

THE CHALLENGE OF HYBRID TEACHING FOR THE INTERNSHIP PROGRAMME

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Teacher Internship, obligatory in many Teaching School programmes, is that part of pre-service education for teacher-students that provides a practice for learning to teach a subject in an actual class. This paper reports the measurements that have been implemented to organize a hybrid form of a Statistics Teaching Internship programme for the teacher students at our university, during 2020. We present some of our actions to meet this challenge, as not even virtual teaching in high schools was possible at all levels. For the schools where the students have not access to computers or internet, the interns had to develop course booklets with tasks, which were collected and corrected. For the university-teaching part, the courses were delivered virtually and filmed so that they could be analysed. The analysis aims at identifying face-to-face amendments so that a hybrid approach can be developed.

INTRODUCTION

In Argentina, after students have graduated as statistician (four years of study and one year for writing the thesis), they can undergo a study programme of the Statistics Teaching School to become a professor of Statistics, which comprises a certificate to teach statistics either at secondary school (within mathematics) or at university (at various faculties). The programme lasts three years with a theoretical education in didactics, curriculum, psychology, history, epistemology, etc. In the third year, the students have to learn how to teach in the residence class. In the first term, they learn to teach at secondary schools, in the second term, they learn to teach at university. This so-called Teaching Internship is compulsory for Statistics Teaching School programmes and is the last subject prior to the performance of teachers that provides a practice to learn to teach statistics as a subject both in high school and at university level.

It includes all the steps from the diagnosis of the Institutions where the interns will do the practices, the analysis of the programmes, the preparation of didactic units up to the analysis of didactic sequences. Both probability and statistics are concept integrators, which allows for the developments of contents from other axes, as facets of the same mathematical work, which includes deterministic thinking along with randomness. The Statistics Teaching Internship focuses on the practice of teaching in mathematics classes for the units on Basic Notions of Descriptive Statistics and Probability in secondary school and in Statistics as a subject at university level (this might vary from introductory statistics, or probability, to biostatistics, depending on the faculty the students choose. In addition, the Teaching Internship links the process of teaching creation and analysis based on didactic theories, on the basis that statistics teachers should aspire to generate a positive view of statistics in students and an appreciation of the potential uses of statistics and their role in future personal and professional areas relevant to each student.

Secondary-School Practice

The organisation of the first semester of the third year, the year of the internship comprises the following issues:

- Main concepts and norms in Argentinian Education, of schools as education institutions and of curricula including government resolutions 2020.
- Institutional analysis and history of the chosen school including the present situation of the school due to the pandemic.
- Interviews 2020: headmaster/headmistress, teachers of the chosen course, and the mathematics teacher.
- The curricular design of the chosen secondary education and the annual planning in the pandemic context 2020.
- Didactic unit planning 2020.
- Considerations and conclusions on the secondary-level performance.

University-Level Practice:

The organisation of the second semester of the third year, the year of the internship comprises the following issues:

- Analysis of university education in Argentina with respect to private and state-run universities.
- Government Resolutions 2020.
- Institutional analysis and history of the faculty.
- Interviews with headmaster/mistress, Teaching Experience.
- Didactic Unit Planning.
- Virtual Didactic Unit 2020.
- Considerations and conclusions on the university-level performance.

Final Integrative Report for the Internship Virtual Classroom

Finally, the students have to defend their didactical analyses of their teaching work before a board of three professors. The evaluation comprises the following issues:

- Statistics and Mathematics.
- Fundamentals, general concept of epistemology.
- Mathematics and its relationship with epistemology
- Teaching of mathematics, statistics and its relation to epistemology.
- In this report, the Internship programme prior to the pandemic is presented; yet, since virtuality has come to stay, a hybrid teaching will eventually be applied.

METHOD

In the first semester, the interns would select the secondary school to carry out their practice and in the second semester, they would choose a public or private university school, provided Statistics is a subject in the curriculum.

Once the interns chose the secondary school, they opted for a course from Year 1 to 5 and had to attend classes for three weeks as observers, propose daily and weekly subject protocol as non-participant observers and write a diagnosis on the chosen students. Furthermore, they had to resort to the Mathematics teacher's planning; within it, they had to refer to the units of Descriptive Statistics Notions and Probability. Based on the curriculum of the Ministry of Santa Fe Province for this unit, they had to propose – as didactic strategies for the Statistics axis throughout secondary level – extra-mathematical problem situations that allow students to interpret and elaborate information on the essential concepts. The list of required concepts and methods covered:

- population, sample, qualitative and quantitative variables, discrete and continuous variables;
- data organization and representation via frequency tables and graphs;
- the statistics mean, mode and median and the interpretation of their meaning;
- the practical performance of inferences and suitable argumentation for decision-making;
- the significance of relative frequencies of an event, the determination of such frequencies through real or simulated experiences; and
- the comparison of relative frequencies with the underlying theoretical probability

Referring to the axis proposed by the Ministry as well as the planning of the selected Mathematics teacher, the students had to comment specifically on the Statistics unit based on didactic theories learned in the preceding Curriculum and the Didactics course. Then, they had to observe two classes taught by the course teacher, plan the remaining classes for such students along the development of the unit and teach-practice them as an internship teacher. The mathematics teacher of the course guided and assessed them and on two unannounced occasions, the Internship Professor observed the class and completed the observation protocol already validated by the chair.

To conclude the first semester practice, the intern should present a report including: an interview with the headmaster/headmistress, with any teacher of the course and with the math teacher; the analysis of the math teacher's planning, a substantiation on the Unit of Statistics Notions and Probability, and their own lesson planning along with a contextual problem situation upon any upcoming topic to be sorted out together with their own evaluation of their experience in secondary school. This report together with the marks by the Math teacher of the selected course and the Internship Teacher constitute the assessment in the process of this first semester.

In the second semester, after the selection of university, school and studies where statistics was an eligible subject, they would attend and observe the statistics lessons for a month, analyse the professor's planning of the subject, optionally propose changes where appropriate and then, practise teaching for two months under the supervision and assessment of the statistics professor, while the internship professor would visit and assess them on three occasions. All these steps constituted the evaluation in process to complete the second semester, together with the presentation of a report on all the activities carried out.

At the end of the year, there was an integrative evaluation when the interns reported their experiences in both levels and defended their proposals for changes to improve the teaching process in these two instances.

The pandemic in 2020 presented a challenge for change. The aim of this work is to show how the Internship of Statistics Teaching of Universidad de Rosario Arts School dealt with the challenge, meeting a methodological strategy, which would serve both secondary and university levels – since their ulterior degree entitles its graduates to teach in high school and at university level – and giving interns the opportunity to complete their studies after the surmounting of spotted difficulties, which would eventually help develop a hybrid approach for the future. The intention of this hybrid programme was to provide the interns with a procedure to allow them to finish their studies and get their Statistics Professor certificate.

In pandemic times, the challenge for virtual education implies the proposal of ways of learning how to teach students without the possibility of face-to-face teaching. Strategies adopted and to be developed for the future will be analysed in order to organise a hybrid Internship Programme for the students of the Statistics Teaching School of Universidad Nacional de Rosario.

The cognitive analysis proposed by Godino (1996) coincides with our methodological proposal since it takes into account:

- a) the agents involved, i.e., the students to whom the text is addressed, the teacher and the reference interpreter, who performs the semiotic analysis of the emissions of the teacher and the students' interpretations;
- b) the objects concerned, i.e., expressions, contents, and interpretative codes.

For this, Batanero and Godino (2002) define the following types of objects involved in the mathematical activity, here referred to as types of elements of meaning, which should facilitate their analysis:

- *Extensive*: situations and problem fields from which the object emerges (problem situations, applications),
- *Ostensive*: material representations used in mathematical activity (terms, expressions, symbols, tables, and graphs),
- *Actuative*: problem-solving procedures and strategies (procedures, algorithms, operations),
- *Intensive*: characteristic properties and relationships with other entities: definitions, theorems, and propositions (concepts, propositions),
- *Validative*: types of argumentation to validate propositions (proof, verification, justification).

Each of these types of elements must be a specific object of teaching in Internship classes, in the statistical activity where they are related by means of *semiotic correspondence*, with the intervention of an interpreter, i.e., the Internship professor.

RESULTS

The procedures proposed to face these challenges are presented. The first semester offered a greater difficulty since in some schools, virtual teaching was not possible due to the fact that students had either no access to computers or mobile phones, or the Internet connection was missing or too bad. In these cases, the interns had to implement course booklets with tasks, which were collected and corrected. In other schools there were virtual classes based on the Mathematics unit corresponding to Statistics and Probability.

The booklets were analysed didactically according to Batanero's approach for secondary education (Batanero, 2001) and a way to correct the answers was implemented for the students to learn from their own mistakes through dialogue, comprehension and improvement according to the recommendations of Santos Guerra (2000), additionally using the elements of meaning from Godino and Batanero (1994). It was concluded that students faced major difficulties (see Table 1) in basic

notions of probability both in intensive elements (concepts, properties) and in validative ones (interpretation of contextual statistics terms). As for descriptive statistics, the items related to charts and graphs bore difficulties related to the selection of graphs (30%, intensive elements), related to their construction (22% ostensive elements), and related to their interpretation (31% validative elements), failing to interpret the statistically worded assignments. As for measurements of central tendency, variability and asymmetry, a greater difficulty occurred with regard to the intensive elements (75%), since the students often failed to choose the most suitable measure of central tendency. With regard to active elements, the students failed to apply the formulae correctly; and the greatest difficulty occurred with respect to validative elements, since the students did not know how to interpret the results.

Table 1. Categories of difficulties observed in the internship at high school related to descriptive statistics and probability, and statistical terms in context

Observed difficulty	Frequency	Classification according to Batanero and Godino (2002)
<i>Probability</i>		
Probability concepts		Intensive
Probability properties		Intensive
<i>Statistics</i>		
Contextual statistics terms		Validative
<i>Descriptive statistics</i>		
Selection of graph	30%	Intensive
Construction of graph	22%	Ostensive
Interpretation of graph	31%	Validative

For the university stage, the courses were taught virtually and videotaped for analysis. The recordings of the virtual classroom were studied through content analysis, where interns in their virtual classes focused on extensive (20%), intensive (30%) and validative elements (40%); only the remaining 10% worked on the ostensive and actuative elements in their classes (see Table 2). At the end of each unit, the students completed a tree-attempt questionnaire with satisfactory results (60% on the first attempt).

Table 2. Categories of focus of students in the internship at university teaching from the videotaped teaching units

Classification according to Batanero and Godino (2002)	Frequency
Extensive	20%
Intensive	30%
Validative	40%
Ostensive and actuative	10%

In addition, the interaction was analysed through chat and discussion for a (see Table 3), especially in the subjects of inferential statistics, where the students revealed difficulties in interpreting confidence intervals for mean and proportion in context (81%), regression analysis (65%), variance analysis (70%) and chi square (56%), and in the general use of the statistics syllabus validated at the private university where the residents participated.

Table 3. Categories of difficulties observed in the hybrid interaction during the pandemic

Difficulties in interpretation	Frequency
Confidence intervals for mean or proportion in context	81%
Regression analysis	65%
Variance analysis	70%
Chi square	56%

DISCUSSION

Is there a way to evaluate the impact of this year's programme? Regarding the experience of the interns in the secondary school, the greatest difficulty observed has been that the students in the schools where the booklets were handed out, would not return them, so that the intern's follow-up was fundamentally done through WhatsApp. The evaluation of the teaching practice in this hybrid form focused on the intern's final report for the first semester, the analysis of what the students learned through the elements of meaning, the didactic theory supporting the preparation of the statistics booklets, the corrections made, and the screenshots from WhatsApp where the interns answered and clarified incorrect answers or whatever the students misunderstood.

The assessment at the end of the second semester (the final evaluation) was organised differently since the universities delivered fully virtual classes at that time. The final evaluation was carried out through a presentation in the Virtual Internship Hall where the interns shared their experiences through this hybrid environment between classes through booklets, plans, virtual classes, the lived experience, and the didactic proposals for improving this process. The report included the planning, the design and the performance of the questionnaire, the assessment of the answers, the course professor's assessment, the assessment of the virtual class observation by the Internship Professor, and the performance of the interns in the forum and in interaction on WhatsApp (how the students were able to clarify their students' learning problems and correct their errors).

CONCLUSION

It can be concluded that the specific value of this year's programme was to allow the interns to attain their degree. The approach used during this year should serve as a reference for the future Internship curriculum. The meta-analysis has unearthed the predicaments to be confronted in order to develop a hybrid approach and to overcome the difficulties discovered by the interns during the teaching process to provide significant learning for the pupils of the courses where they carried out their practice.

As Internship Programme Professors, we should modify the used strategies to carry out a more exhaustive analysis of the teaching practice since the resulting experiences with the students demand a greater emphasis upon the teaching circumstances where major difficulties were found.

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