



Testing the model of double stimulation in a Change Laboratory

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HIGHLIGHTS

- The paper illustrates the analyses of the model of double stimulation.
- The model is applied to the specific Change Laboratory in the case school in Italy.
- The four phases of Apparatus 1 do not follow the double stimulation model in strict order.
- The analysis shows quantitative and qualitative differences of the four phases of Apparatus 1.
- The sixth session acts as a boundary between the first and second block of sessions.

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ABSTRACT

The principle of double stimulation is foundational within Cultural Historical Activity Theory. This paper illustrates an analysis of the model of double stimulation applied to a Change Laboratory in an Italian vocational school. Results show that the four phases relating to Apparatus 1 do not follow the model in strict order, nor do they become concentrated in single sessions. The analysis points at quantitative and qualitative differences of the four phases between the first block and the second block of sessions, with the sixth session acting as a boundary.

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1. Introduction

Many scholars today agree that the agency of teachers is a key mediator of educational change (e.g. [Datnow, 2012](#); [Priestley, Edwards, Priestley, & Miller, 2012](#)). To support students to be ready for their future, teachers themselves need to exert agency by responsibly developing their work and influencing individuals, events and circumstances for the common good ([OECD, 2018](#)). Agency is important not only to promote active learning in students, but also in teacher education ([Juutilainen, Metsäpelto, & Poikkeus, 2018](#); [Tao & Gao, 2017](#)), to go beyond simple curriculum delivery and to back learners' competencies and professional growth for life in a complex and precarious world. Against this

background, intervention research and training play an important role in promoting teachers' agency ([Hökkä, Vähäsantanen, & Mahlakaarto, 2017](#); [Tao & Gao, 2017](#)).

In this article, with the help of a case study, we present a conceptual and methodological approach with its specific theory-driven and participatory design tools. The approach derives from present analysis and commentaries of Vygotsky's studies ([Sannino, 2015b](#); [Clark, Chittleborough, & Chandler, 2018](#); [Nuttall, Thomas, & Henderson, 2018](#)) on the principle of double stimulation. This principle makes it possible to trace how teachers' agency emerges with the help of models and concepts (referred to as second stimuli) co-designed together with interventionist researchers in response to pressing challenges to face. This principle is acknowledged to be a useful resource to investigate agency as an evolving process, in which specific steps undertaken in the participatory design by the teachers can be traced, documented and supported ([Sannino, 2015c](#); [Engeström, Nutall & Hopwood, 2020](#)).

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The principle of double stimulation is considered crucial in the activist and interventionist tradition of Cultural Historical Activity Theory (CHAT), since formative interventions rely on this principle (Engeström, 2007, 2011; Virkkunen & Newnham, 2013). It is however only since 2015 that the double stimulation process has been modelled (Sannino, 2015b) as a process of agency formation. Through this modelling phase, the principle has gained further theoretical legitimacy. The model has been tested in experimental situations with individuals (Sannino & Laitinen, 2015) and small groups (Sannino, 2016), and in school activities (Barma, Lacasse, & Massé-Morneau, 2015; Nuttall et al., 2018; Sannino & Engeström, 2016). The literature, however, still lacks cases which illustrate how the principle works in practice in supporting or generating teachers' agency toward creating tangible change in a school setting. To contribute to filling this gap, this article presents the case of a Change Laboratory carried out between 2016 and 2017 with a group of teachers and technical assistants in an Italian vocational secondary school, which was facing the acute challenge of a steady decrease in the number of students who were admitted to their surveying course.

The article starts by reviewing the concept of agency for teacher education with a special focus on the socio-cultural approach that has been used by most of the authors researching agency in this journal. It then moves to agency as it is understood today in CHAT on the basis of the Vygotskian principle of double stimulation. Next, the paper shortly introduces the Change Laboratory method and present the analyses of how the two steps model of double stimulation relates to the specific Change Laboratory in the case school in Italy.

2. Literature review

2.1. Agency

Eteläpelto, Vähäsantanen, Hökkä, and Paloniemi (2013) reviewed the conceptualisations of professional agency at work and found the following four research orientations: those focused on identity and life course stream, post-structural, social science, and the socio-cultural orientations. Most recent studies in this journal followed the socio-cultural approach, and investigated the connection between agency and professional identity (Connolly, Hadfield, Barnes, & Snook, 2018; Hökkä et al., 2017; Juutilainen et al., 2018; Preston, 2019; Wallen & Tormey, 2019), identity and agency in educational change and educational reforms (Tao & Gao, 2017; Vähäsantanen, 2015), and the effects of cross-cultural dialogue on teachers' agency (Simpson, Sang, Wood, Wang, & Ye, 2018). Within socio-cultural research perspectives agency is defined as the "belief that humans have the ability to influence their lives and environment, however the way they go about this is mediated by cultural tools" (Preston, 2019, p. 333). Still taking a socio-cultural approach, other authors in this journal adopted an ecological stance, thus seeking to understand agency rather than describe it. Pantić (2017) investigated teacher agency for social justice, while Oolbekkink-Marchand, Hadar, Smith, Helleve, and Ulvik (2017) found trajectories along which teacher's agency could be developed.

Other authors have framed agency going beyond descriptions of agency and identity. These approaches share the Vygotskian assumption that tools and objects mediate human activity (Eteläpelto et al., 2013). Within this line of studies, agency is discussed in terms of collectives and the literature refers to diverse forms of collective agency. Relation agency, for example, concerns the ability to work with others to sustain deliberate solutions to complex problems (Edwards, 2011). Collective transformative agency occurs when a collective breaks away from their current

way of thinking and acting, and begins to transform the activity system collaboratively (Virkkunen, 2006). Haapasaaari, Engeström, and Kerosuo (2014) found six possible manifestations of shared agency during Change Laboratory interventions. By analysing the transcripts of the sessions, they found the extent to which the expression of transformative agency were individual or collective forms of agency.

While this literature conveys the recognition of persistent limitations of dominant conceptualisations of agency, not much progress seems to take place in offering meaningful alternatives that can be actually implemented in support of agency formation. This article is an initiative toward this direction. Agency goes beyond a belief about one's own capability to exert power over the context. Individuals and collectives also develop and utilise artefacts to define and solve problematic situations, as well as to gain control of their activities and lives (Virkkunen, 2006). Hence, the use and development of auxiliary stimuli allows individuals to control their behaviour. This is done initially with external stimuli and later internally through complex activities (Vygotsky, 1978). Artefacts of this kind can be produced in teacher training or school development contexts with the help of double stimulation, when members of a school community are confronted with a problem that affects them all in a highly significant way. The artefact (or second stimulus) then becomes a resource for addressing the problem and at the same time a resource to trace the emergence of agency in tangible actions that attempt – and possibly lead – to making a difference.

2.2. The model of double simulation

According to Sannino (2015b), Vygotsky's double stimulation is foundational to understanding how individuals and collectives perform volitional actions in circumstances of cognitive conflict and ambiguity. A task is never simply the task designed by the researcher, instead, the participants in a study creatively reconstruct and interpret the assignment given to them in a process that can be hardly disciplined from the outside. Vygotsky (1978) depicts a situation employing double stimulation as in the following:

The task facing the child in the experimental context is, as a rule, beyond his present capabilities and cannot be solved by existing skills. In such cases a neutral object is placed near the child, and frequently we are able to observe how the neutral stimulus is drawn into the situation and takes on the function of a sign. Thus, the child actively incorporates these neutral objects into the task of problem solving. (p. 74).

Referring to double stimulation, Vygotsky introduces an experiment named the meaningless situation or the waiting experiment (Vygotsky, 1987, 1997). A person is asked to participate in an experiment which consists of leaving the person unattended in an empty room without instructions or tasks to perform. In such a situation, the person hesitates as far as she or he can locate an object – for instance a clock – which is subsequently utilised to make a choice: the person decides to quit the room immediately when the clock hands move to a certain point. According to Vygotsky, the incongruity between the motive of waiting and the motive of leaving is the first stimulus, whereas the clock acquires the function of second stimulus. The clock is turned into a purposeful sign characterising the subject's intention to escape such unsettling situation:

Tying a knot as a reminder, in both children and adults, is but one example of a pervasive regulatory principle of human behaviour, that of signification, wherein people create temporary links and give significance to previously neutral stimuli in the context of their problem-solving efforts. We regard our method as important because it helps to objectify inner psychological processes

(Vygotsky, 1978, pp. 74–75).

Moreover, double stimulation appears key to understanding how subjects wilfully transform their conditions (Sannino, 2015b). It embeds a conflict of motives, which arise when there is a collision between antagonistic tendencies or aspirations, when the person is confronted with situations entailing ambiguity. Along with an ambiguous situation, the conflict of motives is the outset through which the individual wilfully acts to influence his or her environment. Conflict of motives emerge only when having to make a wilful decision, since without hindrances to overcome an action cannot be properly seen as volitional (Leont'ev, 2005). For Thorne (2015) researches on double stimulation have provided a better grasp of agency not only as lived experience, but also as a theoretical construct. The Author also called for a further operationalisation of the principle to assist the analysis of empirical data. Haapasaari and Kerosuo (2015), for example, made an analysis of chains of double stimulation which were integrated with manifestations of shared transformative agency during a Change Laboratory intervention. Double stimulation was also analysed in everyday work through the concept of critical encounter (Engeström, Kajamaa, & Nummijoki, 2015); the authors found that in mundane activities double stimulation is intrinsically interactional, longitudinal, multi-phased and iterative.

Most importantly, Thorne's call has been echoed by Sannino (2015b) who systematised the principle into a model, by testing it on individuals (Sannino & Laitinen, 2015) and small groups (Sannino, 2016) in the experiment of the meaningless situation. Fig. 1 depicts the model of double stimulation that Sannino (2015b) produced drawing from Vygotsky (1978, 1997).

Overall, in Apparatus 1 the person forms the decision to behave in a specific fashion through an auxiliary motive and in Apparatus 2 she or he implements such decision. Apparatus 1 has 4 phases. In Phase 1 the person is presented with two antagonistic stimuli. This means, in the case of the meaningless situation, having to wait albeit with no reason. In Phase 2 a conflict of motives emerges in response to the antagonistic stimuli: wanting to stay and wanting to leave. In the third Phase the person selects a stimulus and

converts it in an auxiliary motive. For instance, the stimulus drawn into the problematic situation is the clock. In Phase 4 the person connects the chosen response with the occurrence of the auxiliary stimulus: the person chooses to abandon the room once the clock hands strike the established point. Apparatus 2 follows with the execution phase, almost as if the planned action was easy and automatic (Engeström, 2007). Hopwood and Gottschalk (2017) have tested this model and suggested that it can be partially applied in everyday work such as parents' services with children at risk.

2.3. Double stimulation in a Change Laboratory

Following the Vygotskian legacy, formative interventions have been devised to promote change as well as to foster practitioners' shared and transformative agency. The Change Laboratory, for example, is a formative intervention method designed to trigger expansive learning (Virkkunen & Newnham, 2013) and the formation of agency (Sannino, 2020) thus promoting the development of work practices by the practitioners themselves (Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996). The basic idea is to organise a space with a rich kit of instruments to represent and analyse disturbances as well as design innovative models of the work activity. A Change Laboratory typically involves from 15 to 20 participants who meet on a week basis for 10 sessions plus distanced follow-up sessions. Supported by a researcher who facilitates the process, during the sessions the participants analyse the problematic and contradictory object connected to their activity, which they then redesign with the help of newly formed concepts (Engeström, 2011). Change Laboratories have been facilitated in diverse organizations (Virkkunen & Newnham, 2013), companies (Haapasaari, Engeström, & Kerosuo, 2018), libraries (Sannino, Engeström, and Lahikainen 2016), and in universities (Englund & Price, 2018) and schools (Botha, 2017; Teräs & Lasonen, 2013).

Most importantly, the Change Laboratory builds on double stimulation (Engeström 2007, 2011; Haapasaari & Kerosuo, 2015;

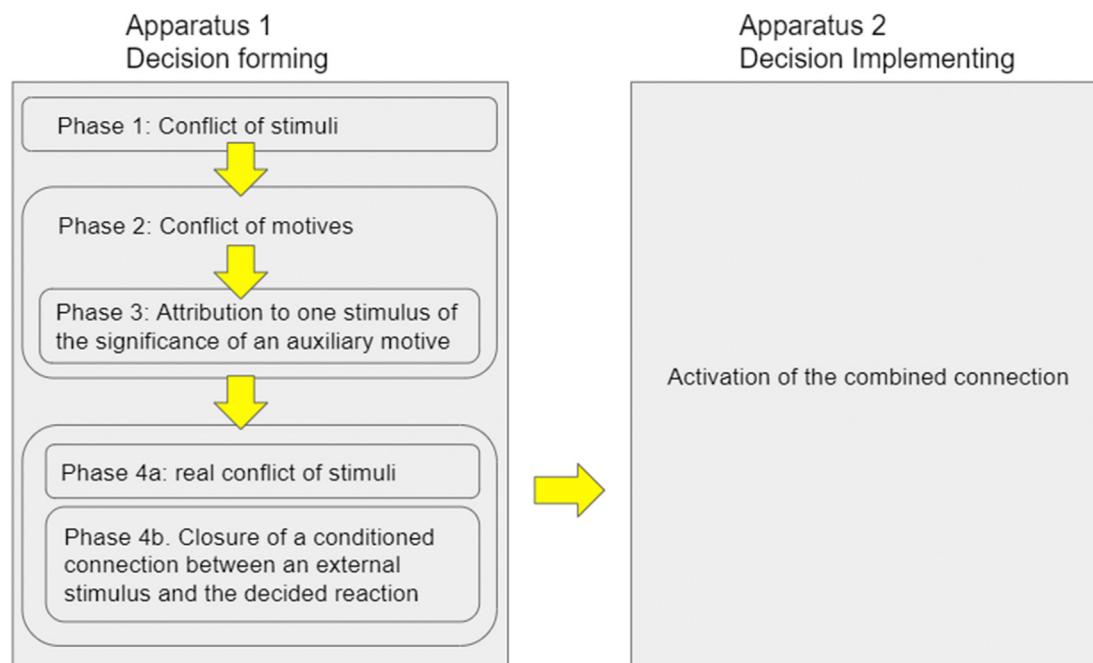


Fig. 1. The model of double stimulation (adapted from Sannino, 2015b).

Virkkunen & Newnham, 2013). For Engeström (2007) double stimulation is the base of formative interventions in the workplace, and it is double stimulation that makes these interventions radically different from design experiments since through this principle the participants develop expansive forms of agency. Engeström, Sannino and Virkkunen (2014) suggest that double stimulation is used methodically in the Change Laboratory to look for conflicts of motives experienced by the participants and to find possible second stimuli to support or to sustain the emergence of agency. Concerning the first stimulus in the Change Laboratory, this “is represented by the mirror in which a challenging problem or disturbance is presented by means of experientially powerful examples, often on video. The first stimulus needs to be acknowledged and articulated by the participants” (Engeström, 2007, p. 373). Concerning the second stimulus, the researcher “can provide concepts that the practitioners can use as instruments for analysing the mirror data” (Virkkunen & Newnham, 2013, p. 49). Initially, this could be a general model with a general and purposeful structure, which the participants can fill with contents corresponding to the assessment they made of the situation (Engeström, 2007). However, during the intervention the participants tend to leave the models presented by the researcher and progressively devise new ones as needed (Engeström, 2011). An analysis of the sessions facilitates the identification of the first and second stimuli that the participants developed during the sessions, as in Engeström (1987/2015) and in Sannino, Engeström, & Iemos (2016).

3. Methodology and methods

This section will firstly operationalise Sannino (2015a) model of double stimulation (Fig. 1) and secondly adapt it to a specific Change Laboratory intervention, with the aim of identifying occurrences of double stimulation at the conversation level within an intervention of 11 sessions, which were recorded and later fully transcribed. The Change Laboratory was facilitated as in-service training for teachers in an Italian secondary vocational institute. The first author facilitated the intervention with eight sessions from February to April 2016, one follow-up session in May, and two follow up sessions the following school year to monitor the progress of the new practice devised during the sessions. At the beginning the participants were fourteen teachers and workshop assistants. While they developed the new practice more teachers and workshop assistants joined in to implement the new practice in two fifth grade classes. The problematic situation that they set to tackle was the dramatic decrease of students in the surveying course which had passed from 104 enrolments in 2008 to 26 enrolments in 2016 (Morselli, 2019).

We maintained that, while Vygotsky's work focused on individual action, double stimulation applied to Change Laboratory as “longstanding cooperative activity is a more complex and time-consuming process that involves chains of double stimulation” (Virkkunen & Newnham, 2013, p. 48). Consequently, we chose the Change Laboratory sessions as unit of analysis, while we searched for the diverse instances of double stimulation distributed across the sessions and the speaking turns of the participants. In order to focus the analysis, we firstly identified the first and second stimuli of the overall Change Laboratory, thus following the analysis of Sannino et al. (2016) and Sannino & Engeström, 2016. The first stimulus was the constant decrease of students enrolled in the surveying course over the past ten years, which is summarised by Design Teacher 1 (originally in Italian, translated into English):

We came from a tradition where we had four Grade 1 classes, sometimes even five. From five Grade 1 classes we have arrived

at a situation where we will have perhaps two Grade 1 classes next year, while this year and the year before we had only one. As such there has been a dramatic drop of enrolments.

(Session 1, speaking turn 7).

Hence, the first stimulus was built progressively during the sessions as an awareness of the causes that had led to the disappearance of the students, a fact that threatened the existence of the surveying course and the jobs of the participants. The second stimulus was developed collectively and progressively as an interdisciplinary project. A comprehensive description of it is given by the land valuation teacher:

Here (in my project proposal) I suggested to resume the old multidisciplinary of project I used (many years ago) both in Agronomy and here (in Surveying) [...] I propose to have 3 h (on week basis) together, but we could do it in a different way, for example 2 h of Design and 1 h of Land Valuation ... in any case together and with a session assistant as coordinator. [...] I put as content the building renewal, but it could be something different, we must decide that together, here (and now) with architects and engineers ... you can see knowledge, competences, contents, and where the various disciplines come into play. [...] A building to be renewed, in 3 (weekly) hours, here we should also change our teaching timetable, which won't be easy, to carry out this project where each teacher intervenes in their (respective) subjects coordinated by the session assistant, and each evaluates their part (according) to their discipline, this is my proposal. For my part, this is my proposal that I wrote in half an hour. As I see it, now we must proceed to develop a very concrete proposal. (Session 6, speaking turn 175).

This interdisciplinary project crossing not only vocational subjects, but also general education subjects, would be employed to advertise the course through students and parents' word of mouth as well as school open days. The participants implemented the interdisciplinary project during the school year 2016/2017, and they refined it the following year, thus contributing to raise the enrolments from 26 students in 2016 to 37 in 2018.

The analysis applied Author's model to the transcripts. Vygotsky named Apparatus 1 as the design phase, and Apparatus 2 the execution phase (Engeström, 2007; Sannino, 2015b). As such, we assumed that in the Change Laboratory Apparatus 1 would correspond to the sessions, while Apparatus 2 would correspond to implementing the new practice in between and after the follow-up sessions. Hence, apparatus 2 was represented by the execution of the interdisciplinary project. The analysis then focused on Apparatus 1 since the transcripts could serve to trace the four phases. Another reason for focusing on Apparatus 1 is that while the construction of the mediating artefact is done often painstakingly, and therefore is of great interest, the execution phase “typically looks quite easy and almost automatic, much like a conditioned reflex” (Engeström, 2007, p. 366).

We coded the four different phases of Apparatus 1 and applied to the Change Laboratory data the following discursive analytical categories, corresponding to the phases of the model: conflict of stimuli, conflict of motives, auxiliary stimuli, and closure.

1) Conflict of stimuli. This indicates a clash between stimuli that highlights a challenge. A conflict of stimuli happens when a participant expresses a problematic issue related to the first stimulus, the problem that collectively is discussed and elaborated upon. In this case a conflict of stimuli was related to the fall of enrolments, hence issues such as problems with the students,

with colleagues, problems in the course or in the school. Examples of conflict of stimuli in the transcripts are recorded in the table below (translated into English).

Quotation	Session	Speaking turn
I will be brief, I think that the cause (for the drop of new enrolments) is the progressive lowering of our educational standards. Over time we have made our subjects easier, thinking to comply with the students' will. Instead, I think that families call for an education to be strict and demanding. In other schools that fail students more, there is better compliance with the rules and more new enrolments. (In sum) <u>I believe that we have lowered the bar too much.</u>	1	55
When I returned (after years of teaching in another institute) I did feel uncomfortable. I felt uncomfortable because of the changed attitude of the people I knew before leaving. And the overall climate changed as well. I found a situation much more static (without personal initiative) compared with the other institute (where I was working), very very much ...	2	585
I work with 6 different teachers who have with 6 mindsets. 6 Having to deal with an interdisciplinary project with 6 different people is not an easy thing.	6	64
Wait 1 s. You talked about compatibility of our interdisciplinary project with the Land Registry. Have you actually checked this?	8	25

The first transcript from Design Teacher 2 evidences a conflict of stimuli between what they do in their school and what the other schools do. The second transcription from the Humanities Teacher evidences a conflict of stimuli in the cooperation among teaching staff before she left and after her return. The third transcript from the workshop assistant evidences the different stimuli that comes from six different teachers when working on a common project, which would cause inevitable conflicts. The fourth quote manifests a problem related to the area where the building should be designed. Thus, conflict in this example is between how this area is expected to be and how it is at the Land Registry.

2) Conflict of motives. Defined by a participant or the experimenter, it points out a conflict between opposing aspirations or tendencies, spacing from double binds to dilemmas (Engeström, 2011; Engeström & Sannino, 2011). The following are examples of such occurrences:

Quotation	Session	Speaking turn
Our problem was what do we do now and what is our role? 1 What type of students do we train? What will they do after the end of their study? They cannot do anything, they cannot do this, they cannot do that. I think that these dilemmas have conditioned us in a negative way.	1	78
We are aware that our students will find a job, and we knew 5 already the things that the experts of the industry told us. (My wonder is) how we can have the world understand that, even though there is the crisis in the building sector, the technician that we train is still essential (for the industry)?	5	69
It is clear that the students' group work is useful only when 11 each component does their job and then shares with the other components, so they all share responsibilities. This has been done, and yet I do not know how I could have done it differently (better).	11	83

The first transcript from the Humanities Teacher reveals the dilemma of the teachers in surveying who, after the school reform 2008, did not know the professional that they were training. The conflict of motives is between training for the professional in the old way or the new way. In the second transcription, Topography Teacher 1 wonders how to make the people in the outer world knowing that surveying is still a good job but does not know how to do it. In the third quote Design Teacher 1 had to use group work strategies such as didactics to deliver the interdisciplinary project, but at the same time he was not able to make such didactics effective. Here, the conflict of motives is therefore between teachers having to use a new teaching method and their not knowing how to use it.

3) Auxiliary stimuli. These refer to stimuli which acquire the function of an auxiliary motive potentially able to transcend the conflict of motives. In our data a participant may propose an idea or concept related to the development of the 2nd stimulus, the interdisciplinary project, as in the following examples.

Quotation	Session	Speaking turn
I think that the method of the interdisciplinary project, 4 which we did many years ago, and regrettably do not do anymore, could be an instrument that allows students to have an overall perspective (on surveying).	4	223
Yes, but with the interdisciplinary project we can show we 6 (the teachers) are working all together and that the students are able to synthesize all that they know (about surveying). We carry a project out and we show it when we present our course (in the open days). We can concretise something on the traditional topics, and this allows us to work within the curriculum because the students summarise what they have studied during the 5 years. This is already one thing, but the fact that we would like our students to become experts of energy insulation, (I see this as a big problem, because) there is a gigantic work that traces back to physics ...	6	415
Of course. The students work in groups to perform the field 5 survey, so that they all survey the whole field, that is they survey (portions of territory) in groups and then all the surveys are put together.	5	105

In the first transcript Design Teacher 1 regrets having given up the interdisciplinary project years before, which was useful to help students connect the diverse technical subjects. The participants have not decided yet to implement the following school year, but some of them already start thinking of it. Hence, an interdisciplinary project could become a meaningful auxiliary motive for the building of the second stimulus. The second transcription by the Topography teacher presents the interdisciplinary project as a possible solution to the problem identified during the discussion, that is to show the rest of the world that they can indeed cooperate and to attract new enrolments for examples in the open days. The third quote from the same teacher displays a detailed planning behind the delivery of the interdisciplinary project to make it effective.

4) Closure. This eventuates when a participant details, often in term of time, the implementation of the second stimulus. Details on the execution include: receiving the approval of school

councils, timing and coordination of the project, who to involve, the role of each participant, and what to do.

Quotation	Session	Speaking turn
We (the teachers) organise the timeline of the project so that it starts with topography, then design, and then land valuation, and you (the session technicians) will manage it. Since you are temporary, during the summer we (the teachers) will plan a project that you (the session technicians) will deliver in during the school year, for 3 h each week.	6	225
In any case we must go to the school director with clear ideas, (and propose her to start the school year with) only one workshop assistant per fifth grade class.	7	226
If we want to start straight away (at the beginning of the next school year) perhaps it is better that we make decisions now.	8	120

The first transcript from the topography teacher organises the timeline of the interdisciplinary project and the sequence of teachers who will work on it. At the same time, it testifies to the fears of a Technical Teacher who is opposing being one of the project’s coordinators. This quotation shows thus the multi-voicedness inside the session, how agreement and coordination is difficult to reach even though the participants agreed that the multidisciplinary project will be carried out. The second transcription is about Design Teacher 1 who points out the importance of going to the school director with a clear request to have the project run smoothly. The third quote from the land valuation teacher solicits making decisions to start the interdisciplinary project without delays.

This analysis uses mixed methods combining qualitative and quantitative methods, with an explorative design (Ponce & Pagán-Maldonado, 2015). The anonymised transcript of the whole intervention is available on Zenodo at <https://zenodo.org/record/838015#.XHf1loj0mM8> in Italian. It comprises 6967 speaking turns which the analysis inspected conforming to the four phases of Apparatus 1. The coding followed the principles for the analysis of qualitative data as suggested by Ravitch and Carl (2015) and Merriam (2009). We firstly read and annotated the transcripts numerous times, with the goal of identifying the four phases as well as their relationship with the model. Following the coding of the data, for each phase we counted the number of occurrences. Regarding the trustworthiness of this qualitative study (Ravitch and Carl, 2019), the verbatim transcription and the coding was performed by the researcher who facilitated the Change Laboratory, and consequently had intimate acquaintance with the outcomes of the intervention and the data. The four phases were first discussed with the second Author of this article, who contributed to the design of this specific Change Laboratory intervention, and Anna Maria Ajello, one of the two supervisors of the intervention, and an expert of CHAT.

4. Results

What follows are descriptive statistics of the data. Rather than looking for causations we searched for possible trends by combining qualitative data with quantitative data and sought to relate findings to theory (Ponce & Pagán-Maldonado, 2015). The explorative analysis considered that the first eight sessions served

to design the interdisciplinary project, and the latest three were a follow up. The latest two sessions were held at the same time when the interdisciplinary project was being implemented, while the seventh session was not a proper session, but a technical teacher council in which the teachers approved officially the delivery of the interdisciplinary project the following school year. At the same time, we decided to include it as a Change Laboratory because it had roughly the same participants, who not only approved but also discussed and improved the interdisciplinary project.

Our explorative analysis revealed that only 18% of the overall speaking turns accounted for instances of Apparatus 1: 8% for Phase 1, 2% for Phase 2, 7% for Phase 3, and 1% for Phase 4. Table 1 summarises the number of occurrences for each of the phases in the 11 Change Laboratory sessions.

The first finding concerns Phase 1 entailing a conflict of stimuli. We found a qualitative variation from the sixth session: while from the first to the fifth session the conflict of stimuli deals with the challenge that had to be tackled, from the sixth session onward, it concerns the problems to be overcome in order to make the interdisciplinary project work. It seems that conflicts of stimuli characterise the whole intervention but the nature of this conflict changes as the intervention evolved. If in the first block of sessions, the participants discuss the problems related to the present situation, in the second block they discuss the problems that arise while the solution is designed and implemented. In other words, the conflict of stimuli related to the first block of sessions concern the construction of the first stimulus of the overall Change Laboratory, which is a shared awareness of the problem to be tackled. In contrast, the conflict of stimuli of the second block of sessions concern the second stimulus of the overall Change Laboratory, that is the new idea that should tackle the problem.

Concerning Phase 2, we only found few conflicts of motives throughout the sessions compared to the overall number of speaking turns. However, there appears to be a quantitative and qualitative difference between the first block of sessions (until the sixth) and the second block. While in the first block the conflict of motives are related to the building of an awareness of the problem to be tackled (first stimulus of the overall Change Laboratory), in the second part the conflicts of motives drop in number and are related to the interdisciplinary projects (2nd stimulus of the overall Change Laboratory). During the initial sessions, the participants analyse the recurring problems related to their activity system (Engeström & Sannino, 2011) and build a shared comprehension of the basic contradiction that pervades their activity. This questioning of the status quo is not only a distanced and intellectual critique, but also includes an emotional confrontation with the experienced problems (Virkkunen & Newnham, 2013). The concentration of conflict of motives at the beginning of the intervention could thus be related to this analysis requiring both intellectual distance and emotional involvement.

About Phase 3 entailing the auxiliary motive, in the first block of sessions only the fourth session has instances of the auxiliary stimuli, when the idea of interdisciplinarity is proposed and immediately discarded. In relation to the second block of sessions (from the sixth session), ideas around the interdisciplinarity are constantly proposed, with a peak in the seventh session (167 instances). Meanwhile, in the 4th phase of closure, instances of this phase appear only in the second block of sessions, as it could be expected. However, most of the speaking turns dealing with this phase are at the beginning of the block, during the sixth and seventh sessions. Most of the decisions on the interdisciplinary project are taken during these sessions.

Table 1
Number of occurrences of the four phases of Apparatus 1.

Session	1	2	3	4	5	6	7	8	9	10	11
Phase 1	82	35	110	46	87	21	66	23	19	23	35
Phase 2	31	25	8	4	29	12	3	1	7	4	9
Phase 3	0	0	0	12	0	74	167	35	82	60	64
Phase 4	0	0	0	0	0	34	38	5	11	6	5
Total speaking turns	612	869	1105	365	596	705	949	305	487	504	466

5. Discussion and conclusions

Researches on double stimulation have provided an improved comprehension of agency not only as lived experience, but also as a theoretical construct (Thorne, 2015). This explorative study sought to apply the model of double stimulation (2015b) at the interactions level of a specific Change Laboratory with vocational teachers. It found the first and the second stimulus at the level of the overall intervention, before focusing specifically on the four phases of Apparatus 1. The analysis combined qualitative data (examples of speaking turns) with quantitative data (number of occurrences). It found that the four phases of Apparatus 1 in the Change Laboratory did not follow the double stimulation model in a strict order, nor did they become concentrated in single sessions. Similarly to Engeström et al. (2015) and Hopwood and Gottschalk (2017) who studied double stimulation in mundane activities, we found that the four phases of Apparatus 1 are distributed across the sessions. In line with Virkkunen and Newnham (2013), a possible explanation for this is the presence of different layers or levels of double stimulation. It could be hypothesised that double stimulation operates from the level of conversation to other levels while the participants begin to cooperate and build a common awareness of the first stimulus. While this paper considers the two most “extreme” levels, namely the level of conversations and the level of the overall intervention, others may emerge in further investigations.

We argue that the model of double stimulation is useful to analyse the Change Laboratory to find possible patterns of agency formation. Our analysis reveals quantitative and qualitative differences of the four phases between the first block and the second block of sessions, with the sixth session acting as a boundary. In the first block of sessions the teachers discussed the problems they were facing (first stimulus of the overall intervention), while from the sixth session they constructed a shared interdisciplinary project (second stimulus of the overall intervention). The four phases of double stimulation of Apparatus 1 change accordingly with the first or second stimuli of the overall intervention. In the first block of sessions the participants deal with the first stimulus, while in the second block they deal with the second stimulus. Quantitative differences follow, with Phase 1 and Phase 2 of Apparatus 1 distributed across the whole intervention, while Phase 3 and Phase 4 characterise the second block of sessions. We can thereby confirm the importance of double stimulation to structure Change Laboratory interventions as Engeström (2007; 2011) suggested. In this specific intervention the building of the first stimulus characterised the first block of sessions, and the building of the second stimulus marked the second block of sessions.

We think that the unicity of this article consists of taking an approach to agency beyond the mere description of the relationship between agency and identity, towards studying agency through an intention to uncover its dynamics and development. Vygotsky himself was cautious about the right unit of analysis that preserved the whole of the phenomenon. We contend that at the level of interactions, this analysis of the double stimulation model is still preserved. Future studies and analysis of other formative

interventions will have to be conducted in order to confirm this explorative analysis. While we concentrated on the Change Laboratory sessions, it could be interesting to extend the analysis through participant observation between and after the sessions, when the teachers implement the new practice “in vivo”.

CRedit authorship contribution statement

Daniele Morselli: Conceptualization, Methodology, Formal analysis, Writing - original draft, Visualization, Data curation, Investigation. **Annalisa Sannino:** Conceptualization, Validation, Writing - review & editing, Supervision.

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