# The citizen in light of the mathematics curriculum

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In this article, the mathematics needed for citizenship is discussed in relation to the Swedish curriculum. The article considers two approaches for discussing mathematics as demanded by, or developed within, a society: *mathematical literacy* and *ethnomathematics*. These approaches provide an alternative understanding for school mathematics in relation to citizenship. In reconsidering the expectations upon the future citizen produced from implementing the curriculum, an argument is made for the curriculum to include elements from critical and socially responsible mathematics education, which include elements of ethnomathematics and mathematical literacy. Such reconsideration is necessary because the transfer of mathematics from school to the outside world is not a straightforward matter. Therefore, it is essential that more focus is directed at citizens in the curriculum, and the transitions they undertake during their trajectories in life, to and from school.

**Keywords***: citizen, curriculum, ethnomathematics, mathematical literacy, transition*

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## Introduction

The aim of this article is to consider how school mathematics is connected to *citizenship* in the Swedish curriculum. This is related to that of determining the mathematics that every citizen needs, for instance to meet requirements for getting a job, to handle mathematical activities in order to cope with everyday issues or to understand and change society. The notion of citizenship in this article is connected to the mutual process between the society and the citizens in which the citizen is seen as having an active part in this dual interplay (EPACE, 2010).

Wedege (2010) suggests that determining the mathematics that every citizen needs has to do with two types of "knowing mathematics in the world". The first type is knowledge *developed* in everyday life, for example, ethnomathematics, folk mathematics, and adult numeracy. The second type is knowledge *wanted* in everyday life, such as mathematical literacy, mathematical proficiency or mathematical competence. We draw on this distinction using the labels *ethnomathematics* and *mathematical literacy* as analytical constructs in order to interpret what is required of the citizen, as expressed in the curriculum. This should be regarded as a way of approaching understanding, rather than creating or interpreting a dichotomy, as the problem is far more complex. It can be understood as dividing school mathematics and the curriculum along practical and theoretical considerations. However, this can be counterproductive, or, as stated by Atweh and Brady (2009), when discussing real world applications versus the dominant discourse of formalised academic mathematics:

> Seen in this way, the intellectual quality of mathematics is measured primarily from within the discipline itself rather than the usefulness of that knowledge for the current and future everyday life of the student. (p. 271)

In focusing on the mathematics that is considered necessary for citizens, we do not discuss mathematics as an academic discipline per se, nor will we focus on the mathematical context. Instead, our intention is to focus on the relationship between the citizen, the mathematics s/he is supposed to need, and the mathematics s/he is supposed to develop in relation to what is written in the curriculum.

Ethnomathematics is connected to the mathematics people develop in everyday life. It focuses on cultural practices, which can be considered related to mathematics and power (Knijnik, 1999; 2012). According to

D'Ambrosio (2001; 2010), an ethnomathematical approach can contribute to peace, equity and human dignity. Research using an ethnomathematical perspective reflects many foci, such as recognising uses of mathematics in different cultures or on its contribution to a more global and just society (Evans, Wedege, & Yasukawa, 2013).

Mathematical literacy also has various foci, aims, and implications. For the purposes of this article, this perspective is interpreted as a view on what people need. Jablonka (2003) writes on how mathematical literacy can be interpreted and states that mathematical literacy:

> may be seen as the ability to use basic computational and geometrical skills in everyday contexts, as the knowledge and understanding of fundamental mathematical notions, as the ability to develop sophisticated mathematical models, or as the capacity for understanding and evaluating another's use of numbers and mathematical models. (p. 76)

Therefore, it seems appropriate to label the mathematics that people need as mathematical literacy. Jablonka (2003) also notes that mathematical literacy is "about an individual's capacity to *use* and *apply* [mathematical] knowledge" (p. 78). The way mathematical literacy is understood by PISA (OECD, 2006) is similar, but with an emphasis on the individual's responsibility to determine the mathematics they need as citizens:

> *Mathematical literacy* is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen. (p. 72)

Explicitly, the PISA definition connects mathematical literacy to the citizen's ability to be reflective; although it is not fully clear upon what the citizen should reflect or even who the citizen is.

Using the analytical constructs of ethnomathematics and mathematical literacy, we outline the structure for the discussion in the following section. We then consider how the Swedish curriculum reflects the different constructs. Using these labels provides insight into the relation between how the citizen is mentioned in the curriculum, both as an issue of demands from the society, in terms of mathematics and also whether there might be an interest in what the citizen could develop through that curriculum. We will also discuss how citizenship is described in the curriculum, and suggest how such a discussion could contribute to a deeper understanding of the mathematically literate citizen and the understanding of her/him in the curriculum. However, we are aware that there are many different viewpoints and stakeholders within the field of mathematics education. Undertaking the challenge to investigate a field of which we are a part has consequences. Bourdieu (2004) notes:

> A scientist is a scientific field made flesh, an agent whose cognitive structures are homologues with the structure of the field and, as a consequence, constantly adjusted to the expectations inscribed in the field. (p. 41)

There is a need to be aware of this dilemma. We have been exposed to school mathematics, as well as having exposed others to it. This has given us insight that we could not possibly have gained from the outside. Trying to be reflexive, we aim to understand how different standpoints within the field of mathematics education may have influenced, or should influence, the curriculum. For this purpose, we have chosen to examine a body of literature, which includes seminal articles written by leaders in their respective fields.

Our point of departure is social, critical, and inspired by the s*ociomathematical* perspective (Wedege, 2004; 2010), in which the citizens' relationship to mathematics is in focus. Further, the interplay between general structures and subjective matters is stressed in the sociomathematical perspective (Wedege, 2004; 2010). We suggest that understanding more about what the curriculum states regarding the citizen and mathematics could highlight the possible tension between what is relevant for the citizen and what is required from society.

## The Swedish curriculum

In Sweden, school is compulsory until the ninth year, when students are sixteen years old. Upper secondary school is voluntary, although almost every student attends, as requirements from society make it, in reality, compulsory. Consequently, what is expressed in the curriculum is what, as interpreted by Skolverket (The Swedish National Agency for Education), is seen as needed for students who become future citizens. Although Swedish students can attend different senior secondary programs (in natural science, social science, and pre-vocational), in the core area of mathematics, topics and competences are the same.

The Swedish mathematics curriculum is divided into *core content* and *competences*. These are listed in tables 1 and 2. *Core content* refers to what should be taught in mathematics classrooms, while *competences* refer to the skills the students are expected to develop and, therefore, provide the framework for assessment (Skolverket, 2011b). Table 2 outlines some features or ambitions that connect to the world outside of school. In the same table, we include PISA's overarching ideas and competences. By doing this, we are not making any particular assumption; instead, we are showing how the Swedish curriculum is not an isolated national phenomenon.

In describing how the mathematics curriculum was designed, Skolverket (2011a) refers to drawing from "international experiences". While no direct reference is made in this document to PISA, there are similarities between PISA's definition of mathematical literacy and the Swedish mathematics curriculum. In later reports from Skolverket (see e.g. Skolverket, 2012), there are references to PISA, indicating that PISA was something that Skolverket was aware of when the new curriculum was being written. In Table 1, it can be seen that PISA uses the term "overarching ideas", whilst in the Swedish curriculum, the correlating term is "core content".

When it comes to the competences, there are further similarities and these can be seen in Table 2. However, the Swedish curriculum stresses that students should be able to "relate mathematics to its importance and use in other subjects, in a professional, social and historical context". This is one difference between the Swedish curriculum and PISA, as these competences are mentioned by PISA only as the role mathematics plays in the world. Nevertheless, there are similarities between this in the Swedish curriculum and PISA's definition of mathematical literacy provided earlier.

Table 1 (OECD, 2006; Skolverket, 2011b)

| **PISA's overarching ideas** | **Core content in Swedish mathematics curriculum** |
|---|---|
| Quantity | Understanding of numbers, arithmetic and algebra |
| Space and shape | Geometry |
| Change and relationships | Relationships and change |
| Uncertainty | Probability and statistics |

Table 2 (OECD, 2006; Skolverket, 2011b)

| PISA's competences | Competences (förmågor) in Swedish curriculum |
|---|---|
| Thinking and reasoning | Follow, apply and assess mathematical reasoning. |
| Argumentation | - |
| Communication | Communicate mathematical thinking orally, in writing, and in action. |
| Modelling | Interpret a realistic situation and design a mathematical model, as well as use and assess a model's properties and limitations. |
| Problem posing and solving | Formulate, analyse and solve mathematical problems, and assess selected strategies, methods and results. |
| Representation | - |
| Using symbolic, formal and technical language and operations | Use and describe the meaning of mathematical concepts and their inter-relationships. |
| Use of aids and tools | Manage procedures and solve tasks of a standard nature with and without tools. |
| - | Relate mathematics to its importance and use in other subjects, in a professional, social and historical context. |

The outcome of school mathematics is likely to be related to the curriculum and may influence the citizen and his/her life trajectories in many possible ways. Therefore, what needs to be problematised is how mathematics education could provide the students with a foundation for active citizenship, or question if this is even possible. What does it mean to be an active citizen, and how is it connected to the specifics requirements in the mathematics curriculum?

In order to problematise and discuss these issues, we examine in the following section what the two approaches, mathematical literacy and ethnomathematics, contribute to the role that mathematics plays in producing certain kinds of citizens, according to the curriculum.

## Mathematical literacy

Wedege (2010) stated: "it is obvious that any definition [of mathematical literacy] is value based and related to a specific cultural and societal context."(p. 31) Understanding these values is connected to *who* makes the definition (Jablonka, 2003). The definition from PISA on mathematical literacy is based on the assumption that mathematical knowledge has a functional value (Wedege, 2010). It "deals with the extent to which 15-year-old students can be regarded as informed, reflective citizens and intelligent consumers" (OECD, 2006, p. 72).

PISA's definition of mathematical literary seems to stress the importance of the citizen to be "concerned and reflective." Although the inclusion of "intelligent consumers," partly contradicts this intention, as the meaning of being a consumer is not questioned. We find another contradiction between the statement: "…in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen" and "*every country needs* mathematically literate citizens to deal with a very complex and rapidly changing society" (OECD, 2006, p. 76, our italics). These statements could form a contradiction if the citizens' wellbeing and self-fulfilment conflicts with providing society with a sufficient work force.

PISA's definition of "mathematical literacy" is one of many, as the terminology varies among researchers. These standpoints are value based and one aim seems to be to avoid what is "too basic". For instance, Hoyles, Noss, Kent, and Bakker (2010) suggest that numeracy and mathematical literacy are not sufficient for describing, for example, advanced workplace mathematics. They use the term *technomathematical literacy* to describe workers' competence to communicate by means of mathematical and specific technological tools.

Kilpatrick's (2001) definition is closer to that of PISA's, but he also suggests the word *literacy* to have a value-based connotation; therefore, he uses the notion *mathematical proficiency* instead. Within this, he defines five strands:

> (a) *conceptual understanding,* which refers to the student's comprehension of mathematical concepts, operations, and relations; (b) *procedural fluency,* or the student's skill in carrying out mathematical procedures flexibly, accurately, efficiently, and appropriately; (c) *strategic competence,* the student's ability to formulate, represent, and solve mathematical problems; (d) *adaptive reasoning,* the capacity for

> logical thought and for reflection on, explanation of, and justification of mathematical arguments; and (e) *productive disposition,* which includes the student's habitual inclination to see mathematics as a sensible, useful, and worthwhile subject to be learned, coupled with a belief in the value of diligent work and in one's own efficacy as a doer of mathematics. (p. 107)

Kilpatrick et al. (2001) further suggest that these strands are interwoven and interdependent, and should equip students with the ability "to cope with mathematical challenges of daily life and enable them to continue their studies of mathematics in high school and beyond" (p. 116).

The various definitions of mathematical literacy seem to have a commonality in the focus on different strategies, strands and procedures. In this approach, it seems as if these procedures are considered important for the citizen's wellbeing and ability to cope with issues of everyday life.

The term *mathematical literacy*, as well as other related terms, is not used in the Swedish curriculum. However, there are statements which seem to suggest that there is in the curriculum the sort of mathematics that students need for active citizenship:

> The upper secondary school should provide a good foundation for work and further studies and also for personal development and active participation in the life of society.

The subjects, which mainly contribute to providing a good foundation for personal development and active participation in the life of society, are the upper secondary foundation subjects [e.g. mathematics] (Skolverket, 2011a, p. 8)

The role mathematics could play in contexts such as the social and the professional is taken into account in the ethnomathematical approach, which instead focuses on cultural aspects of mathematics and, hence, diversity and equity due to the connection between power and culture (Knijnik, 2012).

## Ethnomathematics

Following Wedege (2010), we interpret the ethnomathematical approach as mathematics developed outside of school contexts, also with the potential to be of interest for school and for informing curricula (Meaney & Lange, 2013).

Ethnomathematics is not only about practical mathematics, but offers an approach focusing on interpreting mathematical activities exercised in different groups. Ethnomathematics is described by D'Ambrosio (2010) as relating to the mathematics practiced by different cultural groups, such as workers, indigenous societies, and other groups with shared traditions and objectives.

Ethnomathematics aims to link tradition and modernity, and it provides an alternative to the Western influence in mathematics education (D'Ambrosio, 2001; 2010). This focus on the cultural practices of different groups questions the domination of Western culture within school mathematics because of its exclusion of large sectors of the world's population (D'Ambrosio, 2010).

Another path within the ethnomathematical approach aims to recognise cross-cultural mathematical activities practiced by groups of people within, for example, different workplaces (Evans, Wedege, & Yasukawa, 2013; Wedege, 2010).

In ethnomathematics, a central element is the notion of culture (Knijnik, 1999; 2012) and different cultural uses of mathematics, which also reflect power relations and hierarchies in the respective society. Nevertheless, the question still remains if all humans need or want the same mathematics. Jablonka (2003, p. 79) states: "research shows that there is a diversity of functional forms of numeracy that individuals and groups possess, which are well suited for their particular purposes." This implies that different forms of mathematics should be seen as genuine in their own right (Knijnik, 2012; Radford, 2008b).

One difficulty that surrounds the ethnomathematical approach is its implementation into school contexts, and some critics of ethnomathematics point to this. For example, Rowlands and Carson (2002) critique ethnomathematicians for seeing mathematics as a weapon of cultural imperialism and state: "There seems to be a consensus in mathematics education that formal, academic mathematics is somehow *intrinsically* oppressive and oppressive *because* of its rationalism" (p. 81).

In contrast, Meaney and Lange (2013) investigated the benefits gained from recognising ethnomathematics in the classroom. They suggest that the students' backgrounds and foregrounds have to be considered when adopting an ethnomathematical perspective (Meaney & Lange, 2013). Meaney and Lange also remark on the need to reflect upon the current context in relation to the students' background, and also what they are aspiring toward, so that neither the potential in the foreground, nor the background, are cut off. Therefore, it is necessary to be sensitive to the possible gains and losses for students when ethnomathematics is brought into the classroom. The critical questions are whether the experiences students bring to the classroom are considered, and whether school mathematics is likely to be valued in their future mathematical endeavours. Bringing students' cultures into school mathematical activities is also accompanied by the risk of exoticising, romanticising and trivialising certain cultures. On the other hand, if these are excluded from the classroom, there is a risk of negligence and acceptance of injustice. This is mentioned by Pais (2011), who used a socio-political basis for his critique of bringing ethnomathematics into the mathematics classroom:

> There is no easy way out of this paradox: whether school should be reserved for learning of the globalized knowledge allowing everyone to participate in our high-tech world, or a school that incorporates diversity but runs the risk of domestication of the Other. (p. 221)

Even the discourse surrounding globalised knowledge can be seen as problematic. Dowling (2005) questions viewing mathematics from this perspective due to the irony of revealing mathematical content in different cultures' practices by referring to European mathematics.

> This is the myth of emancipation. […] European mathematics constitutes recognition principles which are projected onto the other, so that mathematics can be 'discovered' under its gaze. The myth then announces that the mathematics was there already. (p. 15)

Atweh (2012) brings up the discussion from another point of view, where the Other, with a capital O, is important in the responsible mathematics education he argues for. In his approach, ethics is the foundation of mathematics education. From this point of view, the encounter of the authentic Other is at the very heart of engaging with each other and in learning. Therefore, not focusing on gender, ethnicity and other inequalities could be just as negative as the stereotype of the traditional mathematics education.

In the context of the Swedish curriculum, ethnomathematics is not mentioned, as is the case of mathematical literacy. However, the absence of ethnomathematics in the curriculum differs in that it states that education should provide students with a foundation for work. Seeing education as the provider implies seeing the student as a receiver and not a contributor. From the ethnomathematical viewpoint, as we have discussed, this idea is challenged.

## The two approaches

In both approaches—ethnomathematics and mathematical literacy—there are worthwhile aims which strive to equip citizens with the mathematics seen as crucial to coping with their lives. The question is what role the educational curriculum of a society may have in accomplishing these worthwhile aims for its citizens, presupposing that school mathematics is useful in the world outside of school. This is often referred to as an issue of transfer, which means that knowledge from one context is used in another (Evans, 1999). Evans (1999) further argues that having a simplistic view of the continuity of knowledge between different contexts may be as insufficient as being stuck in the narrow interpretation of learning as being situated.

Certain assumptions about the world follow both ethnomathematics and mathematical literacy. In the mathematical literacy approach, the technical development of the world is in focus and must be maintained, supported or increased, along with the empowerment of individuals. However, this is also the case with the ethnomathematical approach, wherein globalisation and cultural diversity are in focus, but with the added challenge of the influence of the Western world.

It is not our aim to create a polarised discussion. Instead, our intention is to provide an understanding of the different viewpoints in mathematical education. However, this may also be a reflection of a tension existing within the field of mathematics education itself. Instead of being productive for the field and its influence on the curriculum, this dichotomy runs the risk of getting stuck in debate. The need for citizens' empowerment and technical development does not necessarily counter the need for taking cultural diversity and equity into account. Instead, we suggest that it is necessary to consider the social world, and how the citizen can be viewed in this world from a critical perspective.

## The citizen seen from a social and critical perspective

The citizen, who is also a student whilst at school, needs to be considered in relationship to society. As mentioned earlier, the notion of citizenship concerns the mutual interplay between the citizen and society. This gives the rather complex view of a citizen as a socio-political being. From a socio-political approach, it does not make sense to view mathematics as separate from the world or the social practice in which the activity is embedded (e.g. Jablonka, 2003; Knijnik, 2012; Meaney & Lange, 2013; Radford, 2008a; Radford, 2008b; Radford, 2012; Wedege, 2010). From this socio-political point of view, it becomes necessary to consider how these activities are related to power, and how and why the subordination occurs (Knijnik, 2012). For example, Knijnik (2012) describes Western mathematics as being the ruler that mathematics is measured by. Thus, mathematical activities are given value in relation to their similarities with school mathematics. Furthermore, mathematics used in cultural practices, such as in workplaces, can be difficult to describe as it is interwoven in technical and social routines (see, e.g., FitzSimons, 2013; Williams & Wake, 2007). From this point of departure, it does not make sense to see schools as producers of mathematically literate citizens equipped with a pre-packed solution kit. The individual student and citizen are likely to be influenced by others, both in school and out of school.

Atweh (2012) and Radford (2008a) share a similar vision of human togetherness, as a way of learning. This joint endeavour is also valid for mathematics education, in which learning is about being (Meaney & Lange, 2013; Radford, 2008a). With this extended view of learning, the aspect of ethics is highlighted as a foundation of life and mathematics education (Atweh & Brady, 2008). In their view on ethics, Atweh and Brady (2008) emphasised a moral obligation towards others. They also stress the importance of access to high quality, equitable mathematics education, which is more than mathematics being seen as a set of procedures whose quality is measured with its own tools. Instead, their interpretation of quality is as follows:

> Quality in mathematics education is measured not as, or not only as formal abstraction and generalization, but by its capacity to transform aspects of the life of the students both as current and future citizens. (p. 272)

Education should not only engage students in interpreting the world, but also in the endeavour of changing the world, which Atweh and Brady (2008) consider to be the basis for socially responsible mathematics education. Skovsmose (1994) has a similar view, describing this as *critical mathematics education*. From this, follows the assumption that education has a role to play in either maintaining or changing the social conditions of society (Skovsmose, 1994).

Skovsmose (2005) also highlights the opportunities that a society provides for different groups, depending on gender, age, class, race, economic resources, and culture. He suggests that one way of doing this is to not only take students' backgrounds into consideration, but also their foregrounds. The word *foreground* could be interpreted as horizons of action, which includes the motives or possibilities to move between contexts. Horizons of action, in relation to learners in *transition*, are described by Meaney and Lange (2013). They see contexts as different systems of knowledge and conclude that the transition, which is reflected upon, can be a source of learning. Given this, the transition between context, and what is valued in different contexts, may affect both the students and the citizens' learning and becoming. The learning that can occur from reflecting on the transition is highly dependent on whether it is, for the citizen, a minor or a major issue (Meaney & Lange, 2013).

We interpret the demands made on citizens through the concept of mathematical literacy, and we see what citizens do and create in different cultures and situations, as ethnomathematics. As previously mentioned, this division between ethnomathematics and mathematical literacy is an analytical construction, rather than a straightforward matter of distinct approaches. We suggest that the moving between needs and demands, as the notions are used by Wedege (2010), can be captured in the concept of transition as it is used by Meaney and Lange (2013). Citizens are under ongoing transitions between different contexts that are made available during the trajectories of life. Context, as defined above by Meaney and Lange, as different systems of knowledge, may include different views on mathematics. For example, school mathematics can be a requirement to gain a job or entry into higher education, even if that school mathematics may not be needed once the citizen obtains a certain type of job or has been accepted for higher education. It is also important to be aware of, and to be able to reflect on, the transitions that we as citizens undergo. Otherwise, it is likely that mathematics in out-of-school contexts takes school mathematics as the measure of what it means to be good at mathematics. If school mathematics is taken as the measure, engagement in other activities or ways of seeing mathematics may not be promoted.

## Connections between school mathematics and out-of-school contexts

School mathematics exists and is generally claimed to be useful. This is something that we as citizens are, of necessity, exposed to. Consequently, we assume that the transitions, either to or from school, have an impact on the citizen, even though the issue of transfer of mathematics from school to the world outside could be questioned. Nevertheless, mathematics is often understood as having only one direction, according to Lundin (2012):

> Mathematical knowledge is taken to be a useful tool for action and understanding in the world "out there", outside the school. On the other hand though, engagement with reality as it is, is not believed to lead to the formation of mathematical knowledge. (p. 3)

Some researchers argue that it does not make sense to talk about school mathematics as being useful at all. Lundin (2008) writes about mathematics and mathematical knowledge as a sublime object in that it is assumed to be invisibly present, powerful and emerging inside people in the game of school mathematics, which has been played so many times and so seriously that we gain faith in its connection to reality. He suggests that the real function of school mathematics is one of sorting students. This is in line with Dowling (2005) who writes about different myths produced about school mathematics. The myths give us a false idea about the benefit we gain from school mathematics whilst, at the same time, differentiating students and reproducing inequity (Dowling, 2005).

While Dowling (2005) and Lundin (2008, 2012) question the value of school mathematics in the world outside school, Skolverket (2011b; 2011c) seems to see the curriculum as a straightforward matter or, at the very least, leaving the connection unquestioned. According to the curriculum, the idea of providing students with good foundational studies, work and life in society seem to be central and accomplished through the core content and the competences outlined in the mathematics curriculum.

## Mathematics, curriculum, and the citizen: Concluding discussion

In this article, we have suggested that mathematical literacy is the dominant approach adopted in the curriculum. The assumptions in mathematical literacy and, hence, in the curriculum, tend to consider the empowerment of the individual, and also the need for society to have mathematically literate citizens. However, the conclusion that can be drawn from this is that the state of the world and the mathematical procedures and strategies that the citizen will need to adapt to this world, are taken for granted in the curriculum. This can be considered its major weakness.

The ethnomathematical approach challenges this view by considering different cultural practices. There is also, within this approach, dissatisfaction with the dominance of Western culture in mathematics education. It thus highlights the state of the world as being. Yet, what is not clearly considered is how these different cultural practices could inform the mathematics curriculum without, at the same time, emphasising otherness or contributing to the stereotyping of different cultures considered as Other.

Although there are valid points made for citizenship development in both approaches, neither of these is sufficient, not even if taken together. We consider that it would be beneficial to consider ethics as the foundation of mathematics education. Our reason for this is inspired by socially responsible mathematics education (Atweh, 2012) and its view on being *for* the Other, which moves mathematics education from an individualistic to a collective endeavour. Further, we suggest that this should be made explicit in the curriculum, and that the citizen be addressed before the mathematical procedures. In the curriculum, there are few assumptions made explicitly about the citizen and about the world, and these are expressed in terms of the technical world rather than the social. This is not in alignment with seeing mathematics as a social activity in which humans can engage together. Consequently, there is a need to have a different view of citizens and their potential for changing society for the better.

In other words, being a citizen and a human is more than just being mathematically literate. After all, "learning is both a process of knowing and a process of becoming" (Radford, 2008, p. 225). First, changing the view of the citizen implies a different understanding of the mathematics in the curriculum. Being an "intelligent consumer" as mentioned by PISA, is different from gaining something collectively; for example, a more sustainable world or a more equal social order. Being a consumer is in the interest of only a relatively few citizens globally, while the issue of a more equal society is the concern of a much wider range of the world's population.

In order to get closer to the citizen and what type of mathematics education the citizen may need, we suggest that the expression "citizen in the world" is made explicit in the curriculum, and is addressed before the mathematics. We see mathematical activities as shared experiences in which it is necessary to consider the transitions that students or citizens make during and after leaving school. This could be a way of achieving permeability between school and the surrounding world. Even if there is no transfer of mathematics possible, there are still learners in transition between contexts.

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