
I-Use Statistics in Education

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Abstract

Today's world is overwhelmed with statistics. Virtually, every economic and scientific activity relies to it. And with the modern technology it's easy to visualize these statistics in figures, graphs, charts and maps – making analyses of information even easier.

But in education the use of statistics is statistics is taught as part of mathematics often without context or meaning, or is used merely to show a result instead of doing real analysis and investigation. Research suggests that, while teachers are willing to use statistics, they feel their students experience greater difficulties in statistics than in other topics, and they consider themselves not well prepared to help their students face these difficulties. The aim of the I-Use project is to create an in-service teacher training course that will deal with how to make sense of information through different presentation forms and media.

1 Why Use Statistics

There is an increasing importance of statistical literacy for everyday life. Virtually every economic and scientific activity in the modern world relies on statistics in one way or another. It plays a prominent role in business and industry, aspects of government and scientific and economic progress. Modern computer-based visualisations create a vivid presentation of collected and organized data through the use of figures, charts, living and interactive diagrams and graphs, which helps lead to more critical analyses of information. They offer useful tools in aiding research and studies in many different fields such as economics, social sciences, business, medicine and many others. Their use should essential in modern teacher training programmes

Students are now living in a society that demands evidence-based arguments and decisions. While the world is changing rapidly with respect to the prevalence and use of statistics, the curriculum in schools and the approaches teachers adopt tend to be slow to respond to such changes. Therefore creating meaningful, innovative teacher training plays a crucial role in developing statistical thought processes.

2 Importance and Need for Statistical Literacy

Statistics – as the science of collecting, analysing, and interpreting empirical data – has a central place an education, but certainly in STEM education. Education concerning the use

of statistical information is appropriate for lifelong learners at different levels of education. The relevant use of statistics in education is characterized through its multi-disciplinarity, with its roots in such diverse fields as biology, business studies, economics, environment, ICT, mathematics and social studies (BICKEL 1995). So, statistical literacy should be a key educational goal for all students.

Although statistics as a content domain is widely accepted, typically statistics is taught as part of mathematics often without context or meaning, or is used merely to show a result instead of doing real analysis and investigation.

However, although the use of statistical information in education has been a concern for over a century, there have only been a few, sporadic efforts to stimulate international research and debate on the needs for and types of education and training in the use of statistics. BATANERO & DÍAZ (2010) suggested reasons for including the widespread use of statistics at secondary school level. They commented on the usefulness of statistics for daily life, the important role of statistics in developing critical reasoning; and the instrumental role of statistics in other disciplines and in many professions. Its integration implies a basic quantitative literacy and the acquisition of a set of quantitative skills. These are now recognized as important outcomes for secondary school leavers.

Research (BATANERO et al. 2011) suggests that, while teachers are willing to learn about and spend more time teaching with the use of statistics and acknowledge the practical importance of statistics, they feel their students experience greater difficulties in statistics than in other topics, and they consider themselves not well prepared to help their students face these difficulties. Teachers also have traditional beliefs and a static view of the way statistics can and should be used in class, about learning and teaching goals and how they are linked with content. They do not consider new forms of visualising statistical information as part of curriculum courses.

Different models have been suggested to describe the professional knowledge needed to teach with the use of statistics. Recent research (BATANERO et al. 2011) offers a model of technological and pedagogical content knowledge (TPCK) for the use of statistics in education that takes into account statistical reasoning and concerns the pedagogical expertise for effectively engaging students in learning with technology. The TPCK movement illustrates that teachers need technology, pedagogy and content knowledge skills

As a result, in high school, many students do not have an opportunity to learn to work with statistics and compute-based visualisations. Therefore, despite the fact that statistics offers powerful tools for information analysis and interpretation, many students are not able to mean meaning from the data and information they are presented with. The dilemma is that as more data becomes readily available and the tools for visualising and analyzing the data become more sophisticated, the ability to produce useful information from the analyses is outpacing the capacity to use the knowledge productively.

3 I-Use

I-Use is a European funded project, led by the geography department of Ghent University (Belgium), and with partners from Belgium, Bulgaria, the Czech Republic, Denmark, Greece, Sweden and the UK. During the life span of the project the goal is to create an in-

service teacher-training course that will deal with how to make sense of information through different presentation forms and media.



Fig. 1:
The I-Use Logo

To reach this goal a website, web-based tools and course will be developed:

3.1 The I-Use website

An important part of the project is the development of a website where students and teachers can find relevant statistical material and a gateway – with pedagogical stepping stones – to online databases like EUROSTAT and World Bank Data – and integrate them into their classes (<http://www.i-use.eu>) On the website the results of the research on the use of statistics in education and the associated competences, curricula and pedagogies – done by the project partners – will be published together with the produced education materials.

3.2 Web-based tools

The project is also creating innovative web-based tools to support the educational process in the use of statistical information. The tools will be organized in a toolbox, fully integrated with the web site and be based on the surveyed needs of students and teachers. Special attention will be paid on functionality relate to interactive mapping and navigation as well as comparisons of time series.

3.3 Education materials

The pedagogy employs an activity-based approach, based on problem-solving and on concept development. Multiple representations of information (physical, numerical, and graphical) play an important role in the statistical problem-solving process. The data analysis/interpretation phase requires a thorough understanding of data representations. I-USE will also demonstrate statistics can be used in many disciplines.

The structure of the course materials consists of:

- an introduction to the role and value of statistical information, visualisation and its use in secondary education, lifelong learning and European society
- 4 modules on: statistical literacy and quantitative thinking, examples of the use of statistics in different curriculum areas, communication and active participation with explicit reference to responsible citizenship, and

- an online manual to help teachers to handle the materials and include them in curricula beyond the project.

The course will be based on the widely-acknowledged TPCK principle, whereby teachers develop an understanding which will enable them to adapt both statistical and pedagogical ideas to a classroom setting through the use of ICT. A focus on learners is required so that teachers understand the student diversity in the classroom, so teachers also need adequate pedagogical knowledge about how to use technology in the statistics classroom.

I-USE will also deal with the assessment of student learning making the distinction between assessment of learning (summative) and assessment for learning (formative) approaches. This will be addressed through three basic components, cognition, observation and interpretation that underlie all forms of evaluation.

Based on the extracted rail track further railway infrastructure objects can be detected using geometrical railway construction standards. Therefore the laser points belonging to the catenary wire are derivable using a relative distance and height interval to the rail track and the assumption of a first echo. The points belonging to cantilevers and railway poles can be extracted with spatial queries as well.

4 Conclusion and Outlook

The importance of quantitative thinking is clear in most disciplines and a solid background to the use and interpretation of statistics is very important, especially in the STEM subjects. But although more data and material to analyse data become available most teachers don't use it by lack of knowledge and support. Consequently there is a need for a better preparation of secondary school teachers, who are dealing with the contextualisation of statistical information in their subjects. The I-Use project will help solve these problems. The project started at the end of 2012. By the end of 2015 the work must be finished. All information can be found on the website <http://www.i-use.eu>.

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