

Chapter 20

Fresh Perspectives on Motivation, Engagement, and Identity: A Conclusion



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20.1 Summary

In this book we have collected 15 chapters based on papers presented at the Topic Study Group on “Affect, beliefs and identity in mathematics education” during the ICME-13 conference in Hamburg, Germany, in 2016. We have also invited three experts to comment on subsections of the volume: Wee Tiong Seah on Interest, motivation, and values, Peter Liljedahl on Engagement and flow, and Einat Heyd-Metzuyanin on Identity.

All three commentators experienced some difficulties in finding clear coherence among the chapters. This underlines, as already mentioned in the introduction, the

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wide theoretical and conceptual variety in the field for theorizing affect. This multitude of theories makes it a daunting task to summarize the contents of this volume, but at the same time serves as a reminder of the rich, and ongoing journey leading from mathematics and education to mathematics education (Furinghetti, Matos, & Menghini, 2012). As traced by these authors, research in fields as diverse as psychology, sociology, cultural, and political studies could be adopted or adapted to explore, in greater depth or through different lenses, issues of relevance and importance to those engaged in mathematics education. While interdisciplinary research undoubtedly has the potential to stretch the boundaries of current knowledge, for such work to be both cumulative and productive it should be accompanied, as much as possible, by a common language and terminological precision accepted across the different discipline boundaries.

Sometimes researchers used different terminologies for the same phenomenon due to the very different theoretical lenses they have chosen. For example, while Karaolis and Philippou as well as Felix recognized teacher professional identity to be simultaneously an individual and a social phenomenon, they approached it differently. While Felix focused on recognition by others as the key issue, Karaolis and Philippou focused on self-reflection. Hence, they drifted apart and ended up using partly very different conceptualizations and terminologies. Even when they both discussed self in relation to professional identity, Felix used the concepts self-respect, self-confidence, and self-esteem, while Karaolis and Philippou used the concepts self-image, self-efficacy, and self-esteem.

With respect to methodology, there is great variation from in-depth qualitative case studies (e.g. Kahlil, Lake, & Johnson) to very large longitudinal and comparative studies using quantitative methods (e.g. Bofah & Hannula). Based on the contributions to this volume questionnaires and interviews are the dominating research methods for mathematics-related affect. These methods rely on self-report, meaning that the information we gain about affect is restricted by our research participants' ability to reflect their affect and their willingness to share their observations with us. Self-report is a viable research method, but it is very dependent on participant's ability of reflection and response style, and constrained by cultural difference (Paulhus & Vazire, 2007). People do not have an infinite ability to recall all information relevant to a posed question. A self-reporter may have to resort to a "press release" version of his or her personality just to get on with the task (Paulhus & Vazire, 2007, p. 232). However, the rich autobiographical narratives Felix collected for over a period of up to two years provides an opportunity to avoid many pitfalls of self-reporting.

Observation as an alternative method is illustrated in several chapters (Branchetti & Morselli; De Simone; and to some extent also in Khalil, Lake, & Johnson). The power of this approach is in recording minute details of the events that fleet by fast. For example, Branchetti and Morselli analyzed mathematical argumentation in a group sentence by sentence and De Simone addressed gestures and tone of voice as signals for teacher's emotional orientation.

Rather than choosing either self-reports or observation, one may choose both for the benefit of triangulation. Dobie used a mixed method approach, including ethnographic observations in classes one to three times per week for five months.

These classroom observations provided her data on student willingness to collaborate that did not become apparent in the survey or the interviews. In a similar fashion, analyzing a video-recorded session of student collaboration allowed Montoro and Gil to explain some conditions for flow that were not apparent in the quantitative survey data.

Although it is possible to think about mathematical objects without leaving the mathematics-internal world, mathematics is a social construct and activity (Hersh, 1998). But still, when learning mathematics, it is usually also related to the world we live in. The special character of mathematics as well as of doing mathematics makes it loved by some students and hated by others (Henn & Kaiser, 2001). This polarization may also have an effect on the affect that is related to (learning) mathematics. Thus, although some of the studies presented here might be easily replicated in other subjects, mathematics as a discipline still might have an impact on the results.

In most of the chapters, the role of mathematics was minimal, as discussed by Heyd-Metzuyanin in her commentary. Teaching or doing mathematics was often simply a context that was used to identify the participants or the activity in question, but mathematics had little explicit relevance. Could these studies be replicated in the areas of other school subjects? Probably, with little difficulty. In some cases the results might even be similar. Is this an unanticipated side-effect of interdisciplinary research? And, we need to ask, to what extent does such work move the field of mathematics education forward?

Nevertheless, the role of mathematics as the discipline that is dealt with in the situations studied, is not to be neglected. In comparison to other subjects, the nature of mathematics is special for instance due to its rigorous logic, cumulative structure, highly formalized special language, abstractness, and its role as a gatekeeper for many careers. Three chapters (Dobie; Middleton Mangu, & Lee; Wilkie) discussed the role of mathematics in relation to careers, and two chapters address the specific nature of mathematics as a discipline, namely Erens and Eichler's study in the context of tertiary mathematics and Branchetti and Morselli's study in the context of argumentation on grade six.

The Topic Study Group 28 at ICME was aimed at addressing "all areas of affect, including attitude, anxiety, beliefs, meaning, self-concept, emotion, interest, motivation, needs, goals, identity, norms, values". How well does this book cover the different areas of research? To evaluate this, we used a method earlier employed for the analysis of trends in research on mathematics-related affect in affect working group of CERME conferences (Hannula, Pantziara, & Di Martino, 2018). That analysis identified 51 different affect terms appearing in the titles of 134 CERME papers and their frequencies across the conferences. Then, total of 17,368 instances of affect term appearance were found with the following terms being most frequent: belief, emotion, affect(ive), motivation, goal, efficacy, and attitude.

We have searched for the same words in the chapters (except this chapter *Fresh perspectives on motivation, engagement, and identity: A conclusion* and not including the references) of this volume. The corpus has a total of 141,865 words and total of 4,739 affect term occurrences were found. As in the original study, we checked the context of words, when necessary, to include only those with the affective meaning.

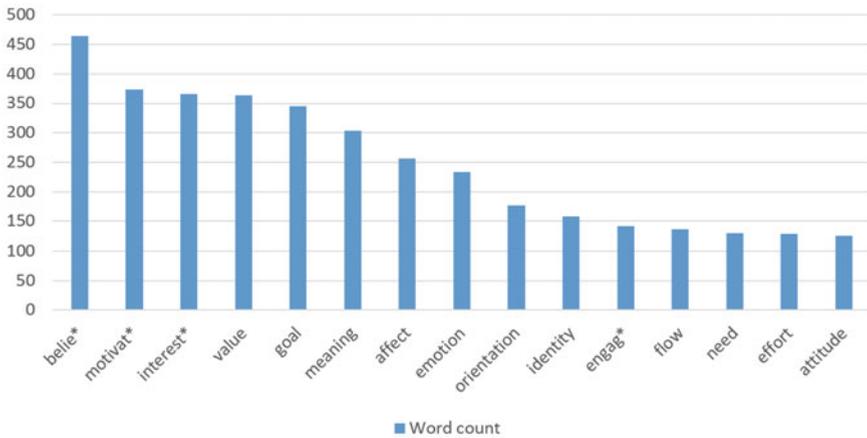


Fig. 20.1 Emotion words that appear more than 100 times in this book (not including the references or this chapter—*Fresh perspectives on motivation, engagement, and identity: A conclusion*)

The 15 most common words each occurred more than 100 times (Fig. 20.1). This list includes the most frequent words from CERME conferences, except for efficacy, which had 93 occurrences.

However, some words from our call of papers are missing from the list of most frequent words. Anxiety was mentioned 34 times and norms 27 times. The term self-concept appeared only eight times, but several related words compensate for it: self-confidence (38 times), self-efficacy (83 times), and self-esteem (36 times).

Based on this word count analysis, motivational concepts seem to have high prominence in the current volume, for example, the terms interest, value, goal, meaning, orientation, and need all appearing more than 100 times.

As in *Fresh perspectives on motivation, engagement, and identity: An introduction*, we use the three dimensions suggested by Hannula (2012) to categorize affect-related theories to examine the terminology of this book. The first dimension identifies three different types of affect and we can see each type represented in this volume: cognitive (e.g. beliefs), motivational (e.g. values, motivation, and many others), and emotional (e.g., emotion, engagement, and flow).

The second dimension distinguishes between theories that focus on the relatively stable aspects of affect (i.e. traits) from the theories that focus on the dynamically changing aspects of affect (i.e. states). Most research in this volume focused on traits, as usual. However, there were four papers looking at the dynamics of affective states. De Simone examined teacher emotional orientations at the moments of decision making, Khalil, Lake, and Johnson investigated teacher’s “in-the-moment” affect, Montoro and Gil studied student flow during problem solving, and Branchetti and Morselli inquired the dynamics of interaction in a group. It is an indication of the relative novelty of this research that these three papers described new phenom-

ena through case studies, which is typically the first stage of research. Clearly, the dynamic aspects of affect need more research.

The third dimension in Hannula's (2012) metatheory identifies three different traditions for theorizing affect: physiological theories, psychological theories, and social theories. Here, almost all chapters used psychological theories, conceptualizing affect as a characteristic of an individual. Two papers in identity were exceptions. Branchetti and Morselli examined identity in the dynamics of a group process and Felix examined teacher autobiographical narratives contextualized in the socio-historical context of their narrators. While only De Simone used an explicitly embodied theoretical construct (emotional orientations), many chapters use embodied methods, taking, for example, gestures, facial expressions, and tone of voice as indicators of emotions (De Simone; Khalil, Lake, & Johnson; Montoro & Gil). The high relevance of bodies for affective interaction was highlighted by Mykia's frustration (Khalil, Lake, & Johnson) when she could not use physical proximity in the virtual classroom to engage a student.

The call for papers explicitly questioned the issue of the mutual relationship between affective constructs and their connection to cognition and other constructs studied in mathematics education, as well as the description of programs for promoting aspects of affect. Some of the chapters did discuss these issues.

The issue of the mutual relationship between affective constructs and cognition or, more in general, on mathematical activity, was developed in the papers by Achmetli and Schukajlow (who studied the interaction between the experience of competence and interest), Bofah and Hannula (who addressed the link between perceived social support and achievement), Zonnefeld (who focused on the effect of a course on mastery of statistics and attitude towards statistics), Morselli and Branchetti (who addressed the interplay between identity and rational behavior), and Vollstedt and Duchhardt (who found two meta-factors structuring the personal meanings into those showing an orientation to mathematics and to social inclusion). Only De Simone addressed the interplay between rationality and emotion with a focus on teachers, and not on students.

Interventions to promote affect were described only by Zonnefeld. The study of programs for promoting affect is therefore an issue that deserves further attention and is a promising avenue for further research.

Concerning the geographical representativeness of the authors in this volume, we note that Western Europe was predominant and Eastern countries were under-represented. It is noteworthy that contributing authors with an African origin were conducting their research in Western universities. Moreover, we may note that the studies here presented were predominantly concerning a single country. Only Kahlil, Lake and Johnson presented a comparison between US and English teachers and Bofah and Hannula dealt with a set of countries. We argue that cross-cultural studies, and studies addressing affective issues explicitly in reference to cultural contexts could be of interest for the research field. An increased focus on socially and culturally contextualized studies would also strengthen the social turn in research on mathematics-related affect.

For the purpose of identifying solid findings in our field, we need more experimental and longitudinal studies to confirm causal relationships between variables and cross-cultural comparative studies to confirm the universality of our findings. This is not an easy journey, as indicated by Bofah and Hannula's results, which showed that many of the relationships between gender, parental and teacher support, student affect, and mathematics achievement were not the same across the five African countries studied.

A potentially promising avenue for further research is examining the Mind-set theory as part of student beliefs. As shown in Zonnefeld's study, training students in incremental theories of intelligence was beneficial especially for female student's beliefs and achievement.

20.2 A Final Comment

The contents of this volume were spawned and loosely shaped by the material presented in Topic Study Group 28 at ICME-13. Underpinning both sets of endeavours is the importance of mathematics in and beyond the years of formal education. This reality was captured graphically by Australia's Chief Scientist: "What if we lived in a world without mathematics? ...Take away numbers, and you take away commerce, farming, medicine, music, architecture, cartography, cooking, sport... and every other activity we've invented since 3000 B.C." (Finkel, 2017, p. 3).

Widely accepted, too, is that both cognitive and affective factors influence students' learning of mathematics.

Individuals' attitudes, beliefs, and emotions play a significant role in their interests and responses to mathematics in general, and their employment of mathematics in their individual lives. Students who feel more confident with mathematics, for example, are more likely than others to use mathematics in the various contexts that they encounter. Students who have positive emotions towards mathematics are in a position to learn mathematics better than students who feel anxiety towards that subject (OECD, 2013, p. 42).

As testified by the different elements in this volume, identifying and capturing the various subsets of the affective domain continues to be a dynamic area of research. The snapshots and syntheses of work presented capture small but important links in the long chain of research on affect and mathematics and can serve as catalysts for further work. The challenge is to forge convergent rather than divergent pathways.

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