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Identity research in mathematics education

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Abstract This paper examines the literature on identity within mathematics education published in journals over the past two decades. It analyses the theoretical underpinnings, research methods and definitions of identity, providing a critique rather than a summary of the literature. A total of 188 articles from 85 different journals are reviewed in the sample. This review finds support for common complaints of this research area as lacking in definitions of the concept of identity and suggests that the writing in this topic is at times theoretically incompatible. Furthermore, the work in this field may be coming from two distinct paradigms. Identity may be seen as an action and fit within a sociological frame or it may be seen as an acquisition, fitting within a psychological framing. Defining identity as something we do, as an action, and in particular as performative is promoted in this paper. Finally, suggestions are made for future directions in identity research.

Keywords Identity · Performative · Literature review · Mathematics education

1 Introduction

If scholarly research is a conversation, then identity is a topic *dejour*, having enjoyed an explosion of research and discussion within mathematics education over the past two decades (Black, Williams, Hernandez-Martinez, Davis, Pampaka, & Wake, 2010; Cobb, Gresalfi, & Hodge, 2009; Lerman, 2012) and forming the subject matter of much current dialogue. A focus on issues of identity in mathematics education research is useful for a number of reasons. It can help us to theorise about mathematics learning in general, for example identity has been referred to by Sfard and Prusak (2005) as the "missing link" in the "complex dialectic between learning and its sociocultural context" (p. 15). It is related to issues of power (Gutiérrez, 2013) and access (English et al., 2008) and therefore to

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equity concerns. It also helps us to understand the participative experiences of the individual, for example exploring the reasons people may choose to continue or discontinue the study of mathematics (Black et al., 2010; Chronaki, 2005). Identity is a lens that is adjustable; one can zoom in (Lerman, 2001) to the level of interactions between individuals or zoom out to look at the wider socio-political context (Stinson & Bullock, 2012). We can look at the big picture, that is, at issues of mathematics learning in general. We can look at the experiences of specific groups of people and at issues of equity. Or we can look at the individual level and try to understand learners' relationships with mathematics. Whichever level of the zoom, identity provides a lens through which we can analyse, understand and deconstruct a situation (Stinson & Bullock, 2012).

However, there exists much theoretical and empirical writing on this topic which does not demonstrate consistent definitions, or awareness of how identity becomes used and, in some cases, does not include a definition at all (Bishop, 2012; Cobb et al., 2009; Lutovac & Kaasila, 2014; Sfard & Prusak, 2005). Without knowledge of the perspectives taken, how can we engage in a productive conversation within this area? How can we build appropriately on others' ideas and develop greater understanding about this topic without a common language or definition of the term?

The seventh Mathematics Education in Society conference, held in Capetown, South Africa, 2013, included more papers on identity than any other broad theme[1] and also a keynote on this topic (Chronaki, 2013). Despite many shared philosophical orientations by conference attendees, there was little cohesion and some conflict between the various positions taken by presenters. Such contrast provides an opportunity to consider the social and political issues of how identity becomes utilised, as came to the fore in this context.

The purpose for this literature review is to examine the writing within our discipline in order to analyse how we are using the concept of identity in empirical and theoretical research. For this review, I conducted a systematic search of the literature to obtain a large sample in a non-biased manner, to represent the way we write about identity in mathematics education. In doing so, I hoped to understand the different ways we use identity in our discipline and find new directions for this research.

The remainder of this article is organised in the following manner. First, I outline the methods I used to obtain the sample. Next, I present statistics characterising this literature. I follow this with a description and discussion of the differing ways identity is defined by researchers in mathematics education articles, producing evidence for the contrasting and conflicting views inherent in our discipline. I argue for a definition that takes a sociological perspective and enables analysis that takes account of the wider context. I conclude with a look at future directions for research in identity within mathematics education.

2 Method

I began by identifying some of the key databases in education available to me. I chose five databases in order to ensure I gained a wide coverage of "hits" in my search for mathematics education literature on identity. These were Education Sage Full text Journal Collection, Education Research Complete (EBSCO host), ERIC, JSTOR, and Proquest Education Journals. I accessed these databases in December of 2014.

[1] See http://mescommunity.info/

My search criteria within all of these databases was the same and as follows: "mathematics" AND "education" in any field AND "identity" in the abstract. I then repeated this search with the adjustment of specifying "identity" in the title so as to include articles which did not have an abstract. I combined the results of each search into a citation manager (Endnote); a total of 2529 citations. I removed 498 duplicated citations. Following this, I excluded all unpublished theses, reports and any non-academic or anonymous articles; this brought the total down to 1489.

The list needed to be further filtered in order for me to ensure all the citations were about mathematics identity in mathematics education. To do this, I read the title, journal and abstract for each. I excluded many articles about science or engineering which had been selected by the search engine because the descriptor STEM was used in the article. I excluded articles about other subject areas within education which were found because mathematics was mentioned as one measure of overall achievement. Articles that were about identity as a mathematical topic, for example trigonometry identities, were excluded. I excluded five articles which had misspelled identify in the abstract. I excluded conference proceedings because these were sometimes treated as book chapters in published proceedings and consequently many conference papers were not found by the search engines. For example, papers from PME conferences were included for some years and not for others. I was left with items from journals only, and of these, I excluded editorials and also book reviews. Finally, I excluded the articles not written in English.

For the remaining 283 citations, I read the entire article. As I read, I excluded those articles which were about identity but not about either mathematics identity or the professional identities of mathematics teachers. These other "types" of identity included gender-identity, racial- or ethnic-identity, community or national identity, youth identity and the identity of mathematics education as a research domain. Again in these articles, often mathematics was merely one measure of achievement rather than a focus for the study. A relatively large number of articles utilising the term "gender-identity" were researching stereotype threat in relation to mathematics performance. I should note that many articles concerned with gender, racial/ethnic or classed identities were also about mathematics identity, and consequently, these were included in the review. Finally, there were a few articles within which there was no discussion about identity and in some cases the word identity was not even mentioned again after appearing in the abstract. These articles, which were clearly not about identity, despite the initial use of the term, were subsequently excluded. This left me with a total of 188 articles included in this review.

The methodology employed here has a number of limitations. Although using five databases ensured a wide variety of publications, there was relatively little duplication. This suggests that extending the search to even more databases would have returned further articles of relevance. Also the more recent articles of 2014 were not yet available. However, it is assumed that those articles found were representative. All the major English language journals in the field were included and the selection was not biased. The decision to include only journal articles provides a limitation as there is much literature which advances our ideas on identity published in different forums, notably conference proceedings and books or book chapters. "*Mathematical Relationships in Education*: *Identities and Participation*" (Black, Mendick, & Solomon, 2009) and "*Becoming a Mathematics Teacher*: *Identity and Identifications*" (Brown & McNamara, 2011), for example, prompted many book reviews in academic journals. These are demonstrably significant works but are not included in this review. My monolingualism created a further limitation. Only reviewing the articles written in

English generated an exclusively "Western" view of the concept. This fact should be considered when reading the results and interpretations.

I "read" each article in an attempt to gain insight into the way in which identity was understood by the writer. I looked for clear statements made about the definition of identity. When work was cited, I paid attention to the purpose for the citation, whether simply a mention of other work in identity or helping to develop the concept of identity employed by the author/s. However, clear statements were not common: often I traced somewhat tenuous links between the "influence" and the position taken by the author/s, and this was a subjective process affected by my own personal limitations of time, space, language, and prior understandings. When reading the articles, I was particularly critical of whether the methods, data analysis or conclusions fit with the definitions or theoretical framework explicated by the authors. I acknowledge that there are many different critical glasses one may wear when reading others' work, and my focus on these aspects will have blinded me to other potential areas for critique (see for comparison Lerman, 2006; Pais & Valero, 2012).

When analysing the articles, I looked at the following: Year of publication, journal of publication, location of study, type of study, number of participants, whose identity was studied, whether the participants came from a specific social group (for example males, Latina students, "urban" children), the definition of identity given and finally which other writers on identity were drawn from in developing this definition, those both within and outside of mathematics education. Each of these will be discussed briefly below.

3 Characterising identity articles: Statistics

Increasing numbers of articles confirm identity to be very topical within mathematics education research (see Fig. 1). If the 1980s and 1990s saw a "social turn" (Lerman, 2000) in mathematics education research, it seems the 2000s and beyond suggest an "identity turn" within social perspectives of our discipline (Chronaki, 2013). Note that because the most recent journal issues were not accessible in the databases, it is likely that the drop in 2014 is artificial. A search within recent issues of mathematics education journals confirms there are some 2014 articles on identity missing from the sample for this reason.

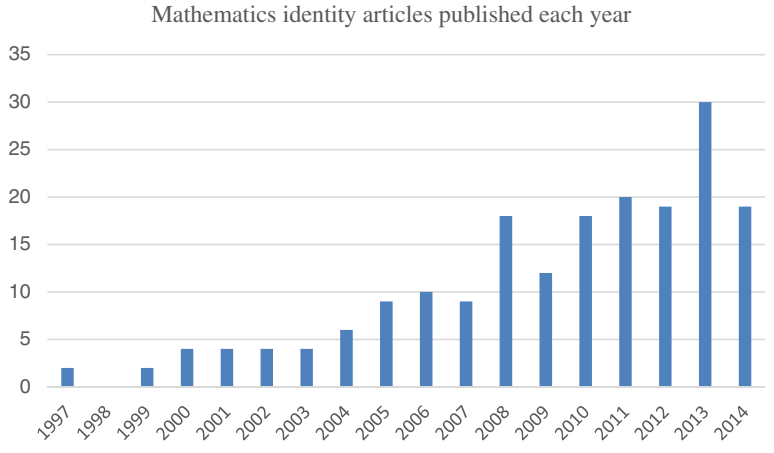

Fig. 1 Sample articles about mathematics identity by year published

The articles were published in 85 different journals, only 19 of these mathematics education journals. However, these mathematics journals published 94 (50 %) of the articles. For example, there were 18 articles in *Educational Studies in Mathematics*, 15 articles in *Journal for Research in Mathematics Education*, ten articles in each of *Journal of Mathematics Teacher Education* and *Research in Mathematics Education* and eight articles in *For the Learning of Mathematics*. The other half of the articles in mathematics identity research found their home in general education journals such as *Teachers College Record*, *Perspectives in Education* or *American Educational Research Journal* for example.

The largest number of studies were located in the US (36 %), 15 % came from the UK, 11 % from Europe and 5 % from each of Australia, South Africa and New Zealand. Twenty-four (13 %) of the articles were theoretical pieces rather than empirical studies and in only a few of these was the location relevant and stated. It was at times very difficult to ascertain the place of study, and in nine percent of the cases, I was unable to determine the location for the study with any certainty. Studies appearing to come from the USA and the UK in particular did not always explicitly specify the location.

There were many different types of studies. Most employed qualitative methods such as interviews, observations, video analysis, autobiographies, and document analysis. In general, the articles presented data from a relatively small number of participants. Of the empirical articles, 17 (9 %) reported on studies of more than 100 participants. Many articles presented case studies drawn from larger studies. Ten per cent of the articles reported on one participant and a further 12 % on two participants. Most (58 %) of the articles reported on fewer than ten participants. This suggests that identity is seen as a complex concept requiring detailed descriptions of individuals rather than generic findings of larger groups. Almost 5 % of the articles did not specify the number of participants.

Half of the articles (50 %) focussed on students at various levels from elementary or primary school through to undergraduate mathematics students at university. Studies focussing on teachers (28 %) and pre-service teachers (17 %) looked either at professional identity of mathematics teachers or at mathematical identity of teachers in general. Some studies (2 %) looked at the identities of both teacher and students in a classroom, and the other studies focussed on other types of participants such as "mentors", domino players, newspaper readers or the authors' own mathematics identities.

Fifty-seven (30 %) of the articles were also concerned with social identity. By social identity I refer to common categorisations of "identity" such as gender, race/ethnicity and class/socio-economic status. Of these articles, 26 concerned race or ethnicity (19 of these articles were about African American participants), 21 considered gender and 9 considered class or socio-economic status (some were concerned with two or three of these categories). Other groups of people specifically researched were English language learners, immigrants, low achievers, or the generic "underserved" members of society. These articles investigated the ways in which these groups of students do (and do not) manage to merge their social identities with their mathematical identities and were concerned with equity issues. Other articles, including theoretical pieces, also touched on these issues of equity. This suggests that identity research is indeed a vehicle in which some mathematics educators investigate students' experiences of marginalisation in schooling.

As typical for writing within mathematics education, the authors drew from a wide range of literature in defining identity, including much work from outside the field of mathematics and even outside education. The largest outside influences on identity appear to be Wenger (1998) and/or Lave and Wenger (1991): 41 % of articles drew from these writers when defining

identity. Holland and colleagues (1998) were drawn on by 20 % and Gee (2000) utilised by 18 %. Within mathematics education, commonly cited writers were Sfard and Prusak (2005) at 21 %, Boaler and colleagues (e.g., Boaler & Greeno, 2000) at 18 % and Martin (2000; 2012) at 12 %. These figures may appear low. I only counted those who were cited as contributing to the discussion and development of a definition for identity. If I had simply counted number of citations, these figures would be higher.

Authors who followed the definitions of Wenger (1998), Sfard and Prusak (2005) or Martin (2000) in general made very clear the theoretical frame they were drawing from but not always their choice of that particular theoretical frame. Some authors were explicit with their own definition, and the data collected were appropriate for their view of identity and the conclusions made consistent with the original definition. However, this level of theoretical coherence was not found across the range of articles.

In some articles, no definition for identity was given at all. These writers reviewed the identity definitions of others but failed to state which of these they followed. In others, rather than a definition per se, the authors gave a description of how identity may be formed instead. Further, in some cases, writers instead defined learning as it related to identity. In general, I found support for the notion that identity literature within mathematics education is poorly defined.

4 Defining identity

Identity can be broadly defined as participative, narrative, discursive, psychoanalytic or performative. Each of these ways of defining identity take into consideration the social context as constructive of identity, and each are represented within the mathematics education literature. The nebulous nature of the construct of identity means any categorisation is a subjective process. Others can, and have, grouped identity definitions in different ways (e.g., see Black et al., 2009). The following section contains a comparison of definitions with a small selection of examples. These examples were chosen from the larger sample to illustrate the theoretical antecedents and the contrasting and overlapping nature of identity definitions in articles reviewed. I chose to include here articles which were clearer regarding their position defining identity, yet lamentably constraints of space prevent the inclusion of all.

Participative identity refers to identity definitions which look at the ways in which identity is constructed through participation and engagement in a social group. Many writers with this view draw from Wenger's (1998) notion of "communities of practice" or from figured worlds (Holland, Skinner, Lachicotte, & Cain, 1998). Boaler's work (Boaler, 1999, 2002; Boaler & Staples, 2008) uses both communities of practice and figured worlds to theorise about the context in which students develop their identities as mathematics learners. Solomon (2007b) applies Wenger's (1998) "social ecology of identity", which includes engagement, imagination and alignment as modes of belonging, to explore identities of undergraduate students. In other work, Solomon (2007a) combines Wenger's model with Gee's (2000) four types of identity in her analysis. Her later work has increasingly used the work of Holland and colleagues (1998), applying discursive positioning to understanding learners' development of "fragile" identities (Solomon, Lawson, & Croft, 2011) and also using Bakhtin's theory of dialogism (Solomon, 2012). Nasir (2002) also uses Wenger's modes of belonging. In later work, she looks at access and opportunities to take on integral roles and at opportunities for self-expression (Nasir & Hand, 2008). Increasingly, her focus has been on issues of power and identity for these students (Nasir & de Royston, 2013).

Wenger's (1998) work also appears particularly useful for those researching into pre-service and novice teachers experiences of becoming a teacher (Friedrichsen, Lannin, Abell, Arbaugh, & Volkmann, 2008; Goos & Bennison, 2008) as well as in-service teachers' experiences in professional development programmes that operate as communities of practice (Graven, 2003, 2004). The concept of figured worlds may equally be applied to research on pre- and in-service teachers (Horn, Nolen, Ward, & Campbell, 2008).

Another often cited work on identity is the research of Martin (2000). He attends to the contexts of "being Black" and of "learning and doing mathematics"(Martin, 2012, p. 59). On one hand, Martin defines identity as a set of beliefs, but he also states that identity is negotiated and looks at participation within "masternarratives" of, for example, failure for African American youth. Martin's work has been taken up by others within mathematics education (Chazan, Brantlinger, Clark, & Edwards, 2013; Cobb et al., 2009; Stinson, 2008, 2013) particularly those with an interest in learning experiences and identity for African American students.

While Martin uses the concept of "masternarratives", narrative identity, by contrast, refers to a view of identity that makes use of the stories people tell, about mathematics for example. Some using this definition draw from the area of narrative inquiry (Connelly & Clandinin, 1990). For example, Kaasila (2007a) uses the notion of "mathematical biography" to understand student or teacher identities in mathematics. He uses narrative analysis methods such as looking for turning points and key episodes in a participant's story (see also Kaasila, 2007b; Kaasila, Hannula, & Laine, 2012; Lutovac & Kaasila, 2014). Williams (2011) in contrast uses an understanding of narrative identity drawn from Holland et al. (1998) and incorporates the concept of figured worlds.

Sfard and Prusak (2005) provide a definition of narrative identity taken up by many within the discipline (e.g., Andersson, 2011; Bishop, 2012; Heyd-Metzuyanim, 2013; McCulloch, Marshall, DeCuir-Gunby, & Caldwell, 2013). They state that identity is the set of stories people tell about themselves and others tell about them, specifically narratives that are "*reifying*, *endorsable* and *significant*" (Sfard & Prusak, 2005, p. 16, italics in original). The job of the researcher is made easier because these stories are not considered to be reflective of identity, rather, the stories are the identities themselves. In practice, the use of Sfard and Prusak's definition of identity entails close attention to the words used by students and other participants and in this manner is much like discourse analysis (see Heyd-Metzuyanim & Sfard, 2012).

Writers who take a view of identity as discursive may hold different understandings of the term "discourse". Those who draw from Gee (2000, 2011) are likely to discuss "the spoken and written words, semiotic systems, representations, and gestures of participants as they use language to communicate, interact and act" (Bishop, 2012, p. 44). Alternatively, much research using discourse identity is post-structuralist, understanding "discourse" as the wider societal meta-narratives, for example Mendick's (2005) work on identity. Mendick and her colleagues have also investigated representations of mathematics in the media (Epstein, Mendick, & Moreau, 2010) mapping the effects of these discourses of mathematics. Those working within this view of identity often draw from the work of Foucault. Llewellyn (2009) explores identity from a post-structural perspective. She follows Mendick in arguing that mathematics is constructed as masculine and draws on Foucauldian analysis in order to do this. Writers such as Llewellyn and Mendick also draw on Walkerdine (1989, 1998) to explore the ways in which girls are subjectively constructed within mathematics. Although Walkerdine did not write on identity specifically, her ideas have been taken up by writers in this field, particularly those utilising terminology such as "positioning" and the "subject".

Others who draw from Walkerdine take a psychoanalytic view of identity. Walshaw (2010), for example, uses psychoanalysis in her work on identity. She incorporates post-structural analysis to look at gendered identifications (Walshaw, 2005) and re-reads Foucault using the term identity to look at the social organisation of power (Walshaw, 2013). A psychoanalytic view of identity can also deepen or critique other, more "face value" ways of looking at identity (Bartholomew, Darragh, Ell, & Saunders, 2011).

Positioning theory examines social interactions within the paradigm of social constructionism (Harre & van Langenhove, 1999). Although not explicitly about identity, the terminology and ideas of positioning have been taken up by a range of writers on mathematics identity, often in conjunction with other views of identity, such as participatory identity (Turner, Gutiérrez, & Sutton, 2011), using the concept of figured worlds (Holland et al., 1998). Wood (2013), for example, uses positioning theory to look at "micro-identity", that is, identity enacted in a moment of time. Esmonde (2009) comments that "[w]hereas the term identity may carry the connotation of an enduring, static, essentialized self, positioning points to the ways in which one does not have an identity but, rather, inhabits or invokes multiple identities or identifications" (p. 1012, italics in original). Esmonde uses these ideas to examine issues of equity in cooperative mathematics learning. Similarly, (Gutierrez, 2009) uses positioning theory together with identity to advocate for equitable teaching for marginalised groups and argues for socio-political research to address issues of power and equity (Gutiérrez, 2013).

Positioning is derived in part from the work of Goffman (1959), who likened the performance of the self to the theatre. Performative identity more typically derives from Butler (1988, 1997) who writes about gender as being performative. This is the stylised repetition of acts over time that works to constitute one's identity. She makes clear that identity does not exist prior to the performance, rather it is constituted through performance. Butler is drawn on by some who work on identity within mathematics education (e.g. Chronaki, 2011; de Freitas, 2008; Gutiérrez, 2013; Neumayer-Depiper, 2013). However, the language of performance sneaks its way into much writing about identity, even when the identity definition does not specifically understand identity in this way. For example, Holland et al. (1998) use the term "dramatized worlds" (p. 53) as another term for figured worlds and Gee (2000, 2011) writes of "enacting" identities by speaking or writing in a particular way.

This very brief summary is by no means comprehensive, and there are many other theorists influencing writing on identity (e.g., see Bernstein, 2000; Bruner, 1991; Ricoeur, 1992), each of whom write about and influence our understandings of identity in very different ways. However, it is also clear that views of identity are far from distinct. They overlap at many places and authors often choose to blend the ideas from a number of different viewpoints.

5 Discussion

Cutting across these broad categories, another way of looking at the different views of identity is as an action or an acquisition, or according to whether identity is a process, or something we have inside of ourselves. Gutiérrez (2013) distinguishes between the socio-cultural and the socio-political by stating that those coming from a socio-political category view identity as something we do rather than something we are. In doing, so she directs attention to a major difference found in the discussion of identity within mathematics education.

To explain the difference between these viewpoints, it is useful to look at the antecedents of the term "identity". Erikson was "the key figure in putting the word [identity] in circulation"

(Gleason, 1983, p. 914). He coined the term "mid-life crisis" but also described an earlier "identity-crisis" as occurring around puberty (Erikson, 1968). His perspective on identity involves the notion of obtaining a core and stable identity. Popular use of the word identity may derive from this Eriksonian perspective. However, another "father" of identity was G. H. Mead (Da Silver, 2011), a sociologist writing earlier last century. Mead (1913/2011) describes the self in a way that incorporates an artificial split between the "I" and the "me" and illustrates the way the "self" becomes "other" to itself and thus constructs identity. Mead's perspective includes a notion of identity as multiple, sometimes contradictory, and performative (Lerman, 2012). These two views of identity are distinct, as made clear by Holland and Lachicotte Jr. (2007):

> An Eriksonian "identity" is overarching. It weaves together an individual's answers to questions about who he or she is as a member of the cultural and social group(s) that make up his or her society. A Meadian identity, on the other hand, is a sense of oneself as a participant in the social roles and positions defined by a specific, historically constituted set of social activities. Meadian identities are understood to be multiple […] and they may reflect, for example, contradictory moral stances. Eriksonian approaches, in contrast, attribute psychodynamic significance to achieving a coherent and consistent identity that continues over the course of adulthood. (p. 104)

Erikson understood identity as an acquisition, something that one has and that becomes coherent and consistent. A Meadian identity is an action, it is something one does, and it is multiple, contradictory and socially constituted.

Many of the key theorists drawn on by mathematics education researchers would fit their definitions within a Meadian view. Identity is generally agreed to be multiple or referred to in the plural. Furthermore, these influential theorists treat identity in terms of an action rather than an acquisition. Wenger (1998) sees identity as "not an object, but a constant becoming" (pp. 153–4). Holland et al. (1998) define identity as "self-understandings" but go on to describe "identity-making processes" (p. 3), which treat identity as a verb. Gee (2000) claims that identity is making a bid to be recognised as a certain type of person. These all describe identity as an action. Similarly, Boaler (2002) sees identity as involving a relationship with knowledge construction; Sfard and Prusak (2005) equate identity with the telling of a story, an action. Martin (2012), however, bridges the acquisition-action divide, defining identity as a set of beliefs (something that can be acquired) and also looking at identity in using mathematics to change the conditions of one's life (an action).

Some of the reviewed literature used definitions that made clear an understanding of identity as something we do. This can be seen in the use of terms such as identity work, talking about identity as something we use, as a process or when describing identity as enacted or performed. Those who use the terminology of identity work are interested in the multiple and often conflicting identities people construct. Chronaki and Matos (2014) use this term to describe teacher change in the context of technology use. Mendick (2005) utilises "identity work" to interpret the stories about mathematics given by girls. Hossain, Mendick, and Adler (2013) use the construct of "identity work" to look at the way prospective mathematics teachers may position themselves within or against dominant discourses of a mathematics development course. Kaasila (2007a) draws on Maclure to define identity as "a resource that people use to explain, justify and make sense of themselves in relation to others, and to the world at large" (MacLure, 1993, p. 311, abstract). Hegedus and Penuel (2008) describe identity as an action in which people position themselves by appropriating and using resources in

social situations. Owens (2007) describes identity as the doing of mathematics and as a state of becoming. Graham and Selmer (2010) use role play to promote change in the professional identity of future literacy and mathematics teachers. The notion of "accessing" and "performing" identity fits well with socio-political analysis in mathematics education (Gutiérrez, 2013; Nasir & de Royston, 2013).

In contrast, there is also much research which discusses identity as being something that an individual has inside of themselves. For example, Cobb et al. (2009) clearly define identity using a situated perspective. Yet they also talk about "core identity" (drawn from Gee, 2000) which, although flexible and socially constructed, implies something internal to the individual. Anderson (2007) uses the metaphor of a tetrahedron to describe four "faces" of identity. This metaphor, and particularly the "nature" face, also drawn from Gee (2001), converts the discussion of identity into one of attributes rather than the modes of belonging as described by Wenger (which form the other three faces). Another attribute treated as if it were identity is that of beliefs. Jita and Vandeyar (2006) discuss identity as if it were about dispositions toward and beliefs about mathematics teaching. Naidoo and Parker (2005) draw on Bernstein's notion of a subject identity and treat identity as synonymous with philosophy of teaching. While Grootenboer (2013) acknowledges the problematic exercise of defining identity, he utilises an understanding of identity to be mathematical knowledge and skills as well as beliefs, values and attitudes.

Within such framing identity is seen as a catch-all term for affect. These definitions appear to capitalise on identity as a trendy new word, perhaps adopted to replace, or to be more general than, the term "affect". Mathematics education has a strong research tradition in the affective domain. Research which looks at beliefs, goals, motivation, attitude and mathematics anxiety, for example, is undoubtedly an important area. But is it about identity? Beliefs, goals and motivation are all things that people have and as such may fit with a psychological view of identity. Alternatively, beliefs, knowledge and attitude can be seen to influence people's identity enactments—without being considered identity in itself (see also Goos, 2013). The area of affect makes a valuable contribution to mathematics education, but the domain does not need to be re-branded as identity. Doing so muddies waters already filled with a variety of definitions.

However, a bigger problem exists when researchers fail to consider the difference between action and acquisition within the same article. These writers discuss identity as if it were an acquisition despite having defined identity using a theoretical frame that views identity as an action. In doing so, they talk about identity in theoretically inconsistent ways. The problem is that many writers seem to draw from the broad theories aligning with the Meadian, sociological, approach to identity, and yet discuss their data and participants as if identity resided within the individual's core and then attempt to measure it. This has been described as succumbing to the popular conviction of a true self residing "somewhere inside, in some privileged space" (Gubrium & Holstein, 2001, p. 1). Taking a psychological perspective on research about individuals' relationships with mathematics is not necessarily problematic: the problem lies in the act of defining identity in a contradictory manner to the methods used and conclusions drawn. This happens, for example, when identity is defined using a sociological frame and then a psychological understanding is used to analyse the individual.

Can we combine the action and acquisition views of identity? Klein (2012) talks about having her "cake" and eating it too. She uses both psychology and post-structuralism as a bi-focal lens through which to understand interaction patterns in pre-service teacher development. However, Klein uses the psychology lens to see how the participants make sense of

mathematics and the post-structuralist lens for how they make sense of themselves, that is, identity. Jaworski (2012) distinguishes between "personhood" and identity; personhood being the term to consider the psychological aspects of self and identity being that which is formed in relation to the social context. While using both psychological and sociological perspectives in their research, these authors situate the construct of identity firmly in the sociological.

6 Conclusions and future directions

This paper attempts to generalise the ways in which we talk about identity within the mathematics education community. However, by focusing on definitions and theoretical frames, I have drawn attention away from other important foci that may have been considered in its place. In particular, this review has highlighted the concerns of the westernised world over those of researchers in other areas. It is very possible that identity is a "first world problem", the concern of researchers in nations where access to quality education is not the issue and there exists the luxury of considering individual and social group relationships with mathematics.

Secondly, in this article, I have perpetuated a dichotomy within the identity literature of mathematics education and I wish to acknowledge that all dichotomies are problematic. There are of course understandings of identity that do not fit easily into one camp or the other (Martin's work is an example). However, I hope this demarcation helps to clear otherwise muddy waters. Identity is a research area with much to offer, as demonstrated by the wide range of scholarship discussed here. With more clarity, the concept of identity can continue to provide helpful insights into our experiences of learning mathematics.

Identity is worthy of being more than a "fad", so long as we ensure we are clear of which conversation we are a part. There is certainly evidence in our writing that we are not always talking about the same thing when we talk about identity, and we can see this in the contrasting conversations about identity as action and as acquisition. It is essential that we make clear our understandings of identity when discussing our research and also situate our research within the appropriate theoretical frame, be that sociological or psychological.

Furthermore, I suggest that by defining identity as something we do, be it identity-work or identity as performative, we form a sociological understanding and distinguish this concept from the others of a psychological paradigm. This sociological perspective of identity provides us with the opportunity to differently view peoples' experiences of mathematics learning and teaching; it provides something new. We also widen the lens from the individual to address issues of context, social groupings and power (Gutiérrez, 2013).

I find it useful to think about identity as action, specifically performance, and in this way it is distinct from a psychological view. I see identity as the performance and the recognition of the self. It exists in the moment of the performance and as it is recognised. We perform our selves—be it by telling stories, joining groups, acting in a particular way at a particular time, positioning ourselves and others within wider societal discourses. In these ways, our identities are performative, we act them into being (Butler, 1988) and past acts influence those in the future. Furthermore, identity is a result of the process of identifying, whether this is self-identification or identification by others. This view of identity keeps in mind the audience at all times as the ultimate identifier and enables us to consider the ways in which power is exerted in this recognition. Perceiving identity as an act, a performance that may or may not be recognised as desired, is a useful future direction for research. It is in this direction that the study of identity has much to offer.

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