

Validation and production of inquiry didactic sequences of biology

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Abstract

The objective of this paper is to describe the stages of validation and production of inquiry didactics sequences (IDS) and to discuss contributions to the approach between the research in biology education and the practice. Our research are a combination of combines the solving of problems in educational practice and elaborating and validating theories. The IDS are a set of activities organized with beginning, development and finish. The IDS have a context and the students of science classes need to resolve a scientific issue, during the class. Our model has 3 phases: Research phase, Practice phase and Dialogic phase (RPD model). There are productions, evaluations and re-workings. All phases are divided into stages. In the research phase, the research group make productions, actions or validations. In practice phase, the protagonist is a teacher. In dialogic phase, the research group do the changes based on the practice and the theories. We conclude that the stages of validation and production are important to produce research data in biology education and the stages are important for teacher training. All stages and phases provide opportunities to learn how to collect data, create problems of research and discuss the results. For PhD students in Science Education, the RPD model offers the opportunity to understand how the stages of a research in biological education are. When we used the RPD model, we produced tools to analyze the argumentation, to do theses and dissertations and to produce educational materials for the biology education.

Keywords: Validation; design research; biology education; inquiry didactic sequences.

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Theoretical Background

In this study we present the stages of validation and production of inquiry didactics sequences (IDS). The objective is to describe the stages of validation and production of IDS and to discuss contributions to the approach between the research in biology education and the practice of teachers.

Our research is a combination of solving problems in educational practice and elaborating and validating theories. We use the term “Educational Design Research” for our studies, but there are many terms. This choice is according to Reeves et. al. (2011, p.59):

We use the term educational design research for three primary reasons. First, the simpler term of design research is also used by researchers in the field of human-computer interface design and industrial engineering. The modifier educational is our attempt to distinguish this research approach from those used in other fields. Second, although the term design-based research has many adherents, it

seems to us to over-emphasise the design aspects of the approach. Third, the two primary books published to date concerning educational design research have not adopted the term design-based research to any great extent.

But, what is an Educational Design Research? According to Plomp (2009, p.13):

As stated educational design research is the systematic study of designing, developing and evaluating educational interventions (such as programs, teaching-learning strategies and materials, products and systems) as solutions for complex problems in educational practice, which also aims at advancing our knowledge about the characteristics of these interventions and the processes of designing and developing them.

The studies about educational design research is present by Reeves (2006) as a cycle process (Figure 1).

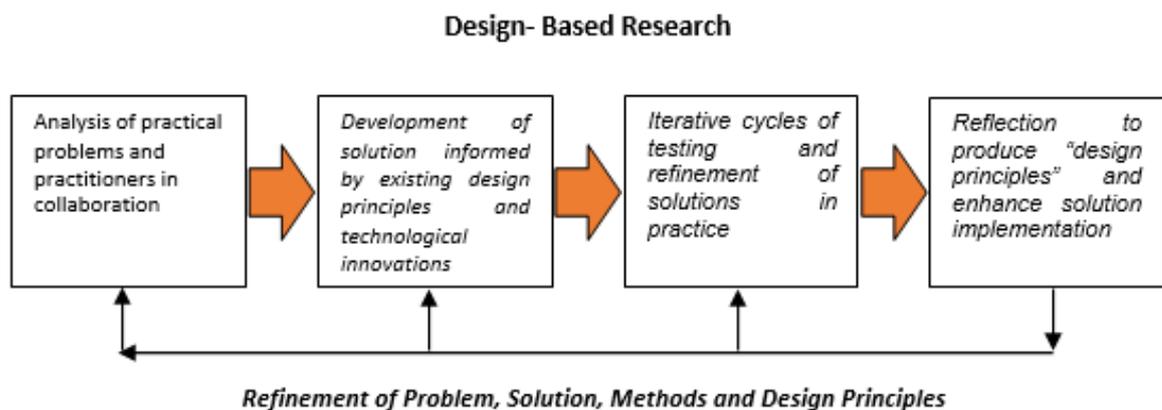


Figure 1. Cycle from Design-Based Research (REEVES, 2006).

Plomp (2009, p.23) consider that the validation studies are important when the studies “*have a focus on designing learning environments or trajectories with the purpose to develop and validate theories about the process of learning and how learning environments can be designed*”. In these studies of validation is important to analyse specific trajectories in classroom. The researchers do not control the application and the reality changes the course (time of activities, treatment of the content and organization of groups). The studies of validation are important to analyse. In our case, we test some studies about inquiry teaching and scientific literacy (SASSERON and CARVALHO 2011). Other theories are about argumentation in classroom (JIMENEZ, 2010)

According to Zabala (1998), a didactic sequence is a set of assignments. These assignments are organized with beginning, development and finish. In our IDS there is a social context and there is a

scientific issue. The production and validation of these sequences have stages based on Guimarães and Giordan’s (2013). In this paper, the authors suggest the EAR model that are possible to develop 3 phases:

- Elaboration (this phase is a theoretical framework to guide the teaching action and action strategies),
- Evaluation (this phase is specific validation tools and a step in which there is an application in the classroom)
- Reworking (when teachers can change the activities based on the experience of application and the theories of education).

Our IDS relate to biology classes, and the themes of IDS are about ecology and evolution. We have a particular interest in theme biodiversity, because we live in a country with high biodiversity and lot environmental problems. At school, the biodiversity is taught as a synonym for variety of species.

Brazilian educational materials do not offer a broader approach. The IDS teaches the biodiversity at the genetic, individual and ecosystemic levels. Our IDS develops the argumentative skills in biology classes. The IDS promotes a construction of a critical thinking in students so that they can give opinion in the most different situations involving the biological knowledge. These skills offer the opportunity to teach that there are different points of view about the preservation and conservation of biodiversity.

Construction of inquiry didactic sequence

For this study we present a description of how is the process of a production and validation of IDS. The production of IDS has 3 phases: Research, Practice and Dialogic.

Phase 1 - Research

The first phase is called research because the authors of IDS dedicate to study the contents to create de IDS. The IDS are divided in three stages: production (P), first evaluation (A1) and first reworking (R1).

The first stage of our work is the production (P). The production is the stage in which authors choose the theme of IDS that is related to some component of the curriculum of biology. The research about the theme begins. The authors are in contact with current scientific researches about the theme, and sometimes they contact specialists on the theme. In our case, we have some research groups about ecology, botany, zoology and science education that can help us with contents about these areas. In this stage, the authors create a socio scientific problem.

The second stage is the first evaluation by the research group (A1). The researchers of our team read, discuss and suggest modifications. In the meetings, the researchers discuss epistemology, science education and scientific aspects about the IDS. The next stage is the first reworking (R1). The authors do the necessary changes and corrections in the text.

Phase 2 - Practice

In this phase, there is an application of IDS and the teacher is an important agent. This phase are divided in three steps: the second evaluation (A2), the second reworking and the application (AP).

The next step is an evaluation by teachers (A2). The teachers, who will use the IDS, make the evaluation and suggest new modifications. Sometimes, we have a meeting with 10 teachers who participate of step A2. In this case, we collect suggestions through interviews or questionnaires. The next stage of Reworking (R2) happens. The authors, based on the suggestion of teachers, do the modifications to adequate the IDS to reality of teachers. After these stages the IDS is ready to next stage: Application (AP). Researchers record the classes. Researchers interview teachers and students. These interviews are important to get information about the reality of school. Written productions are copied and filed in portable HD.

Phase 3 - Dialogic

This phase is important because there is a change of experience between the authors of IDS and the teachers and students. The research group considered and discussed all suggestions.

A new meeting of the researchers happens and the next stage occurs: the second evaluation by the research group (A3). This evaluation promotes modifications to adapt the IDS to reality of school or the requirements of theories. The new suggestions are made and the authors do the final stage: the final reworking (R3).

Findings and conclusions

Our model has 3 phases: Research phase, Practice phase and Dialogic phase (Figure 2). All phases have the actions of the EAR model (GUIMARÃES and GIORDAN, 2013). There are productions, evaluations and reworking. Research phase is composed by stages P, A1 and R1. All productions, actions or validations are made in the research group. Practice phase is composed by stages A2, R2 and AP. In this phase, the protagonist is the teacher. The Dialogic phase is composed by stages A3 and R3. The research group does the changes based on the practice and the theories.

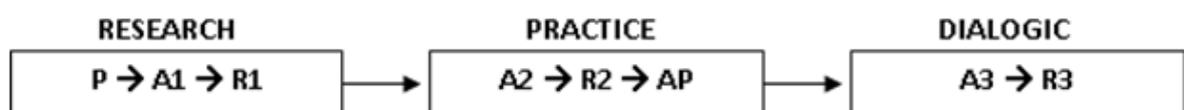


Figure 2. The phases and stages of model Research-Practice-Dialogic (RPD)

We conclude that the stages of validation and production are important to produce research data in biology education and the stages are important for teacher training.

In research phase, the authors of research group express their education theories in the form of activities. It is an important phase because the members of research group have a possibility to learn about the theories in education.

In practice phase, the teachers are part of the production process. The phase has promoted reflections on the practice of teachers, their problems and difficulties. Practice phase has provided an opportunity for teachers to understand how to use activities to promote the construction of arguments by the students

In dialogic phase, the teachers are called to opine on many occasions and they use tools to evaluate the IDS. In teacher training, the practice phase provides an opportunity for teachers to understand how to use activities that promote the construction of arguments by the students. The model with the phases research - practice - dialogic (RPD) promotes opportunities to solve some biology classroom issues. The IDS can address the lack of materials on biodiversity to teach students to have critical thinking.

All stages and phases provide opportunities to learn how to collect data, create problems of research and discuss results. For PhD students in Science Education, the RPD model offers the opportunity to understand how the stages of a research in biological education are. When we used the RPD model we produced tools to analyse the argumentation, to do theses and dissertations and to produce educational materials for the biology education.

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