

CHAPTER 3

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RETHINKING CHARACTERIZATIONS OF BELIEFS

Abstract. In this chapter we consider beliefs and the related concepts of conceptions and knowledge. From a review of the literature in different fields we observe that there is a diversity of views and approaches in research on these subjects. We report on a small research project of our own attempting to clarify the understanding of beliefs among specialists in mathematics education. A panel of 18 mathematics educators participated in a panel that we termed “virtual”, since the participants communicated with us only by e-mail. We sent nine characterizations related to beliefs, selected from the literature, to the panelists, asked them to express their agreement or disagreement with the statements, and also asked each to give their own characterization of the term. The answers were analyzed, searching for the elements around which the concept of beliefs has developed along the years. We discuss issues on which there was agreement and disagreement and conjecture what lies behind the differences. As a final step we make some suggestions relating to characterization of the term belief and ways of dealing with it in future research.

1. INTRODUCTION

The purpose of this chapter is to draw attention to theoretical deficiencies in belief research. First, the concept of belief (and other related concepts) is often left undefined (e.g., Cooney, Shealy, & Arvold, 1998) or researchers give their own, possibly contradictory, definitions (e.g., Bassarear, 1989; Underhill, 1988). A second important problem is the inability to clarify the relations between belief and knowledge. At the end of the chapter, we describe the results of an empirical research study in which we tried to characterize the concept of belief based on views that emerged from written reports of mathematics education specialists in the field of beliefs.

2. BELIEFS AND CONCEPTIONS

Beliefs and belief systems began to be examined, to some extent, at the beginning of this century, mainly in social psychology (Thompson, 1992). But before long, behaviorism began to dominate research in the psychological domains. The focus turned to the observable aspects of human behavior, and beliefs were nearly forgotten. New interest in beliefs and belief systems emerged mainly in the 1970s, through developments in cognitive science (Abelson, 1979).

Individuals continuously receive signals from the world around them. According to their perceptions and experiences based on these messages, they draw conclusions

about different phenomena and their nature. Individuals' subjective knowledge, i.e., their beliefs (including affective factors), is a compound of these conclusions. Furthermore, they compare these beliefs with new experiences and with the beliefs of other individuals, and thus their beliefs are under continuous evaluation and may change. When a new belief is adopted, this will automatically form a part of the larger structure of their subjective knowledge, i.e., of their belief system, since beliefs never appear fully independently. Thus, an individual's belief system is a compound of her conscious or unconscious beliefs, hypotheses or expectations and their combinations (Green, 1971).

2.1. Different Understandings of Beliefs

As discussed in other chapters of this book (Leder & Forgasz; Op't Eynde, De Corte, & Verschaffel; Törner), there are many variations of the concepts belief and belief system used in studies in the field of mathematics education. As a consequence of the vague characterization of the concept, researchers have often formulated their own definition of belief which might even be in contradiction with others. For example, Schoenfeld (1985, p. 44) states that in order to give a first rough impression "belief systems are one's mathematical world view". He later adds explanations of his position, interpreting beliefs "as an individual's understandings and feelings that shape the ways that the individual conceptualizes and engages in mathematical behavior" (Schoenfeld, 1992, p. 358). Hart (1989, p. 44) – under the influence of Schoenfeld's (1985) and Silver's (1985) ideas – uses the word belief "to reflect certain types of judgments about a set of objects". Lester, Garofalo, and Kroll (1989, p. 77) explain that "beliefs constitute the individual's subjective knowledge about self, mathematics, problem solving, and the topics dealt with in problem statements". Törner and Grigutsch (1994) label their research object as the "mathematical world view", as is done in Schoenfeld (1985). In a recent paper by Grigutsch, Raatz, and Törner (1998) this concept is elaborated further, and anchored into the theory of attitudes, as explained, for example, in Olson and Zanna (1993). Other researchers, Underhill (1988) for one, think that beliefs are some kind of attitudes. Yet another different explanation is given by Bassarear (1989) who sees attitudes and beliefs on the opposite extremes of a bipolar dimension.

When looking at these different, and in some case even contradictory (Underhill, 1988; Bassarear, 1989) characterizations of beliefs, one observes that most of them (Underhill, 1988; Lester et al., 1989; Thompson, 1992; Furinghetti, 1996; Lloyd & Wilson, 1998) refer to the static part of beliefs saying: beliefs are, constitute, are contained etc. The definition given by Schoenfeld (1992) stresses the dynamic part of beliefs, i.e., how beliefs function. The definition proposed by Hart (1989) puts forward the aspect of judgments. The place of beliefs on the dimension affective – cognitive may be seen in different ways. If we were to stress the connections between beliefs and knowledge, we would see beliefs mainly as representatives of the cognitive structure of individuals. However, to see beliefs as a form of reactions toward a certain situation means that we consider beliefs to be linked to the affective part of individuals.

In research, there are representatives of both viewpoints. Some researchers consider beliefs as a real part of cognitive processing. Most researchers acknowledge that beliefs contain some affective elements, since the birth of beliefs happens in the social environment in which we live (McLeod, 1989, 1992). Among the six definitions of belief given above, those of Underhill (1988), and Lester et al. (1989) stress the affective component, whereas the definitions of Bassarear (1989) and Thompson (1992) are more on the cognitive side. In this book the different orientations are present in Goldin's chapter (affective orientation), in the chapters by Op't Eynde et al. and by Törner (cognitive orientation), while the chapter of Leder and Forgasz has a more marked mixed orientation (affective/cognitive).

In his study, Saari (1983) tried to structure the central concepts of the affective domain. He grouped them using three categories: feelings, belief systems, and optional behavior. Belief systems are seen as being developed from simple perceptual beliefs or authority beliefs – via new beliefs, expectations, conceptions, opinions and convictions – to a general conception of life. Such a viewpoint, that attitude has a component structure, seems to be commonly accepted in psychology today. One may find the following definition in the dictionary of psychology (e.g., Statt, 1990, p. 11): Attitude is “a stable, long-lasting, learned predisposition to respond to certain things in a certain way. The concept has a cognitive (belief) aspect, an affective (feeling) aspect, and a conative (action) aspect”. The same threefold structure is found in many definitions on attitudes within research on mathematics education (e.g., Hart, 1989; Olson & Zanna, 1993; Ruffell, Mason, & Allen, 1998).

2.2. Different Characterizations of Conceptions

Conceptions belong to the same group of concepts as beliefs, which are also used in different ways in mathematics education (and the wider) literature. For example, Thompson (1992) understands beliefs as a sub-class of conceptions. But she claims that “the distinction [between beliefs and conceptions] may not be a terribly important one” (p. 130). Thompson's idea is taken up by Furinghetti (1996) who explains an individual's conception of mathematics as a set of certain beliefs. A different understanding is given by Pehkonen (1994) who, in accordance with Saari (1983), characterizes conceptions as conscious beliefs.

Some trials for a definition of conceptions are given, among others, by Freire and Sanches (1992), Ponte (1994), and Lloyd and Wilson (1998). For example, Lloyd and Wilson (1998, p. 249) connect beliefs with conceptions saying: “We use the word conceptions to refer to a person's general mental structures that encompass knowledge, beliefs, understandings, preferences, and views”. But there are other researchers who clearly distinguish the meaning of these two terms. For example, this is the position emerging from the following passage of Ponte (1994) who has used Pajares (1992) as an authority:

They [beliefs] state that something is either true or false, thus having a prepositional nature. Conceptions are cognitive constructs that may be viewed as the underlying organizing frames of concepts. They are essentially metaphorical. (p. 169)

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