

## UNIVERSITY INTRODUCTORY STATISTICS COURSES IN ICELAND

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*The purpose of this study was twofold: first to gather information regarding teaching of the introductory statistics courses at the university level in Iceland and to gain more insight about educational beliefs of those teaching these courses and to see how well their teaching is aligned with the Guidelines for the Assessment and Instruction in Statistics Education (GAISE, 2005). An online survey was used. Results suggest that the reform in statistics education that has taken place in the last three decades has not yet reach Iceland. The comparison with the GAISE recommendations supports this as it suggests that instructors of introductory statistics courses at the University level in Iceland are not aligned with the GAISE recommendations. The exception is the use of technology GAISE guideline. It appears that technology is well underway in introductory statistics courses taught at the University level in Iceland, with the exclusion of using technology in developing concepts in class.*

### BACKGROUND

In recent decades researchers have focused more on teachers' beliefs in regards to education. This increased interest in the topic has led to definitions of the concept by researchers. In spite of this work a consensus on the definition of what teachers' educational beliefs are is missing (Pajares, 1992; Thompson, 1992). Some researchers have tried to reach such a consensus while others have argued that one single definition of the term should not exist (McLeod & McLeod, 2002). Despite this Pajares (1992) has provided a definition of educational beliefs as being individuals' own judgments of the truth and falsity of a proposition. This definition is coherent with major work in the fields of education and educational psychology.

Since educational beliefs influence how teachers practice and behave, the importance of studying educational beliefs has been pointed out when it comes to studying teachers' behaviors and practice (Fives & Buehl, 2008; Speer, 2005). It has also been pointed out that any curriculum or reform changes are more likely to take place when their goals take into account teachers' beliefs (Handal & Herrington, 2003).

In the last decades the field of statistics education has been greatly affected by a reform movement that has focused among other things on changing introductory statistics courses. This reform movement originated from changes that have taken place in statistics education in recent decades such as changes that have emerged in the content of statistics courses due to influences from new textbooks some thirty years ago (Cobb, 2005). Along with a substantial increase in student enrollment in introductory statistics courses (Garfield & Ben-Zvi, 2008; Garfield, Hogg, Schau, & Whittinghill, 2002). Finally there is the influence from a movement to reform the teaching of the mathematical sciences in general (Moore, 1997). The aforementioned increase in student enrollment has been followed with considerable changes in the types of students taking introductory statistics courses at the college level, moving from more homogenous groups in fields such as biology and agriculture to more heterogeneous groups from different fields like the social sciences, nursing and business. All these changes have led to more focus on the introductory statistics course (Cobb, 2005). Numerous projects have been launched to make the introductory courses more appealing and more efficient due to its new diverse clientele. One of these projects endorsed by the American Statistical Association (ASA) are the Guidelines for the Assessment and Instruction in Statistics Education (GAISE, 2005). These guidelines include six recommendations to use for teaching introductory statistics courses at the college level. They include suggestions such as using real data, promoting active learning and highlighting more conceptual understanding instead of knowledge of procedures.

Teachers' educational beliefs have not been studied in the field of statistics education despite the reform that has taken place. Most studies in statistics education regarding beliefs are related to students' beliefs toward statistics. It is therefore important to explore teachers' educational beliefs when it comes to statistics education. Such information can both influence

change and also guide educators and researchers in implementing reformed recommendations in the field.

The purpose of this study was to gather information regarding the teaching practice of the introductory statistics courses at the university level in Iceland. And to gain insight about the educational beliefs of those teaching introductory statistics at the university level in Iceland and to see how well the teaching is aligned with the GAISE (2005). The research questions are:

1. How do instructors' educational beliefs in statistics education relate with their teaching methods when it comes to teaching introductory statistics classes?
2. To what extent does an instructor's professional background relate to their alignment with the GAISE guidelines?

## METHOD

An online survey system ([www.qualtrics.com](http://www.qualtrics.com)) was used to send out a survey to instructors (n=46) of introductory statistics course at the university level in Iceland. The instrument consisted of 28 questions that were translated to Icelandic from the two survey instruments, 23 items came from the STI (Statistics Teaching Inventory developed by Joan Garfield, Robert delMas, Andrew Zieffler and Beth Chance) and three items from the 1998 Survey of Introductory College Statistics Course (developed by Joan Garfield). In addition the researcher designed two items. The questions focused on instructors' teaching and assessment practices, philosophies and beliefs and their professional background.

The study participants consisted of 46 instructors of introductory statistics courses at the University level in Iceland. These instructors came from four Universities in Iceland. The introductory courses were quite different in nature but in order to be considered an introductory statistics course, course descriptions had to include at least one of these topics: descriptive statistics, distribution (normal and sampling) and methods of statistical inference. The amount of time dedicated to these topics in each course varied. Some of the courses spent all semester on statistics while other courses only used four-six weeks focusing on statistics. In some cases a combination of statistics and methods for particular fields constituted the course. All of the courses were in-class sessions taught in Icelandic.

The survey was sent out in March of 2009 and participants had four weeks to reply. Two reminder emails were sent out during this time. Five individuals contacted the researcher and informed him that they did not qualify as an in-class instructor of statistics. So the number of participants went from 46 to 41. The number of responses used for the analysis was 25 or 60.97% of those 41 that received the survey by email.

## RESULTS

Most of the students enrolled in introductory statistics classes came from the social sciences or 37%. Number of students in a class ranged from seven to 240 students per course, the mean was 78 students per course. Courses with students from the fields of education and health science had the lowest number of students per course. The mathematic requirements for the courses varied, 24% of all the courses had one or two mathematics courses at the university level as prerequisites. For the other ones basic high school mathematics was sufficient.

Around 52% classified their professional status as faculty (Tenure Track), professors and adjunct faculty/instructional staff (part time) counted for 12% each and 16% were specialist. Two participants did not give up their professional status. The average years these instructors had in teaching introductory statistics course were 7.76 years; the range was from two to 30 years.

Around 64% of the instructors had not taken any graduate courses in education or educational psychology. Instructors that classified their professional status as adjunct faculty (part time) or faculty (tenure track) were the only ones that had taken some graduate coursework in that subject; most of them had taken one course. Lectures were the most common teaching method used. Exams(s) were used frequently or sometimes by 21 (95.5%) instructors. More than half (52%) of instructors' reported that their own teaching was similar or very similar to the teaching they received themselves as students in an introductory statistics course. Increased availability of

computer and software technology and instructors own dissatisfaction with their courses was most often reported as major reasons why changes had been made to instructors' own teaching.

More than half or 52.6% used technology most of the time when demonstrating data analysis in class. About 26% used technology for every class session when showing data analysis. Students were required to use technology for assessments that took place outside of the classroom for all of the instructors. And for 69.3% of them students were required to use technology most of the time or every time that they had assessment outside of the classroom. The lowest reported frequency of technology used was when instructors used technology to explain concepts in class; around 52.6% never or sometimes use technology in those situations.

The research questions put forth here were meant to shed light on the relationship between instructors' educational beliefs in statistics education and their teaching methods when it comes to teaching introductory statistics classes at the University level in Iceland. Only two significant relationships were found in the data. The first was a positive moderate relationship ( $r = .612$ ) between those instructors with a strong agreement with teaching practices recommended by GAISE and their use of technology when demonstrating data analysis or explaining concepts in-class and also for outside of class in conjunction with assignments and activities. The latter one was a positive moderate relationship ( $r = .604$ ) between those instructors holding educational beliefs that are aligned with the GAISE recommendations about teaching and learning and their use of technology when demonstrating data analysis or explaining concepts in-class and also for outside of class in conjunction with assignments and activities.

We failed to answer research questions two here since there was not a significant relationship between the type and amount of coursework instructors have completed and their alignment with the GAISE guidelines.

A comparison from the results of the survey with the GAISE recommendation revealed that instructors in Iceland are most aligned with the fifth GAISE recommendation to use technology for developing concepts and analyzing data. This comparison was only with the last four GAISE recommendations since any item in the survey did not assess the first two. The results show that all instructors use technology in their courses, both in class- and for outside class assignment.

## CONCLUSION

Even though we will not be able to generalize about statistics instructors at the University level in Iceland the results from the survey should give good insight about how statistics teaching is at this level. Results from the survey suggest that the reform in statistics education that has taken place in the last three decades has not yet reach Iceland. The comparison with the GAISE recommendations and the results of the survey strongly support this as it suggests that instructors of introductory statistics courses at the university level in Iceland are not aligned with the GAISE recommendations. Of the four GAISE guidelines that the instructors in Iceland were compared to they align most with the use of technology recommendation. It appears that technology is well underway in introductory statistics courses taught at the University level in Iceland, with the exclusion of using technology in developing concepts in class.

Results from this study also support the idea of formally introducing the GAISE recommendations to those that teach statistics in Iceland and to measure attitudes and willingness to follow them. This could provide a good opportunity to do a follow up study that would measure student success in the introductory statistics course before and after implementations of the GAISE recommendations.

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