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Charlotte Barbier, Eric Bruillard

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Media from Multiple Perspectives:  
Analysing the Texts, Studying their Use,  
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## **New resources creating tensions in teachers' activity: The case of the Education Through Research model and the Student-Researcher Digital Notebook**

**Charlotte Barbier**

*University of Paris, Paris, France • barbier.charlotte@live.fr*

**Eric Bruillard**

*University of Paris, Paris, France • eric.bruillard@parisdescartes.fr*

### **Abstract**

This article focuses on the tensions created in teachers' activity by the uses of a symbolic instrument – an inquiry-based method called the Education Through Research model – and a digital one – the Student-Researcher Digital Notebook, designed to implement the model. Our research was guided by the following questions: How did teachers use these instruments to conduct their own class project and achieve their learning objectives? What kind of contradictions did the introduction of these resources lead to, and how did teachers try to overcome them? We collected data on the instruments and their uses through document analysis, interviews with the teachers as well as observations carried out in the classrooms. We analyzed data using Engeström's activity theory framework (1987) in order to understand the contradictions within teachers' activity created by the introduction of each instrument. Our main results indicate that both the ETR model and the SRDN first tend to disturb teachers' activity but then allow them to either carry out and change their practices or legitimate their pre-existing practices.

### **Keywords**

Educational resources, science education, digital tool, inquiry-based learning

### **Research context: creating a digital tool to implement an inquiry-based approach**

#### ***Les Savanturiers and their Education Through Research model***

Les Savanturiers is a French science education program created in 2013 by a former elementary school teacher which aims to help and support the implementation of science projects in elementary and secondary schools by teachers. Each project lasts 10–15 weeks and is mentored by a researcher (Carosin & Demeuse, 2018; Les Savanturiers, 2016, 2018). Teachers are encouraged to follow a specific inquiry-

based approach – created by Les Savanturiers – called the Education Through Research (ETR) model, which notably includes the following eight steps:

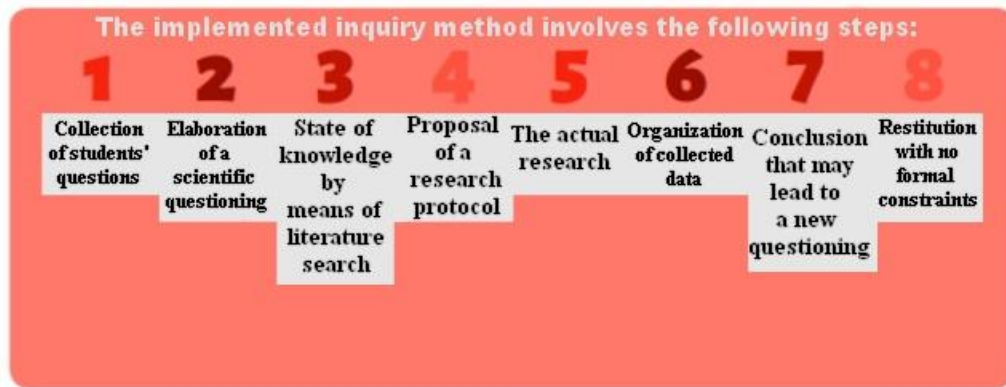


Figure 4: Diagram of the 8-step model (Les Savanturiers, 2016)

This differs from other inquiry-based approaches (Calmettes, 2012) by starting directly with the collection of students' questions without presenting a problem or situation beforehand and by not included the elaboration of hypothesis explicitly in the model. The ETR model is also flexible, as it encompasses a wide range of different ideas and concepts, such as having experts mentoring class projects, promoting collaboration among students, fostering creativity and critical thinking skills, trying to adopt the attitude of a researcher, or following the eight steps. Teachers are thus encouraged to adapt elements of this approach to their own practice.

In order to instrument the ETR model, a digital tool was designed.

### ***Designing the Student-Researcher Digital Notebook (SRDN)***

In 2016, Les Savanturiers answered a call for proposals<sup>40</sup> to design an inquiry-based learning environment to implement teachers' projects in the classroom (Caisse des dépôts et Consignations, 2016b). Working in a consortium involving researchers, regional education authorities, teachers and educational software developers, they designed a digital tool called the Student-Researcher Digital Notebook (SRDN).

The SRDN was conceived to structure an inquiry-based approach, enabling students to work collaboratively and allowing teachers to use only some functionalities that they consider appropriate for their project (Cisel, 2018). The SRDN is a web application composed of several modules that can be used independently of one another. It contains a brainstorming module to write proposals and categorize them, a document storage and sharing module, a form module where teachers can send questions to

<sup>40</sup> The e-FRAN call for proposals was launched by the French Ministry of Education to promote the design of educational digital tools by consortia comprised of various private and public (Caisse des dépôts et Consignations, 2016a; Cisel et al., 2017)

students and a research follow-up space designed to enable students to produce structured writings by following a step-by-step process. Two paths are offered: the researcher path – which includes the following sections: question, hypothesis, protocol, data, results – and the engineer path – containing the following: technical problem, technical solution, protocol, results and conclusion.

The research follow-up space contains a “research sheet” that any student belonging to the same group can modify and where teachers can add comments, validate or close each section. This part of the SRDN also contains a module called the “research draft” that is individual and where students can access several scaffoldings (Bruner, 1983) to improve their own writings.

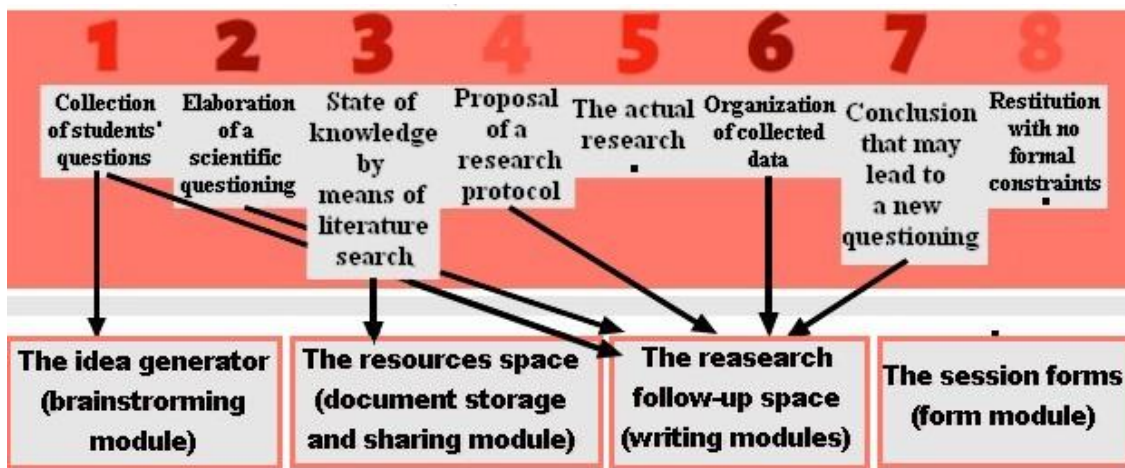


Figure 5 The links between the 8 steps model and the SRDN modules

When comparing the 8-step model and the SRDN, we notice that some steps can be implemented through several modules, whereas some elements are missing in the digital tool: notably, no space is dedicated to the mentor. Also, some elements, such as the engineer path, can be found in the application but not the model.

Thus, the ETR model and the SRDN only partially match each other and the discrepancies between the instruments can be a source of tension. This begs the questions: how did teachers use these resources and what kind of difficulties did they encounter?

## Framework and research question

We studied the uses of the ETR model and the SRDN through Engeström’s activity theory framework (1987). According to this theory, activity is considered in a systemic way, as a whole composed of several interconnected elements (Engeström, 2011): the subject of the activity, its object, the instruments used, the community engaged in this activity, its division of labor and the rules regulating the activity.

Activity systems are dynamic since they contain internal tensions, called contradictions, which are a source of change because subjects will try to overcome them. Engeström argues that four levels of

contradiction exist in activity systems: primary contradictions, resulting from a tension within a component of the system; secondary contradictions, arising when two different components conflict with one another; tertiary contradictions, occurring when tension arises between new and old elements of an activity system; and quaternary contradictions, stemming from conflicts between different activity systems.

As instruments within a teacher's activity system, the introduction of the ETR model and/or the SRDN may lead to various contradictions. Since the ETR model and the SRDN are both adaptable resources and the French education system allows teachers significant pedagogical freedom, a multiplicity of uses are possible. Therefore, our research was guided by the following questions: how did teachers use these instruments to conduct their own class project and achieve their learning objectives? What kind of contradictions did the introduction of these resources lead to, and how did teachers try to overcome them?

To answer these questions, we collected various data on several class projects following the ETR model and implemented by the SRDN.

## Methodology

We used a combination of qualitative methods (Van Campenhoudt et al., 2017) to collect data about the instruments and their uses by teachers.

First, we carried out a document analysis (Bowen, 2009) about the ETR model, the design of the SRDN as well as the links and discrepancies between the two instruments. The corpus of documents included the pages of the Savanturiers' website, the *vademecum* and guides created by the programme, and the application itself.

To get an overview of the various contexts in which the SRDN was being tested, we visited eight different classrooms and noticed how varied their situations were. Concerning the educational context, some schools were comprised of academically successful students while others were struggling schools. The grade levels were varied too: the youngest students were in primary school (age 7) and the oldest were in higher education (age 19). Class projects were quite different too, in the subjects and in the pedagogical objectives set by teachers.

We then selected four projects based on a variety of criteria – context, grade level, type of project – and implemented a longitudinal follow-up based on observations of these four classes, representing more than 30 hours of observation. This enabled us to get information about the projects' proceedings, the activities carried out, the resources used, the modules of the SRDN used, and the difficulties encountered.

After each session, we talked with the teachers to find out more about their perception of the instruments. We also carried out seven semi-structured interviews with teachers, with an average duration of 50 minutes, to find out more about their motivations for taking part in the project, their pedagogical objectives and their uses of the SRDN outside the classroom, mainly to prepare their lessons. The qualitative material thereby collected enabled us to get numerous data about the uses of the instruments, the context of use, and the purpose for which they were used (Cisel et al., 2019).

### Results: tensions in teachers' activity and partial appropriations

We use the term “tension” to refer to various kind of difficulties encountered by teachers, going from simple software malfunctions to contradictions, in the sense of Engeström's theory.

#### *User tests, an example of one activity system*

In the context of the research project surrounding the design of the SRDN, the uses of the application by teachers and students in their class were user tests. From the point of view of teachers, we can model the user tests according to the following activity system:

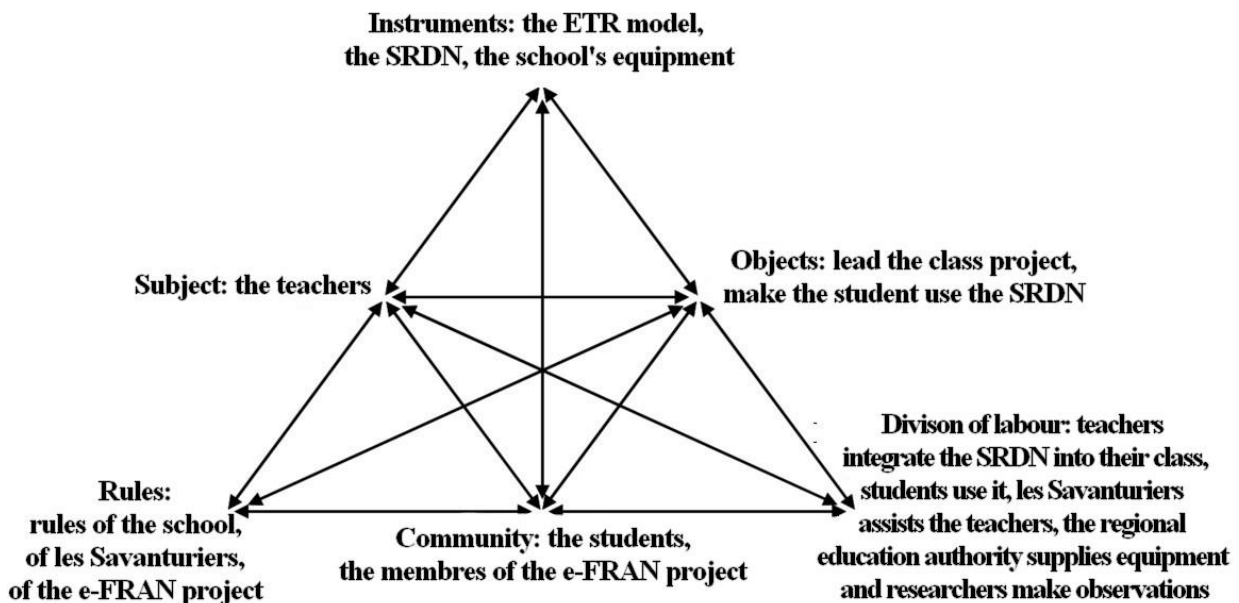


Figure 6 The user tests activity system

This model helps us visualize the elements of the activity and how they can lead to contradictions. We first noticed a primary contradiction in the object of the activity: teachers were torn between leading their project and using the SRDN to help designers identify bugs, creating situations where the application was used without any pedagogical objectives. Another primary contradiction was identified within the instrument node: to use the application, computers or tablets with Internet access are necessary, yet most



schools encountered connectivity issues. To overcome this contradiction, some teachers came up with a circumvention scheme, like sharing a smartphone connection or relying on the regional education authority to supply additional equipment such as hotspots. Others had a backup plan that did not involve using the SRDN.

This kind of difficulty reflects the need for schools to have reliable computer infrastructure for teachers to be able to use online resources like the SRDN. Because of this, the SRDN sometimes had a disrupting role in teacher and class activity.

Another source of difficulties was that the SRDN was still a prototype at the time of the research and had technical problems. The SRDN creation timeline did not match with the school calendar.

The design also took longer than initially planned. Therefore, the SRDN was not finished when schools tested it and still had several bugs, which had repercussions on class activities. We can analyze this as a form of quaternary contradiction between the teachers' activity system and the consortium's activity system for developing the application.

Using this method of analysis, we got several research results regarding the contradictions induced by the use of the SRDN and the ETR model. In the following section we present a synthesis of our main results.

### ***New instruments creating tensions***

We noticed that the SRDN did not replace the other resources that teachers usually used, like blank sheets and photocopies, and we witnessed a hybridization between paper resources and digital resources. For example, in most classes, students would write down their proposition in their notebook and then write them a second time in the SRDN. Consequently, using the SRDN meant adding another instrument to the activity, which does not necessarily lead to a contradiction but complicates the activity. Moreover, as the application contains numerous functionalities, navigation could be complicated and when no time was dedicated to showing the class how to use the instrument, students would incessantly call their teacher for help. This can be seen as a secondary contradiction between the students – who are part of the community of teachers' activity – and the SRDN, an instrument. The application is ill-suited for struggling students and even for independent students, and getting familiar with it requires substantial time, which is therefore dedicated to learning how to use the SRDN instead of engaging in other learning activities.

Apparently, no class used the SRDN to keep records of data or results analysis. One reason for this is a secondary contradiction between the instrument and the rules of the activity – the duration of the projects and the school calendar. Typing on a computer or tablet can be quite time-consuming for young students and, as not much time is left at the end of projects, teachers prefer students to write on paper instead.



The scaffoldings of the research draft were also rarely used, due to another secondary contradiction between the instrument and the subject – the teachers – as their pedagogical objectives did not match the purpose of the scaffoldings. Primary school teachers mentioned that it is too ambitious to teach young students about scientific reasoning. Secondary school teachers explained that they did not have enough teaching time to focus on scientific arguments.

Through our study of the instrumented projects, we also got a better understanding of the way teachers perceive the ETR model and how it was implemented. It is the use of a digital resource that helped us understand the use of the symbolic resource and its contradictions.

Surprisingly, no class exactly followed the 8-step model in their project. Teachers would add new steps or skip some. For example, one teacher imposed the research question, while another added an activity before collecting students' questions to trigger their questioning. When we interviewed teachers, we realized most of them barely knew what the eight steps were, and had different conceptions of what the ETR model encompasses. For some, it essentially meant stimulating students' questioning, while for others it was about formulating hypotheses and conducting experiments. Confronted with the heterogeneous nature of teachers' conceptions of the ETR model, it seems difficult to talk about appropriations of the model as whole.

We can interrogate the reasons why the model is not implemented as a whole in the classroom in its current form. And it appears that the current ETR model, instead of facilitating teachers' activity, tends to disturb it when the 8-step model is followed, because it contains various internal contradictions.

The first contradiction is due to the contrast of the approach of the model and the non-directivity principle, which states that teachers are free to modify elements as they wish. This creates a primary contradiction within this symbolic instrument: if teachers can change several parts of the model and still call it the ETR model, then the model has no core and anyone can develop their own conception of this symbolic instrument. This gives the impression that teachers are using the same resources when sometimes they are not.

The other contradictions are mainly secondary contradictions.

Teachers did not receive any training on how to implement the ETR model and therefore developed confused conceptions of what the ETR model is supposed to be, which can be seen as a contradiction between subject – the teachers – and the instrument. The model also conflicts with the community node – the students – at two stages: the first step of the projects is supposed to be the collections of students' questions, but this assumes that students already have questions on the topic before starting the project, which is rarely the case. When implemented as it is, as we have observed, students simply do not know what to say or write. Most teachers overcame this contradiction by presenting a problem or trigger

situation to foster students' questioning before collecting their questions. The other difficult moment is the literature search, because this can be quite complicated and time-consuming for students to search for relevant information. To overcome this contradiction, some teachers selected documents themselves and gave them to their students instead of doing a real literature search. Others put the literature search at the center of their project and made students use this search to answer their questions instead of setting up experiments.

Another secondary contradiction arose between the community – the mentor – and the subject – the teachers. The mentor role is not clearly defined in the ETR model and so their implications varied from one project to another, sometimes disturbing the activity of teachers who were expecting them to be more involved, to propose activities and so on.

These tensions highlight the flaws in the ETR model and why some changes were necessary for this symbolic instrument to be used in the classroom.

Despite these contradictions, teachers managed to use both instruments to lead their projects, revealing the benefits they can offer.

### ***Some benefits and appropriations***

The SRDN was mostly used during the first steps of the projects and for specific purposes: to collect students' ideas or questions, to save documents found online and for the teacher to share documents with the whole class. Several teachers also used the SRDN to instrument the formulation of research questions, hypothesis and protocols. These uses were intended and expected. We also witnessed some diversions from the SRDN: for example, one teacher used the brainstorming module to work on students' grammar mistakes in their question formulation. As this kind of use was not intended when the application was designed, this reflects the personal use of the teachers. During interviews, these teachers explained that they had decided on their pedagogical objectives beforehand and adapted the instrument to try and achieve them. Therefore, we can consider that these diversions are a sign of appropriation.

Several teachers considered that one of the advantages of the application is to facilitate class management since it gathers various tools together and allows them to see and comment quickly on students' writings, synchronously or asynchronously. These benefits are not specific to the SRDN and can be found in other digital tools. On the contrary, the advantages of the research sheet are more specific: teachers praised this module for enabling them and their students to visualize their progress in their projects and for structuring students' approach while keeping clean and organized tracks of the work done.

Regarding the ETR model, we noticed adaptations of elements drawn from the model. For instance, one primary school teacher made his students write blog posts about their project because one element

mentioned in the ETR model is communicating about one's research. The vague nature of the model enables flexibility, which some teachers take advantage of to innovate in their classroom and create new activities.

During interviews, some teachers said they had joined the Savanturiers to change their practices, and the introduction of the ETR model helped them achieve that goal when they managed to overcome the induced contradictions. Other teachers enrolled in the program because they already had a project idea and were looking for a recognized framework to work in. In this case, the resource did not change their activity and teachers relied on the flexible aspect of the ETR model to adapt it to their own existing practices.

## Conclusion

The introduction of the instruments did not modify teachers' pedagogical objectives, but it changed the way they tried to achieve them. These changes were different for each teacher, depending on their usual personal teaching methods. For most primary school teachers, the biggest change was using digital tools with their students and making them write using tablets or computers. To other teachers, the challenge was to make their students search for information instead of giving it to them right away.

As far as the ETR model is concerned, our research underlines that ill-defined models lead to tensions in subjects' activity and create difficulties for those who wish to appropriate them. Nevertheless, concurrently, the open and flexible nature of the ETR model enables the Savanturiers program to recruit very different teachers and give them a formally recognized space to develop innovative projects, try new practices, or legitimize their existing practices.

The design and use of the SRDN helped us reveal tensions in the ETR model that were inconspicuous until then. Most of the adaptations of the model that teachers made in their classrooms could not be translated in the SRDN. Therefore, we saw how the reification of a flexible model in a more rigid resource lead to various contradictions, which impacted teachers' activity.

Regarding the SRDN, the observed uses were coherent with the consortium's intentions. However, a significant part of the application's benefits was not specific to this instrument, which questions its relevance compared to other digital tools that teachers are already familiar with. Moreover, the mastery of the SRDN requires a lot of time, which can be an obstacle to its appropriation by teachers and students. These aspects should be considered when designing new educational tools or when choosing an existing instrument for the classroom.

At the start of the 2019 school year, the SRDN was made available to all teachers outside of the Savanturiers program. This raises the question of the new uses or diversions that will be made and opens

up new research perspectives. Another possible continuation of this research could be to study the training courses and materials created by Les Savanturiers and see how taking part in this training influences teacher's teaching methods and objectives.

## References

- Bowen, G. A.** (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27-40. <https://doi.org/10.3316/QRJ0902027>
- Bruner, J.** (1983). *Child's talk. Learning to use language*. Oxford University Press.
- Caisse des dépôts et Consignations.** (2016a). *Appel à projets e-FRAN*.  
[https://www.caissedesdepots.fr/sites/default/files/medias/pia/appel\\_a\\_projets\\_e-fran.pdf](https://www.caissedesdepots.fr/sites/default/files/medias/pia/appel_a_projets_e-fran.pdf)
- Caisse des dépôts et Consignations.** (2016b). *Les Savanturiers du Numérique*.  
[https://www.caissedesdepots.fr/sites/default/files/medias/projet\\_13\\_dp\\_cdc.pdf](https://www.caissedesdepots.fr/sites/default/files/medias/projet_13_dp_cdc.pdf)
- Calmettes, B.** (2012). *Didactique des sciences et démarche d'investigation—Références, représentation, pratiques et formation*. L'Harmattan.
- Carosin, E., & Demeuse, M.** (2018). *Les Savanturiers—Rapport d'évaluation final* (p. 110). [https://les-savanturiers.cri-paris.org/wp-content/uploads/2018/11/recherche\\_rapport-vf.pdf](https://les-savanturiers.cri-paris.org/wp-content/uploads/2018/11/recherche_rapport-vf.pdf)
- Cisel, M.** (2018). Développer l'éducation par la recherche avec un carnet numérique. *The Conversation*.  
<http://theconversation.com/developper-leducation-par-la-recherche-avec-un-carnet-numerique-94683>
- Cisel, M., Barbier, C., & Baron, G.-L.** (2019). *Rapport scientifique de synthèse de la recherche Cahier numérique de l'élève chercheur (CNEC)* [Research Report]. Université Paris Descartes (Paris 5).  
<https://hal.archives-ouvertes.fr/hal-02278348>
- Cisel, M., Beauné, A., Voulgre, E., Bernard, F.-X., & Baron, G. L.** (2017). Analyse d'un outil de décision utilisé dans la conception d'un EIAH. *Environnements Informatiques pour l'Apprentissage Humain*. <https://hal.archives-ouvertes.fr/hal-01634157>
- Engeström, Y.** (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Orienta-Konsultit Oy.
- Engeström, Y.** (2011). From design experiments to formative interventions. *Theory & Psychology*, 21(5), 598-628. <https://doi.org/10.1177/0959354311419252>
- Les Savanturiers.** (2016). *Vade mecum enseignants 2016*.
- Les Savanturiers.** (2018). *Appel à Mentors*. <https://les-savanturiers.cri-paris.org/wp-content/uploads/2018/07/am1819-vfweb.pdf>
- Van Campenhoudt, L., Marquet, J., & Quivy, R.** (2017). *Manuel de recherche en sciences sociales* (5<sup>e</sup> édition). Paris: Dunod.