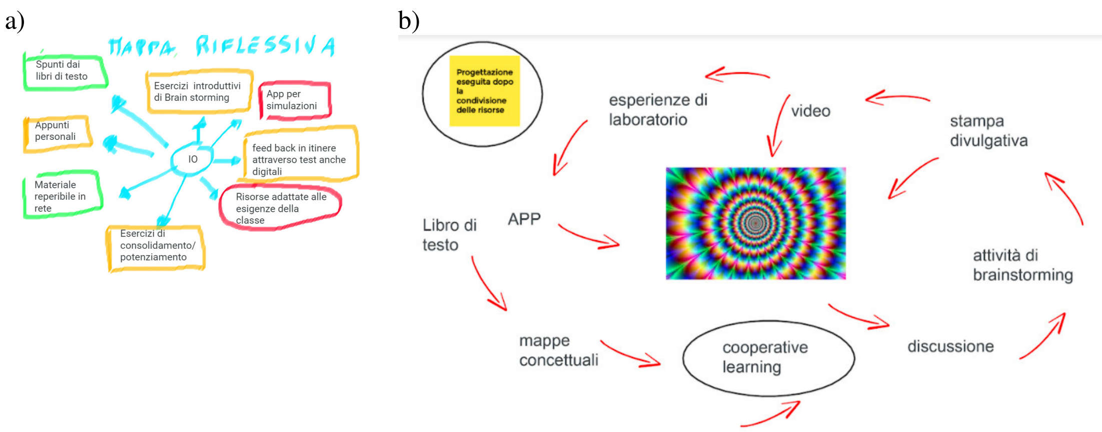


Figure 3. RMTRS before (a) and after (b) a discussion between teachers and researchers

In the RMTRS, before the discussion, the teacher (teacher A) outlines some social resources in red, main material resources in green, and the cognitive resources in yellow. There isn't any connection between the resources. Nevertheless, in the final RMTRS, teacher A doesn't distinguish the "type of resources", whereas she highlights an interconnection between them, in a circular way.

Finally, a shared document (using Google Document) has been filled and transmitted, including all the resources the teachers pointed out in their maps (Table 1).

Table 1. Shared resources document: material, social and cognitive, subdivided into non-digital and digital ones.

	No-Digital Resources	Digital Resources
Material	Textbook	e-book
	Conceptual maps	OneNote, Jamboard, Open Board
	Newspapers	Learning and Simulation apps
	Exercises books	Web platforms
	Scientific journals	Exercises books
	Guided exercises	Software for lab
	Scientific reports	Physics Apps
Social	Discussion	Video on Youtube
	Shared results/feedback	Shared results/feedback
	Brainstorming	Brainstorming
	Laboratory activities	Software for laboratorial Simulation
Cognitive	Flipped Classroom	Flipped Classroom
	Learning chunk	Learning chunk
	Brainstorming	Brainstorming
	Cooperative learning	Use of sharing platforms to manage working groups

Starting from these resources, following the idea of DAD, with specific schemes of use, each teacher produced a document, which is the e-plan (i.e., the plan shared through the net) of his/her learning chunk, focused on a laboratory activity, organized following the "5E+1E" IBSE methodology.

A guide scheme to plan an activity to include in the learning chunk is shown in Figure 4. The teacher's e-planning documents were shared in the classroom.

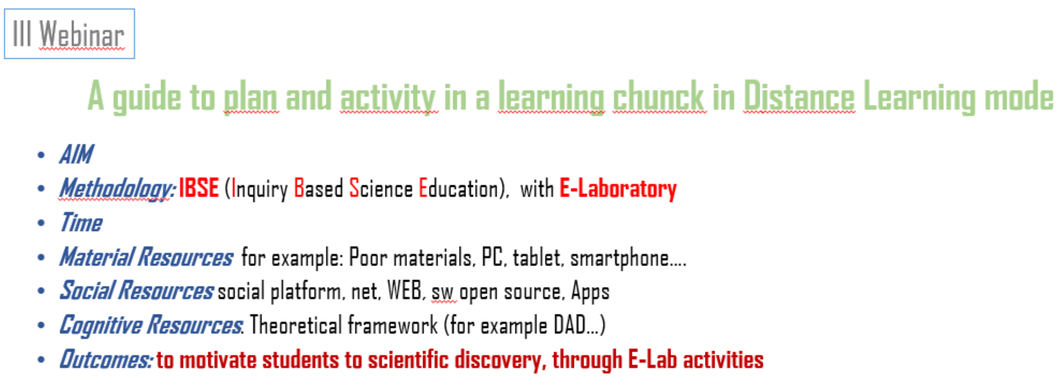


Figure 4. A guide scheme to realize the plan of activity including in a learning chunk

3.4 Webinar 4

In the last webinar, the researchers shared with the teachers an activity in which they experimented with fifty 16 year-old students in SOL Mode. The activity was focused on the investigation of the "light spectra". Students were engaged, stimulating the curiosity to discover the main similarities and differences between different lamps. In order to answer this question, they were involved in building a spectroscope, in the E-Laboratory phase (Figure 5), by using simple and low-cost materials (CD, scissors, carton rolls, lamps, tape…).

IV Webinar

Figure 5. Students build an instrument, the spectroscope, using simple and low-cost materials and the teacher.

4. Case study: the learning chunk planned by teacher A

Here we show a case study about teacher A. She is 40. She teaches Maths and Physics in a Scientific High School. She has previous experiences in a National project (Liceo Matematico [23], [24]), working on interdisciplinary learning units. Her RTMRS have been previously shown in Figure 3.

She organized a learning chunk, including a laboratory activity on the Archimedes' thrust. She planned an activity, following the scheme in Figure 4: the methodology was the IBSE 5E + 1E, the time was 4 hours, in the material resources, she listed all the simple and low-cost materials needed to realize a dynamometer, built by following some indications in a Youtube video, in the E-Lab phase.

Specifically, she planned to use the following resources:

- Material resources: a bowl, glass spheres, polystyrene, and plastic balls, plastic caps, paper clips for the Explore phase; a spring, a paper sheet, a hook, a wooden stick for the E-Laboratory phase
- Social Resources: Google suite, Network, Internet
- Cognitive Resources: Distance Learning, Debate, Peer to Peer.

Moreover, she detailed all the 5E+1E phases. Figure 6 shows the Engage and the E-Laboratory phase as she planned. Specifically, in the Engage, the teachers have to offer the students some imagination to arouse the students' curiosity and introduce the floating. Nevertheless, in the E-Laboratory phase, the students and the teacher are invited to build an instrument (the dynamometer) to investigate the Archimedes' principle.

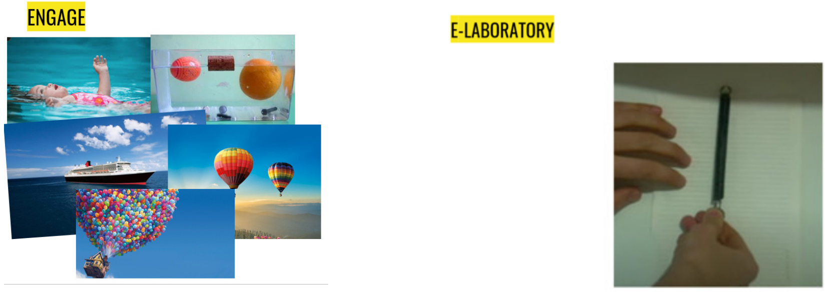


Figure 6. Engage and E-Laboratory phases, as suggested by Teacher A, with the "building of a dynamometer."

Teacher A outlined that both the instrumentalization and instrumentation processes have effectively obtained artefacts and/or documents. Specifically, she produced the RMTRS (before and after the discussion) and the e-planning document. Moreover, for each material resource, she organized some schemes of use to process some artefacts to obtain an instrument (the dynamometer).
She thinks this e-training improved her ICT competencies and skills and, as a consequence, a more aware use of ICT contributed to better planning of the lesson and more mindful use of the resources.

5. Findings
At the end of the course, the teachers were asked to fill up a "Google Forms" about using ICT and multimedia in planning a laboratory activity in SOL mode. Here we show the results about three specific questions:
a) Which material, cognitive and social resources are relevant to physics teaching?
The teachers consider that the resources useful for the Physics teaching are:
➢ Software to organize and plan a Learning Chunk (Onenote, Open Board, Jamboard)
➢ Social App (Google Meet, Zoom, WeSchool, Microsoft Teams) to organize all the activities in SOL mode, including some laboratory ones.
➢ Cloud Software (for example, Padlet, Classroom, Edmodo, WeSchool), to share educational materials between teachers-teachers, teachers-students, and students-students
Moreover, they agree that for Physics teaching, further specific technologies are Physics Applets and Virtual Laboratories, which are necessary to comprehend the topics better and realize virtual experiments.
Nevertheless, the teachers consider all the digital resources highlighted in this course (see Table 1) are relevant ICT and multimedia in Physics teaching as a support to the active methodology used in the laboratory phase (specifically IBSE).
b) Which competencies does a Physics teacher need to be able to use digital technologies in a meaningful way in Physics lessons?
From their answers, we may deduce that, in order to be able to use the previously written digital technologies and resources, the Physics teacher has to acquire some competencies, specifically:
➢ He has to be able to plan and experiment with a Physics learning chunk, also in the SOL mode.
➢ He has to be able to search and choose the right Applets, and he has to place them in the context.
➢ He has to be able to communicate and share his educational experiences with a scientific community (which may be both virtual and face-to-face)
➢ He has to be able to use all the available resources and organize schemes of use.
➢ He has to be able to organize some resources, thus producing documents and/or instruments.
c) What are effective approaches to be used in teacher education to acquire these competencies?
Teachers retained that main approaches to be used to acquire the over-mentioned competencies are:
➢ Webinar/courses, oriented to discussing how the learning methodologies may be changed, including the digital technologies.
➢ Webinar/lessons/courses about creating planning and maps and using specific software.

- Courses focused on laboratory activities in a SOL mode and included the Physics Applet in the lesson.

Teachers agree that this course has been coherent with the criteria they have identified as necessary to achieve ICT competencies and skills in Physics teaching.

Starting from the teachers' answers and analyzing their RMTRS and their planned activities, we deduced that the resources necessary in the e-learning mode are quite different from those used in the traditional teaching activities. Specifically,

- Material resources: generally, the Physics laboratory lesson is carried out in well-organized laboratories, where the students use standard instruments, with schemes of usage generally given by the manufacturers and well experimented with during the years. Nevertheless, in the e-learning mode, the students are forced to build their instruments by themselves (in a Physics e-laboratory). The material resources have to be readily available materials, only, so the schemes of usage are not "standard" and the teachers have to be trained to organize them.
- Social resources are negligible in the face-to-face lesson, whereas they are necessary for e-learning. Also, teachers have to organize specific schemes of usage and documents for these resources.
- Cognitive resources: the theoretical and conceptual frameworks have to be modified to fit the new social resources (ICT, web, and so on). This research paper already used the DAD as updated in this sense.

Here we analyzed a single case study only. Nevertheless, a "collection" of the documents produced by the teachers, as supported by the researchers, could be used as resources in future laboratory e-learning activities, also aimed to be available to future experimentation, so adding a contribution to the literature about the Physics distance learning teaching.

Finally, the ICT and multimedia contribute to the teachers' professional development if there is an awareness and effective use of all the resources.

6. Conclusions

There are no claims and specific learning & teaching materials in literature to guide teachers and students in the Physics Lab in a synchronous distance learning mode. The conceptual framework used here also aimed to organize some documents starting from specific resources and is also functional to the organization of sharable teaching materials in a community of variable dimensions (class/interclass up to the whole teachers' community), which is connected by using social networks. For this purpose, we are organizing some specific shared experimental settings, as future work, in order to create a Physics laboratory literature in the distance mode. We also planned to experiment with similar Physics activities with teachers, from 3 to 10 grade, as future work.

7. Authors' ORCID iD

Oriana Fiore, 0000-0002-3119-0965
Maria Giuseppina Adesso, 0000-0002-5147-5669
Roberto Capone, 0000-0001-9454-8453

8. References

[1] Rocha H, Faggiano E and Mennuni F 2020 *Mathematics Education in the Digital Age* (MEDA) p 109

[2] Porter L R 1997 *Creating the Virtual Classroom: Distance learning with the Internet* (John Wiley & Sons, Inc.)

[3] UNESCO 2020 *290 million students out of school due to COVID-19: UNESCO releases first global numbers and mobilizes response* 4 March 2020 Retrieved 6 March 2020

[4] Pepin B, Choppin J, Ruthven K and Sinclair N 2017 *ZDM Mathematics Education* **49**(5) pp 645-661

[5] Rabardel R 1995 *Les hommes et les technologies. Approche Cognitive des instruments*

contemporains (Paris: Armand Colin)
[6] Vergnaud G 1998 Toward a cognitive theory of practice In A Sierpinska & J. Kilpatrick (eds) *Mathematics education as a research domain: A search for identity* (Dordrecht: Kluwer Academic Publishers) pp 227–241
[7] Gueudet G and Trouche L 2009 *Educational Studies in Mathematics* **71**(3) pp 199-218
[8] Gueudet G, Pepin B and Trouche L 2012 *From Text to 'Lived' Resources: Mathematics Curriculum Materials and Teacher Development* (New York: Springer)
[9] Vérillon P and Rabardel P 1995 *European Journal of Psychology of Education* **9**(3) pp 77-101.
[10] Adler J 2000 *Journal of Mathematics Teacher Education* **3** p 205
[11] Remillard J T 2005 *Review of Educational Research* **75**(2) p 211
[12] Trouche L, Gueudet G and Pepin B 2020 *Documentational approach to didactics* In S. Lerman (ed) Encyclopedia of Mathematics Education p 237 (Cham: Springer)
[13] Bybee R W 2014 *Science and Children* **51**(8) p 10
[14] Dewey J 1926 *Democracy and education* (New York: MacMillan)
[15] Kagan S and Kagan S 1994 *Cooperative learning* **2** (San Juan Capistrano CA: Kagan Cooperative Learning)
[16] Scheerer M 1963 Problem-solving. *Scientific American*, **208**(4) p 118
[17] National Research Council 1996 *National science education standards* (National Academies Press)
[18] Driver R 1985 *The pupil as scientist?* (Open University Press)
[19] Adesso M G, Capone R, Del Sorbo M R and Fiore O 2019 Light the world and change its color: A case study in Italian secondary school using IBSE methodology *Journal of Physics: Conference Series* **1286** (1) 012033 (IOP Publishing)
[20] Broggy J, Childs P E, McCormack O, McManus B and O'Dwyer A 2014 TEMI: Teaching Enquiry with Mysteries Incorporated. In *Proceedings: Science & Mathematics Education Conference (SMEC)* (Dublin City University, Dublin, Ireland)
[21] Barbieri S, Carpineti M and Giliberti, M. 2014 The European TEMI project involves Italian teachers: first outcomes In Proceeding GIREP-MPTL 2014 *International Conference: Teaching/Learning Physics: Integrating research into practice* **759** Università degli Studi di Palermo
[22] Rocha K D M 2018 Uses of Online Resources and Documentational Trajectories: The Case of Sésamath In Fan L, Trouche L, Rezat S, Qi C and Visnovska J *Research on Mathematics Textbooks and Teachers' Resources: Advances and issues* p 235 (Springer)
[23] Capone R, Rogora E and Tortoriello F. S. 2017 *Matematica, Cultura e Società* **2**(1) p 293
[24] Capone R, Adesso M G, Del Regno F, Lombardi L and Tortoriello F S 2020 Mathematical competencies: a case study on semiotic systems and argumentation in an Italian High School *International Journal of Mathematical Education in Science and Technology* **52**(6)