

Attitudes Measurement: Nature, Issues, Methods, and Recommendations

Myint Swe Khine (2015) *Attitude Measurements in Science Education: Classic and Contemporary Approaches*. Information Age Publishing: Charlotte. ISBN: 978-1-68123-084-9. 314 Pages, Price: \$45.99 (Paperback)

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1 Introduction

There have never been so many measurements of attitudes, through surveys, polls or tests. One may ask, why? As they impact behaviours, attitudes definitely influence individuals and the society as a whole. Measuring students' attitudes, which are in part shaped during education, can be highly valuable in order to understand socio-scientific issues. It is thus of great importance not only to have instruments to measure these attitudes, but also to understand how they develop, change, evolve, and interact with other factors, and eventually to support decision-making, which is the main goal of Myint Swe Khine's book *Attitude Measurements in Science Education: Classic and Contemporary Approaches*. It has a clearly *practical* orientation towards the measurement of attitudes and includes many useful empirical studies illustrated by concrete examples, but also valuable theoretical points, with implications for researchers, teachers, and students. The editor, Dr. Myint Swe Khine, is a professor and chair of an assessment and evaluation centre, at the Emirates College for Advanced Education, in the United Arab Emirates, and adjunct professor at the Science and Mathematics Education Centre at Curtin University, in Perth, Australia. In his past appointments, he also worked at the National Institute of Education, at Nanyang Technological University in Singapore. He published many articles and edited several books on science education.

The book is a collection of chapters written by Norman Reid (chapter 1), Lars Brian Krogh (chapter 2), Zacharias C. Zacharia, Ioanna Rotsaka, and Tasos Horvadas (chapter 3), Per Kind and Patrick Bromby (chapter 4), Yukung Yu and Felicia Moore Mensah (chapter 5), Ya Hui Michelle See and Bernice L. Z. Khoo (chapter 6), Carina M. Rebello, Stephen B. Witzig, Marcelle A. Siegel and Sharyn K. Freyermuth (chapter 7), Richard K. Coll and Levinia Paku

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(chapter 8), Ernest Afari (chapter 9), Anita Welchand and Douglas Huffman (chapter 10), Darko Hren (chapter 11), Barry J. Fraser and Seon Uk Lee (chapter 12), and Myint Swe Khine (chapter 13). Chapters 1–8 deal with attitudes in general, while chapters 9–12 focus more specifically on the relations between attitudes and socio-scientific issues. Even though all chapters can be read independently, newcomers in the field of research on attitudes may find it useful to begin by reading chapter 1 that provides an extremely useful overview of the basics on attitudes (definitions, methods, historical, and theoretical perspectives). Then one could look at chapters 2–3 and chapters 8–12, which provide very concrete examples of attitude measurements. Depending on their research questions and interests, more experienced researchers may directly read chapters 4–7, which discuss more advanced issues related to attitudes (scales, meta-analysis) or offer a theoretical perspective on attitudes. In addition, readers may also find useful to first have a look at chapter 13, which gives a useful summary of all chapters in the book and may allow readers to directly find a particular topic of interest. As a result, this review does not aim at summarizing the content and insights of each chapter (as chapter 13 does). Rather my aim is to provide an overview of the most relevant information on the measurements of attitudes, as well as discuss some educational implications of the book.

2 What Are Attitudes?

An important issue with attitudes is that they are not directly observable. As a result, it is not easy to define them. For example, attitudes have been confused with behaviours or emotions, but even though they are related, they are not the same. Actually, “it took decades for the concept of attitudes to crystallize into any kind of agreed meaning” (p. 3). Now, experts generally agree with a characterization of attitudes that includes three components: “cognitive (what we know), affective (how we feel), and behavioural (how we behave)” (p. 7). The first chapter, written by Norman Reid, clarifies that the definition of attitudes is the outcome of a long and mature historical process, and is now defined as: “a tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour” (p. 8); it also presents the main issues (e.g. the difficulty to measure something unobservable) and some important properties (e.g. the stability of attitudes through time) related to attitudes. Finally, one should also keep in mind that attitudes are always inferred (because they are not observable) from a behaviour, and thus “absolute measures are impossible, only comparisons can be made” (p. 35).

Another important issue emphasized in the book is the need to realize “that there has to be an attitude target” (p. 11); in other words, one should always know *towards what* the attitude is measured. In many studies, this is not clarified and thus it is a source of confusion. It is suggested by Norman Reid in the book that the target can be of four kinds, which are attitudes towards “i) the science as a discipline, ii) the learning of the science subject, iii) topics in a particular course, iv) the methods of science” (p. 11).

Last but not least, it may be valuable to keep in mind that educational research is characterized by the opposition between two research paradigms: on the one hand, methods based on empirical, quantitative data, and derived from the natural sciences, and on the other hand, methods based on qualitative aspects, derived from the humanities. The former is only useful in “identifying the nature of a problem”, whereas the latter is necessary for “understanding the problem” (p. 49). Both paradigms are currently considered separately, and one suggestion of the book is to mix them together in order to improve research on attitudes.

3 Why Measuring Attitudes?

The goal of attitude measurement is “advancing science education designing curriculum, choosing powerful pedagogies and nurturing students” (p. 309). More specifically, through attitude measurement, students’ or teachers’ interest in science is analysed. As a vast majority of the book is devoted to students’ attitudes, teachers may find helpful some conclusions of the empirical studies presented in the book in order to improve their own teaching with their students. For example, the conclusion of the study in chapter 9 is that “students’ attitudes towards the learning of science and academic achievement were positively correlated” (p. 257), implying that science educators could foster students’ self-efficacy beliefs in order to enhance their academic success. Besides, in the study of chapter 10, it is argued that “programs that engage students in authentic scientific problems can significantly increase students’ attitudes and views of science.” (p. 277), which once more could be an interesting suggestion for teachers eager to improve students’ attitudes by committing them into real scientific activities.

Besides students’ attitudes, those of teachers towards a pedagogical tool can also be studied, as it is shown in chapter 3, in which teachers endorsed the educational use of simulations. Again, teachers may find it useful to first have a look on chapter 13 (pp. 309–314) in order to focus on a particular chapter of the book that meets his or her pedagogical needs. Also, researchers interested in the reciprocal influence of the environment (in the sense of culture or education) and attitudes may focus on chapter 2 (pp. 47–82) and also have a look at chapter 8 (pp. 223–242) or at chapter 12 (pp. 293–308).

4 How to Measure Attitudes?

One major aspect of the book is to give an overview of the whole implementation process of measurement of attitudes through extended empirical studies (including interview and/or questionnaire, experts’ judgement, sample choice, methods, data collection, data analysis, results, and conclusions), and key quality criteria (validity, reliability). This may be extremely useful for researchers eager to better understand all the steps for accurately measuring attitudes. For this purpose, chapter 3 (pp. 83–117) is a good illustration of such a process. More specifically, it may be of interest to highlight three key points.

First, classical tools such as interviews or questionnaires are typically used for measurement of attitudes. Regarding the choice of a questionnaire, suggestions of two kinds can be found in this book. On the one hand, researchers have the possibility to design their questionnaire based on existing ones, such as the Test of Science Related Attitudes (a.k.a. TOSRA, see, for example, chapter 10, pp. 263–281) or the Multiple Response Model (a.k.a. MRM, see, for example, chapter 5, pp. 139–178), in which case only some specific items can be kept, modified or even translated (see chapter 12, pp. 293–308) according to the researchers’ needs. On the other hand, it is also possible to design new items, which is typically the case when the research targets a new area (see, for example, chapter 3, pp. 83–117, or chapter 11, p. 283–192). Different possible scale choices for a questionnaire are also discussed in chapter 1 (for instructive examples of Likert scales, see pp. 39–40, Appendix A), and science education researchers may find useful a summary list of general recommendations for accurately performing a survey in chapter 1 (p. 37). Examples of used items are also present in almost all empirical studies reported in the book (see, for example, pp. 285–286).

Second, a major part of the book is dedicated to the use of relevant statistical analyses in measurement attitudes, such as descriptive analysis (histograms, frequency, means, and standard deviations), classical statistical analysis (Cronbach alpha, pre-post/test, multiple linear regression, factor analysis, ANOVA, and correspondence analysis), and more advanced contemporary methods of analysis (structural equation modelling, item response theory). These analyses, which are illustrated by tables and graphs, are understandable even with a very limited background in statistics. In particular, and due to the usual multifaceted aspect of attitudes, emphasis is put on *factor analysis*, which is necessary for distinguishing different constructs in a pool of items. For example, in chapter 2, one may see a detailed factor analysis used for checking the unidimensionality of a set of given items, as well as the interpretation of its loadings (pp. 57–58). Common errors that should be avoided are also discussed, such as the confusion of ordinal and quantitative data, the misinterpretation of correlations, and the confusion between reliability and unidimensionality of scales.

Third, measurements of attitudes should be *valid*, meaning that one should be assured to measure what one actually wants to measure, and not something else. Also, measurements should be *reliable*, meaning they should exhibit stability through time. The lack of validity and reliability evidence in many studies is also emphasized in the book. They should always be provided in a study involving measurements (for an example of how this can be done, see pp.98–97).

5 Conclusion

In sum, Myint Swe Khine's book *Attitude Measurements in Science Education: Classic and Contemporary Approaches* is extremely rich, instructive, and insightful at several levels, and for different purposes. For example, science education researchers will definitely find useful the various examples of practical attitude measurements through different empirical studies, as well as the main theoretical prospects in research on attitudes. Also, teachers as well as students could also benefit from this book, as research results and teaching implications are emphasized, especially the value the former can bring to the latter. Even though some chapters require some more advanced understanding of the issues related to attitude measurements, the major part of the book is accessible and of great interest for an audience who has some curiosity in science education research.

Compliance with ethical standards

Conflict of interest The author declares no conflict of interest.