JOURNAL OF SOCIAL SCIENCE EDUCATION
2025, VOL. 24, ONLINE FIRST
https://doi.org/10.11576/jsse-7562

Article

Going beyond the model: Characteristics of civic visual literacy

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Keywords: social science education, civic visual literacy, visual representation, flowchart, scatterplot, phenomenography, civic reasoning

Highlights:
– Civic visual literacy is partly model generic, partly model specific, and partly content dependent
– A central aspect of civic visual literacy is moving beyond the model itself
– *Entirety*, *expansion*, and *agency* are three key aspects that students need to discern

Purpose: The aim is to specify the meaning of visual literacy within the context of social science education (SSE).

Design/methodology/approach: Data consist of 94 recorded small-group discussions from four learning studies in SSE aimed at qualifying students' reasoning about societal systems and issues. Phenomenography was used to identify key aspects that students needed to discern if they were to develop qualified reading of flowcharts and scatterplots.

Findings: Civic visual literacy should be understood as partly model generic, partly model specific, and partly dependent on the content visualised. Entirety, expansion, and agency are aspects that students must discern if they are to develop a more qualified civic visual literacy and thus be able to reason about societal systems and issues in a qualified way, using visual representations as a tool.

Research limitations/implications: Four models were used. Future studies should investigate the extent to which the results hold in relation to different subject content and model types.

Practical implications: Entirety, expansion, and agency must function as focal points in SSE teaching when visual representations are used.

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Suggested citation:
Jägerskog, A. & Tväråna, M. (2025). Going beyond the model: Characteristics of civic visual literacy. *Journal of Social Science Education*, *24*, online first.
https://doi.org/10.11576/jsse-7562

Declaration of conflicts of interests: No potential conflict of interest was reported by the authors.

1 INTRODUCTION

In school, as well as in everyday life, students are exposed to various forms of models and visual representations. The ability to read, interpret, and make meaning of visually presented information, often referred to as visual literacy (see, e.g., Avgerinou, 2007; Cruz & Ellerbrock, 2015), has been highlighted by many scholars as a key ability students must develop (Lopatovska et al., 2016). This ability is necessary not only for students to understand and take part in what is visually expressed but also because visual literacy is necessary for analysing, thinking critically about, and using what is visually expressed to solve problems (Glazer, 2011). The ability to analyse, critically reason about, and constructively address problems related to, for instance, societal issues and systems is key to what it means to become a citizen (Händle & Henkenborg, 2003; Sandahl, 2020; Tväråna, 2019; Tväråna & Jägerskog, 2023; Westheimer & Kahne, 2004). It could therefore be argued that it is crucial for students to develop the ability to read and critically reason about visually represented information. However, the fact that students encounter different types of models daily does not mean that they can automatically interpret and use them (Schoen, 2015).

Visual representations are commonly used in social science education (SSE). This could partly be because many models are used in the academic disciplines that inform SSE (such as economics, political science, sociology, and law), which are then also used in SSE teaching. The rather frequent occurrence of visual representations in SSE teaching could also be because many different kinds of visual representations (such as graphs, diagrams, scatterplots, and flowcharts) are used to help students grasp the many complex phenomena, systems, and relations taught as part of SSE. The importance of developing visual literacy in SSE has, therefore, explicitly and implicitly, been noted by several researchers (see, e.g., Bodén, 2023; Glazer, 2011; Lake, 2002). They argue that the ability to read, interpret, analyse and critically examine information presented in different kinds of graphs and visual models is a core aspect of civic literacy. Students thus need to be given the possibility to develop this ability through SSE teaching. For this to happen, there is a need to specify what visual literacy in SSE entails more precisely. Earlier research has defined this ability in terms of being able to read graphs (Glazer, 2011), being familiar with commonly used SSE models, being able to critically engage with social science models (Lake, 2002), or what students tend to do when reading and creating visual representations in SSE (Bodén, 2023). Although all those definitions somewhat capture what it may mean to be visually literate in SSE, they do not particularly specify what students must discern if they are to develop visual literacy in SSE. Nor do they specify if visual literacy should be understood as a model-generic ability or rather a model-specific ability. Also, the definitions do not specify what, more specifically, teaching in SSE needs to focus on to help students develop this competence.

The aim of this paper is therefore to empirically qualify and specify the meaning of visual literacy within the context of SSE, what we will call *civic visual literacy*. Such a specification has the potential not only to deepen the understanding of the meaning of visual literacy in a specific subject context, but also to inform teaching about the key aspects to focus on to facilitate the development of this ability in students. The research question is, therefore: What are the characteristics of civic visual literacy?

The results presented in this paper are a synthesis of data and results from a larger study consisting of four separate learning studies in SSE, each aimed at qualifying students' civic reasoning about societal systems (Learning studies 1 and 2, see Tväråna et al., 2024) and societal issues (Learning studies 3 and 4, see Jägerskog et al., 2024), using visual representations.

2 VISUAL LITERACY AND CIVIC REASONING

Literacy as a concept initially included only aspects of reading and writing (Barton, 2006; Burnet, 1965). However, over the decades, the concept has been broadened to include also other aspects, such as visual aspects (see, e.g., Barton, 2006; Kress, 2003; Rowan & Honan, 2005). Many definitions of visual literacy have, as mentioned earlier, included aspects of reading, interpreting, and making meaning of visually presented information, but also aspects of criticality, analysis, evaluation, and the production of visual representations (Averginou & Pettersson, 2011; Bamford, 2003; Bresciani & Eppler, 2015; Cruz & Ellerbrock, 2015; Lake, 2002; Lee et al., 2016; Metros, 2008; Rowsell et al., 2012). In the study presented here, the focus is primarily on reading, using, evaluating, and critically analysing the visual representations, rather than producing them.

It has been argued that literacy, and thus also visual literacy, needs to be understood in relation to specific school subjects because literacy can be understood as the ability to use the language and symbolic systems within a certain practice (Waagaard, 2023). Different school subjects entail subject-specific concepts, models, and symbolic systems. Consequently, becoming literate and visually literate in a specific school subject involves learning to interpret, use, and critically evaluate the concepts, symbols, and models used in that particular context. Lake (2002) argues that a central aspect of civic competence is the ability to read, interpret, and analyse information presented in graphs, as well as the ability to be critical of the information that is presented, and refers to this ability as "critical social numeracy." However, interpreting, using, and critically evaluating these models is not necessarily easy for students, and these skills should rather be understood as an ability that students need to practice and receive help to develop (Cruz & Ellerbrock, 2015). Investigating what it means to read visual models in SSE and what teaching needs to focus on to facilitate the development of civic visual literacy is therefore central to SSE (Bodén, 2023; Nissen & Stenliden, 2020), and for the qualification of students' civic reasoning.

Development of students' civic reasoning about societal systems and issues is a central aim of SSE. International research on critical thinking highlights perspective taking, reasoning, abstraction, comparison, and evaluation as key features (Abrami et al., 2008; M. Davies, 2013; Facione, 1990). The purpose of critical thinking is often described as arriving at sound reasons for decisions and actions (Dewey, 1910; Ennis, 1996; Paul et al., 1993). Thus, critical thinking encompasses argumentation (Mason & Scirica, 2006) and judgment making, which include a normative, or moral, dimension (Elder & Paul, 1998). Recent studies indicate that transfer of critical thinking skills within a subject domain is much more common than between different subject domains (Nygren et al., 2018; Tiruneh et al., 2018), supporting the notion that critical reasoning has a subject-specific dimension. Research on critical reasoning as a subject-specific skill in SSE and civics emphasises the ability to interpret, scrutinise, and evaluate information (Guath & Nygren, 2022; Journell et al., 2015; Nygren & Guath, 2019); to distinguish and understand different perspectives, consequences, and connections (J. Lo & Adams, 2018; Tväråna, 2019); and the capacity for self-reflection (Mason & Scirica, 2006). Tväråna (2019) describes civic reasoning as the capacity to form a personal stance on social issues related to democracy and societal life by critically evaluating evidence and arguments. Thus, in this study, "qualified civic reasoning about societal systems and issues" entails reasoning about societal systems or issues as dynamic, open, and as possible to change (see also Jägerskog et al., 2024; Tväråna et al., 2024). As previous research suggests that visual literacy is a pivotal aspect of civic reasoning, the focus of this study is to explore and specify the characteristics of civic visual literacy.

3 TWO TYPES OF VISUAL REPRESENTATIONS OF SOCIETAL SYSTEMS AND ISSUES

The visual representations this paper focuses on—flowcharts and scatterplots—are frequently used in SSE teaching. Both representations illustrate how different factors relate to each other and are therefore commonly used in SSE to help students understand processes, relations, or causality in different systems or phenomena in society (Nissen & Stenliden, 2020). Flowcharts are typically used to graphically illustrate processes such as change, movement, and causality and scatterplots are often used to exemplify or illustrate covariation and correlations between different factors related to a societal issue (Lake, 2002; Wennersten et al., 2020).

Previous research has identified that a key to developing a qualified understanding of societal issues and systems is understanding these issues and systems as dynamic processes rather than static states (Jägerskog et al., 2021). One of the challenges with both scatterplots and flowcharts is that they are static even though they illustrate dynamic phenomena, relations, and systems (see also Cohn et al., 2001; P. Davies & Mangan, 2013; Derbentseva et al., 2007; Reingewertz, 2013; Wheat, 2007). Consequently, there is a risk that students perceive the processes in a flowchart as fixed relations between unchanging units, rather than as dynamic and reciprocal relations between evolving entities (Derbentseva et al., 2007; Safayeni et al., 2005). Similarly, there is a risk that students perceive the curves and data in graphs as casualties of a static reality, rather than as simplified casualties in a representation that attempts to grasp an aspect of a complex and changing reality (Jägerskog, 2020; Wheat, 2007). Other challenges are the risk of students reading graphs as a collection of separate data points rather than reflecting a larger pattern (Glazer, 2011), the difficulty in relating the graph to the real world (P. Davies & Mangan, 2013; Strober & Cook, 1992; Treagust et al., 2017), and the risk of focusing on decoding the graph itself rather than focusing on the phenomenon illustrated (Colander, 1995; Jägerskog, 2021). Research has identified the interpretation of arrows in flowcharts as a challenge for students, especially when arrows in the same image have different meanings (McTigue & Flowers, 2011) and when several simultaneous processes are depicted (Wennersten, 2020).

Because flowcharts and scatterplots are commonly used in SSE teaching, and because they both illustrate core aspects of SSE (such as relations, processes, systems, causality, and change), we believe these visual representations to be good cases to study. Thus, we believe that a synthesised result from studies looking into students' reading of four such visual representations has the potential to say something about civic visual literacy more generally.

4 THEORETICAL PERSPECTIVE AND METHODOLOGY

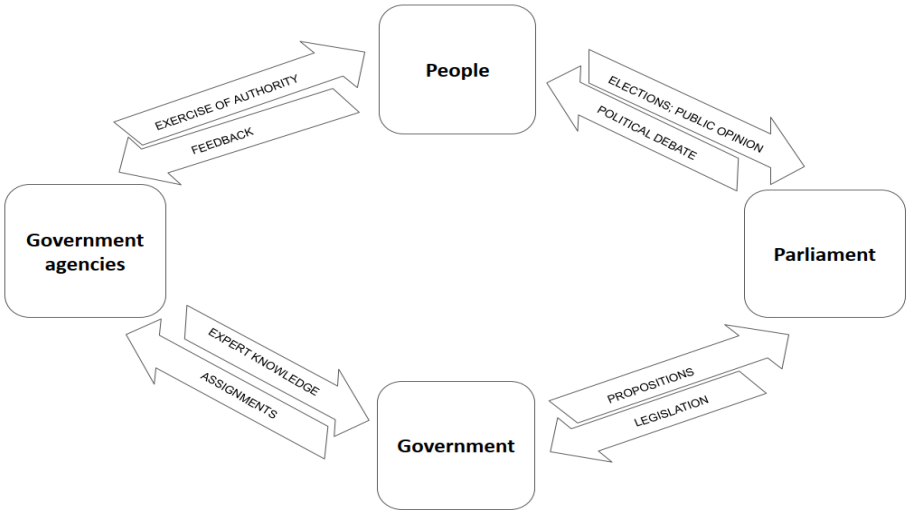
The following section introduces the larger research project, the design of the project, and the theoretical framework of the paper. It also describes participants, the empirical data, and the analytical methods used.

4.1 The research project

The results presented in this paper are based on data from a larger research project focusing on the development of students' visual literacy in SSE. The research project was conducted through four separate learning studies (Pang & Marton, 2003) in SSE. Learning study is a form of education development research (see Plomp & Nieveen, 2013; van den Akker, 2013) where teachers and researchers collaborate to address subject-didactic challenges that teachers face in everyday

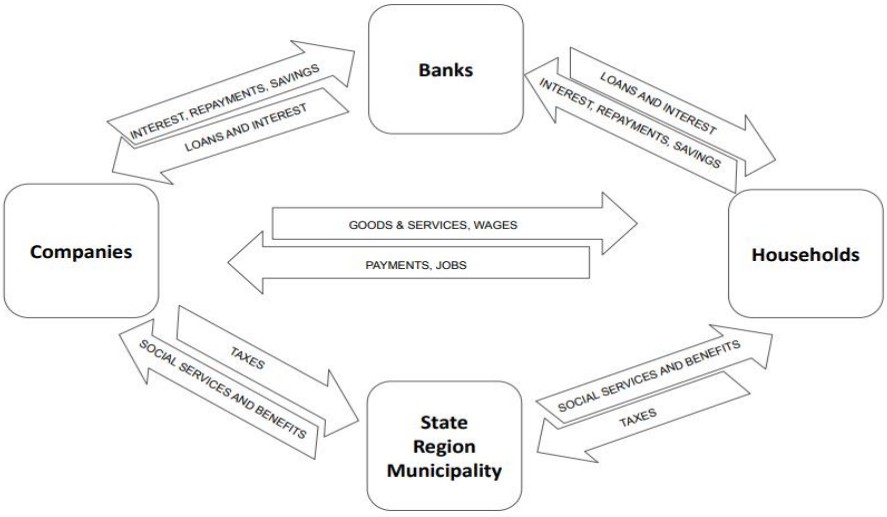
teaching. Each of the four conducted learning studies used a visual representation as a tool to help students develop a qualified understanding of and reasoning about the content focused on in the lesson. Two of the learning studies used flowcharts as the visual tool, and two of the learning studies used scatterplots. The two former learning studies (using flowcharts as a starting point) aimed at developing students' reasoning about different societal systems: the Swedish democratic system (see Figure 1, where boxes illustrate actors in the system and arrows illustrate processes of influence) and the economic system on a national level (see Figure 2, where boxes illustrate actors in the system and arrows illustrate how money flows in the system). The latter two learning studies (using scatterplots as a starting point) aimed at developing students' understanding of and reasoning about different societal issues: sustainability issues, which took its starting point in a scatterplot illustrating the relationship between countries' GDPs per capita and their CO^2 emissions per capita (see Figure 3) and welfare and social justice issues, which took its starting point in the relationship between the number of years women go to school in different countries and the number of children they have (see Figure 4).

Figure 1. Flowchart of the Swedish democratic system, as used in one of the four learning studies



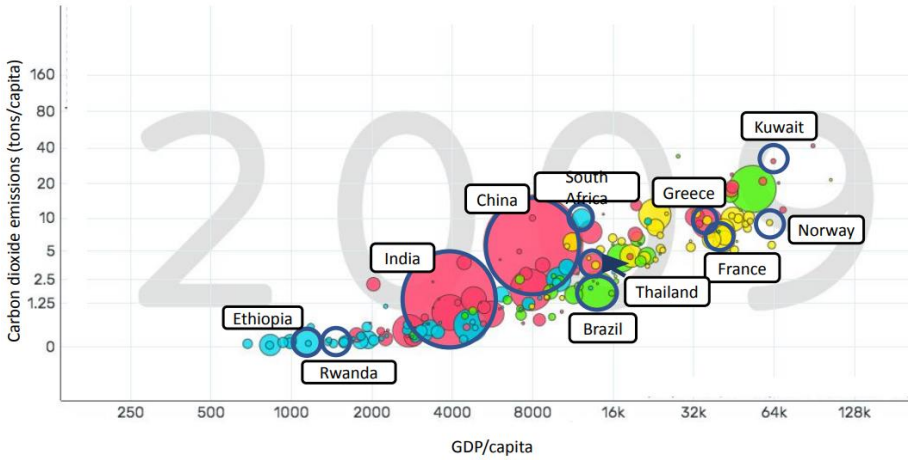
Adapted from Tväråna et al., 2024.

Figure 2. Flowchart of the socioeconomic cycle, as used in one of the four learning studies



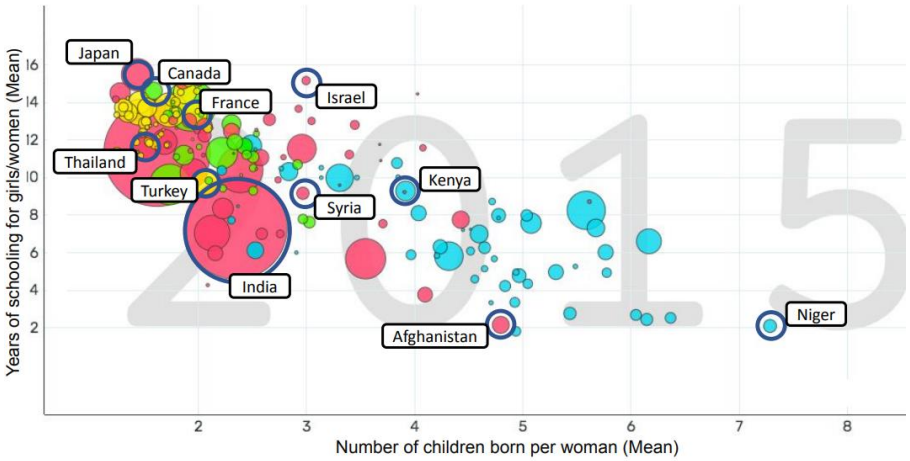
Adapted from Tväråna et al., 2024

Figure 3. Scatterplot illustrating the relationship between countries' GDPs per capita and their CO^2 emissions per capita, as used in one of the four learning studies.



Based on free material from CC_BY LICENSE gapminder.org[1] (As presented in Jägerskog et al., 2024).

Figure 4. Scatterplot illustrating the relationship between the number of years women go to school in different countries and the number of children they have



Based on free material from CC_BY LICENSE gapminder.org (As presented in Jägerskog et al., 2024).

4.2 Phenomenography as a theoretical framework

Phenomenography is used in this paper to define learning and analyse data. In phenomenography, learning is understood as discerning aspects of a phenomenon that one has not previously discerned (Marton 2015; Marton & Booth, 1997). Learning thus involves discerning increasingly more aspects of a phenomenon, and consequently, the role of teaching is to create possibilities for students to experience, or discern, new aspects of the phenomenon in focus. A fundamental assumption in phenomenography is that a phenomenon can be experienced (or understood) in a limited number of qualitatively different ways (Marton, 2015). Another central assumption is that

[1] https://www.gapminder.org/data/

these different ways of experiencing (called *conceptions*) facilitate different ways of relating to (for instance, talking about or acting in relation to) the phenomenon (Marton & Booth, 1997; Pang & Ki, 2016). This means that the way a student experiences a phenomenon or subject matter is crucial for how they relate to it and, therefore, what they can do in relation to it. This also means that different conceptions can be identified through an analysis of how students talk about, discuss, or act in relation to the phenomenon. For this paper, this means that the way students talk about a flowchart of the relationships between actors in a societal system, or about a scatterplot of the relationship between two factors related to a certain societal issue, can inform how these phenomena are experienced or understood by the students.

A phenomenographic analysis results in a number of qualitatively different conceptions of a phenomenon. This, in turn, enables the identification of what distinguishes one conception from another and thus which aspects of the phenomenon seem to be critical for a student to discern in order to understand the phenomenon in a more qualified way. These aspects are called *critical aspects* (Pang & Ki, 2016) and are used to inform teaching to even better facilitate learning of the phenomenon investigated (M. Lo, 2012; Marton & Booth, 1997; Marton et al., 2004; Thorsten & Tväråna, 2023).

Conceptions and critical aspects need to be understood in relation to the context and the object of learning, or the knowledge that the teaching is aimed at developing (Marton, 2015). In the study presented in this paper, the aim was to identify what appears to be crucial for students to discern for them to be able to i) use a flowchart to engage in well-founded reasoning about the relations between actors in a societal system (in this case, the Swedish democratic system and the socioeconomic system), and ii) use a scatterplot to engage in well-founded reasoning about the relationship between two factors related to a societal issue (in this case, linked to societal issues of sustainable development and welfare, because these were the societal topics focused upon in the lessons that formed the basis of the study). This means that the phenomena investigated were *a flowchart showing the relations between actors in a societal system* and *a scatterplot showing the relationship between two factors linked to a societal issue*.

4.3 Participants

Eight schools participated in the study, of which four were secondary schools (years 6–9) and four were upper secondary schools (years 10-12). The schools varied in terms of inner city, suburban, and socioeconomic neighborhood across three Swedish cities. Approximately 450 students (from years 6, 7, 8, and 9 in secondary school and year 1 in upper secondary school) participated. Each of the four learning studies was carried out in two to six classes, resulting in a total of 18 classes being involved in the study.

4.4 Empirical data

The results presented in this paper are based on 94 recorded and transcribed small-group discussions, lasting between eight and fifteen minutes. The groups were given a task that posed a problem, and they were asked to solve this problem, using data from the visual representation presented in the task (as shown in Figures 1, 2, 3, and 4 above). The problem was related to either the societal system in focus (the Swedish democratic system or the socioeconomic system) or the societal issue in focus (sustainability issues or welfare and social justice issues). In phenomenography, different experiences are not understood as being tied to specific individuals

(Marton & Pong, 2005). Rather, a person is considered to be able to express different experiences of a phenomenon in different situations and contexts. Group discussions can therefore provide valuable material for phenomenographic analysis, because students' experiences are challenged and influenced by other students and by teaching materials.

The various group discussion tasks are described below and summarised in Table 1. In the group discussions preceding the research lessons focusing on the Swedish democratic system and the socioeconomic system, students were asked to discuss how the different parts in the system were related. More specifically, the task in relation to the flowchart of the democratic system asked them to reflect on who can participate and influence whether there should be a new law concerning mobile phones in schools. The task in relation to the socioeconomic system asked them to reflect on what effects a closure or downsizing of companies due to the COVID pandemic could have on the socioeconomic system as a whole. In the group discussions preceding the research lessons focusing on the sustainable development (the GDP/CO^2 scatterplot) and welfare/social justice issues (the number of school years/number of children scatterplot), students were asked to decode the scatterplot in terms of actual numbers and describe and reason about the differences between a couple of highlighted countries in the scatterplot and how these differences could be explained.

In the group discussions held at the end of the research lesson, having dealt with flowcharts illustrating the Swedish democratic system and the socioeconomic system, students were asked to discuss what would happen if one of the actors in the systems were removed (such as the parliament in the Swedish democratic system or the bank in the socioeconomic system). In the group discussions following the scatterplot-based lessons, students were presented with three scatterplots illustrating three different potential scenarios for the future relationship between GDPs per capita and CO^2 emissions per capita in various countries, or the relationship between fertility rates per woman and girls' education levels in different countries. Students were then asked which of these scenarios they believed to be most fair, most probable, and what it would take to get there.

Table 1. Summary of the four learning studies (LS)

	Aim of the research lesson	**Visual representation used**	**Task for group discussion before research lesson**	**Task for group discussion after research lesson**
LS 1	Qualify students' understanding of and reasoning about *the Swedish democratic system*	*Flowchart* of the Swedish democratic system (see Figure 1)	With the help of the flowchart, discuss who can participate and influence whether or not there should be a new law concerning mobile phones in schools	With the help of the flowchart, discuss what would happen if one of the actors in the systems (the parliament) was removed
LS 2	Qualify students' understanding of and reasoning about *the socioeconomic system*	*Flowchart* of the socioeconomic system (see Figure 2)	With the help of the flowchart, discuss what effects a closure or downsizing of companies due to the COVID pandemic could have on the socioeconomic system as a whole	With the help of the flowchart, discuss what would happen if one of the actors in the systems (the bank) was removed

	Aim of the research lesson	Visual representation used	Task for group discussion before research lesson	Task for group discussion after research lesson
LS 3	Qualify students' understanding of and reasoning about *sustainability issues*	*Scatterplot* of the relationship between GDP per capita and carbon dioxide emissions per capita in various countries (see Figure 3)	Decode the scatterplot in terms of actual numbers, and describe and reason about the differences between some of the countries and how these differences could be explained	Discuss which of three suggested possible future scenarios (as illustrated in three different scatterplots) they believe to be most fair, most probable and what it would take to get there
LS 4	Qualify students' understanding of and reasoning about *welfare and social justice issues*	*Scatterplot* of the relationship between fertility rates per woman and girls' education levels in different countries (see Figure 4)	Decode the scatterplot in terms of actual numbers, and describe and reason about the differences between some of the countries and how these differences could be explained	Discuss which of three suggested possible future scenarios (as illustrated in three different scatterplots) they believe to be most fair, most probable and what it would take to get there

4.5 Data analysis

Data were analysed in a three-step process. First, a phenomenographic analysis of the small group discussions was conducted to identify *different conceptions of the four visual representations*. More specifically, the phenomena analysed were students' conceptions of i) a scatterplot of the relationship between two factors related to a societal issue (GDP/CO^2 and number of school years/number of children, respectively), and ii) a flowchart of a societal system (the Swedish democratic system and the socioeconomic system, respectively). This resulted in the identification of several conceptions as well as critical aspects related to flowcharts (Tväråna et al., 2024) and scatterplots (Jägerskog et al., 2024), respectively.

Second, we *compared the conceptions and critical aspects* identified in relation to the flowcharts with the conceptions and critical aspects identified in relation to the scatterplots. This was done to identify potential similarities and differences between students' readings of the different model types so that we could further specify the meaning of civic visual literacy in SSE. This was done by dividing the data into two sets—one containing the transcriptions of group discussions focusing on societal systems using flowcharts (data from learning studies 1 and 2) and one containing the transcriptions of group discussions focusing on societal issues using scatterplots (data from learning studies 3 and 4). We went through the two data sets again to see whether the utterances belonging to the different categories of conceptions in the two data sets resembled each other in any way, and thus also whether there were similarities and/or differences in the discernment of critical aspects in the two data sets. In this analysis, we analysed the material in light of the question "Are there features in the conceptions and critical aspects identified in the two data sets that resemble each other and thus seem to deal with a similar overarching conception and critical aspect?" As part of this analysis, we also divided each data set into two—one for each particular element of content (thus, one data set for each of the flowcharts and one for each of the two scatterplots). In this analysis, we investigated whether certain critical aspects seemed more difficult for students to discern depending on the content illustrated in the flowchart and scatterplot, respectively.

Third, after having identified both similarities and differences in the conceptions and critical aspects between the data sets, we analysed the material again to *identify what kind of reasoning was made possible in relation to the discernment of each critical aspect*. This was done by going through

the empirical material again and categorising what the students were able to do when reasoning in line with each of the conceptions. In this analysis, the two researchers individually and together searched for kinds of reasoning in relation to students' discernment of different critical aspects. This was done in light of the question "When students have discerned a particular critical aspect, what are they able to do in terms of reasoning about the topic in focus?" The kinds of reasoning identified in this analysis were tested in relation to the data, reformulated, and tested again in an iterative process until a result was reached that was considered both valid and reliable.

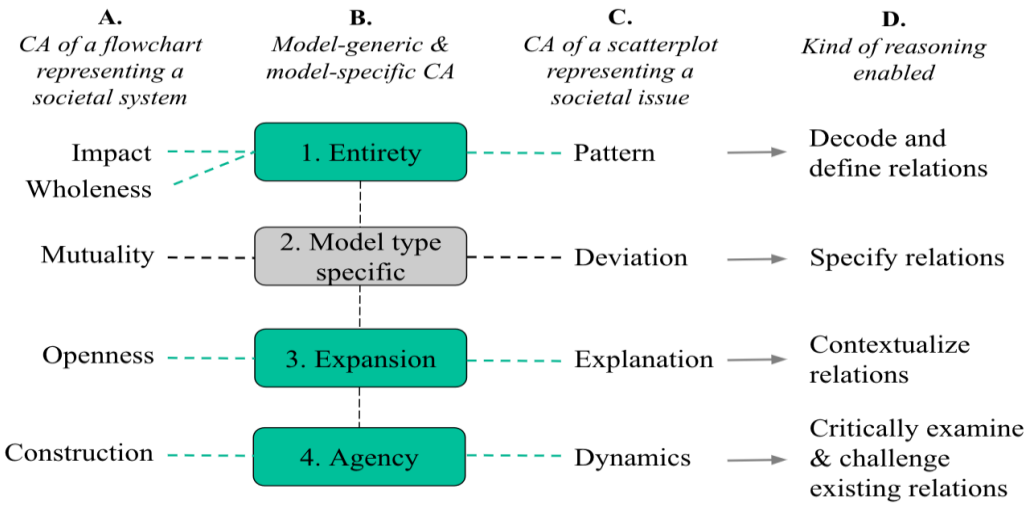
5 WHAT CHARACTERISES CIVIC VISUAL LITERACY?

In this section, the results from the analysis are presented. First, we present *three model-generic aspects of civic visual literacy* identified in the material (Section 5.1). When presenting each of these three aspects, we also elaborate on and exemplify *the kinds of reasoning made possible* in relation to the discernment of each critical aspect (which further elaborates on what was presented in Holmén et al., 2024). Second, we discuss *model-specific aspects of civic visual literacy*, presenting two aspects that seem to be critical in relation to flowcharts and scatterplots, respectively (Section 5.2). Finally, we discuss *content-specific aspects of civic visual literacy,* presenting how the content illustrated in flowcharts and scatterplots seems to affect the reading of the model (see Section 5.3).

5.1 Model-generic aspects of civic visual literacy

In the research project on which this paper is based, we identified aspects that seemed to be critical for students to discern in order to develop a qualified reading of flowcharts and scatterplots, respectively. Five critical aspects were identified in relation to flowcharts (Tväråna et al., 2024, see also column A in Figure 5) and four in relation to scatterplots (Jägerskog et al., 2024, see also column C in Figure 5). Although the reading of flowcharts and scatterplots requires discernment of aspects distinctly related to that particular model type, the analysis described above, where the different data sets were compared, revealed several similarities in terms of aspects highlighted as being central for students to discern (see column B in Figure 5). We believe that three aspects could be considered model-generic and thus relevant for both types of models. These are *entirety*, *expansion*, and *agency* (see aspects 1, 3, and 4 in column B in Figure 5).

Figure 5. Figure illustrating critical aspects (CA) (columns A, B and C), and kind of reasoning enabled when critical aspects have been discerned (column D).



5.1.1 Model-generic aspect 1: Entirety

The first model-generic critical aspect deals with entirety and thus with the importance of students reading the visual representation as a whole, rather than as separate parts. In relation to both flowcharts and scatterplots, several students tended to focus on the separate details in the models, rather than on the model as a whole.

When reading the flowchart, many students tended to focus on only the instances/actors/"boxes," ignoring the arrows. To an experienced flowchart reader, the arrows are almost impossible to overlook. However, the empirical data show that there is a clear risk that students ignore the arrows and focus on separate actors or instances (such as the bank or the public sector in the flowchart illustrating the socioeconomic system), and therefore overlook the wholeness of the system. In some cases, students did pay attention to the arrows, but they focused on the relationship between only two actors at the same time (for instance, between companies and households in the flowchart illustrating the socioeconomic system, or between the government and authorities in the flowchart illustrating the Swedish democratic system), rather than on the system as a whole. For a person who knows how to read a flowchart, it is self-evident that it does not consist of isolated parts or "pairs of actors," but of related actors that affect each other. It is also self-evident that a change in the relationship between two actors or instances in the system affects the whole system. For a novice, however, this is not evident, and it is thus something that needs to be discerned. Consequently, it proved to be critical for students to discern that the flowchart illustrates *relationships of impact* between different actors and instances (in other words, that the arrows are central) and that the flowchart needs to be understood as a *whole,* rather than sets of pairs. When reading the scatterplot, some students tended to focus on isolated plots in relation to one or two of the axes, thus ignoring, or not discerning, the pattern as a whole. To an experienced reader of diagrams, it may be perceived as impossible to disregard the overall pattern in a scatterplot. However, for a novice reader, the overall pattern may easily be overlooked. Consequently, it is critical that students understand that there is a relationship between the two variables shown on the x- and y-axes (for instance, between a country's GDP per capita and its CO^2 emissions) and that *there is an overall pattern* in the scatterplot.

When students had discerned entirety, their reasoning about the societal system or issue in focus was characterised by *decoding and/or defining the relations*. In relation to the flowchart, students would discuss how a change in one part of the system has consequences for the rest of the system (see example in quote [1]), compared to mainly discussing the separate instances/actors represented in the flowchart (which was the case when this aspect was not yet discerned). In relation to the scatterplot, students would discuss how the two axes in the diagram related to each other (see example in quote [2]), compared to only discussing the positions of individual countries in the diagram, without relating them to the larger whole (as was the case when this aspect was not yet discerned).

> [1]
>
> A: If we say that we work at a company that goes bankrupt, then we don't get any money, so we can't pay taxes, and then we would need to get benefits if we don't have any money.
>
> B: But we take out loans from the bank.
>
> A: Yes, but we won't be able to pay back if there's a crisis with companies. And then we would need more support from the government, regions, and municipalities; but that doesn't work. They don't have all the money. They get some money from the companies. (...) It becomes a

kind of vicious spiral. I think it affects everything here, and it affects the bank. They get less money in, and so on.

B: So, if we were to summarise it, though we're not done yet, work goes to the bank. Households also go to the bank, with an arrow to the bank. And this thing, official sector…

A: Public sector.

B: ...it goes to households and goes up to... an arrow up to companies. And then from the companies, there's an arrow going... two arrows going to households. And then two arrows go from households to companies.

A: Yes, so the bank... or no, I mean the companies affect, like... They affect each other a lot, so things wouldn't go well for society as a whole if many companies, especially large companies, shut down. People who work there wouldn't get any money, and then they can't pay for anything, and they'd need support, but there's no money.

B: Financial crisis.

(...)

A: Yes, but if all companies were to shut down, there would be a pretty big economic crisis, I think. So, I believe it really affects everything here. It becomes a vicious spiral if the companies were to go bankrupt, really.

(Year 6, flowchart illustrating the socioeconomic system)

[2]

A: The further to the right, the higher the income level, you can actually see that in this diagram.

B: Yes, but also the further up, the more carbon dioxide. So, you can see that the rich countries are in the upper right and the somewhat poorer countries are in the lower left.

(Year 8, scatterplot illustrating the relationship between GDPs per capita and CO^2 emissions per capita)

In quotes [1] and [2], the students have discerned the entirety of the flowchart and scatterplots, and they are able to decode and define the relationships involved with the help of the models. In quote [1], the students discuss how companies' bankruptcy can affect all parts of the socioeconomic system and potentially lead to a financial crisis in society. In quote [2], the students can define the scatterplot pattern and conclude that the higher the GDP, the higher the CO^2 emissions and vice versa.

In summary, when reading visual representations in SSE, particularly if they illustrate relations of some kind (as is the case with both flowcharts and scatterplots), it is critical that students read the visual representation as a whole. We thus argue that entirety is an important aspect of civic visual literacy and something that needs to be highlighted in teaching when visual representations are used. The discernment of this aspect enables students to decode and define the relations illustrated.

5.1.2 Model-generic aspect 2: Expansion

A second model-generic critical aspect deals with expansion. It seems to be crucial for students to understand that there is more to the system or issue than what is explicitly depicted in the visual

representation. Students thus need to grasp the larger context of the societal system or issue illustrated in order to effectively use the visual representation as a tool for qualified reasoning.

Students need to read a flowchart as *illustrating an open system*, although visually it may appear "closed." This means that for students to reason about societal systems in a qualified way, using a flowchart, they need to understand that the system affects and is affected by factors that are not explicitly illustrated (for instance, other economies and nature/sustainability issues in the socioeconomic system flowchart). In other words, students need to develop an understanding that flowcharts visualise only some aspects of a system rather than "the full picture." What is illustrated in the flowchart thus needs to be placed in a larger context if students are to reason about the system in a qualified way. Similarly, when reading scatterplots, students must discern that the pattern illustrated needs to be *understood and explained by other factors in a larger system*. Students thus need to understand that what is shown in the scatterplot is just some aspects of a larger system, where more factors are involved than are explicitly shown and where many factors affect each other. For instance, to draw qualified conclusions about the relationship between a country's GDP per capita and CO^2 emissions per capita, other factors, such as a country's natural resources, political governance, production, and transportation, need to be taken into account. Consequently, it proved to be critical in relation to both flowcharts and scatterplots that teaching facilitates students' understanding that there is a context not explicitly illustrated in the model and that this context needs to be considered when discussing, analysing, and evaluating the societal system or issue illustrated.

When students had discerned expansion, their reasoning was characterised by *contextualising the relationships*. This means that their reasoning not only focused on describing the relationships illustrated (as was the case in the examples in relation to entirety above), but also included factors and aspects not explicitly shown in the visual representation but of relevance for understanding and explaining the relationships. For instance, students would discuss what other factors or instances depicted in a flowchart affect and are affected by what happens in the system illustrated. An example of this can be seen in quote [3], where the students contextualise central processes in the democratic system. Students would discuss what factors depicted in a scatterplot could affect the variables shown on the x- and y-axes and thus what factors may affect the relationship between the two variables in focus in the diagram (see example in quote [4]).

[3]

A: I think you can't tell it directly to the *Riksdag* [the Swedish Parliament], you might tell it to the authorities. Maybe they make proposals to the government, and the government makes proposals to the parliament. I don't know, can you email the *Riksdag* like this and just: 'Hi there, I have some opinions?' Then they would be quite busy just reading a bunch of hate mail, and that's not very nice. So it must be that you contact the authorities.

B: The authorities, yes, but it's someone ...

A: It can also go from authority to authority.

B: Oh my God! [reads from the fact sheet:] Opinion: opinions in society that are spread through, for example, the media, social media, and demonstrations.

A: Yes!

B: So, when people are demonstrating outside the *Riksdag*: 'We don't like the mobile phone ban!' Then they have to do something about it.

A: Exactly, yes, because we might start a school strike and just: 'We want our mobiles.'

B: Then they have to fix it, that's right, then it will be this election opinion.

(Upper secondary school, flowchart illustrating the Swedish democratic system. The students discuss possible ways of influencing a proposed law banning mobile phones in schools)

[4]

A: You can see here that Sweden and the Netherlands, which are slightly wealthier countries, as you can see, emit more carbon dioxide.

B: So, you mean that wealth is related to carbon dioxide emissions?

A: Maybe. And then, for example, you see Congo, which is a country with a dictatorship. And you see that it, or you know that they... they don't have as much income as Sweden, and then you can see here on this bubble chart, as I like to call it, that Sweden is much higher up in carbon dioxide emissions. But Congo is a dictatorship, and that probably affects where it is placed in this diagram.

B: And it can also be related to the fact that when you have a lower income, you can't afford to buy things that consume, like a car or going on trips.

(Year 8, scatterplot illustrating the relationship between GDPs per capita and CO^2 emissions per capita)

In quotes [3] and [4] above, the students have discerned the expansion of the flowchart. This means that they are not only able to decode and define the relationships illustrated, but also contextualise them. In quote [3], the students jointly discover how forming opinions is part of the democratic system, and how this is concretised in their everyday contexts. In quote [4], the students have discerned that there are other factors not explicitly illustrated in the scatterplot that may affect the pattern, such as political governance and consumption. Although the students in this example do not deepen this discussion, there is great potential for more qualified reasoning.

In summary, when reading visual representations in SSE and when using these as tools for analysing societal issues and systems, it seems crucial to take the broader context into consideration. What is illustrated in the visual representations needs to be *expanded* for a qualified reading and use of the visual representations. Discerning this allows for more qualified and contextualised reasoning about the relations involved in the societal system or issue illustrated.

5.1.3 Model-generic aspect 3: Agency

The third model-generic critical aspect deals with agency. For students to reason about societal systems or issues in a qualified way, they needed to discern the dynamics and changeability inherent in the visual representations. In relation to both visual representations, if students were to reason about the societal systems and issues in a qualified way, it was crucial for them to understand that what was illustrated was not deterministically set, but could be changed by human activity.

In relation to flowcharts, it proved to be crucial for students to discern that both the illustration as such and the system itself are *constructed by humans and can thus be changed.* This means that students need to understand that the way a societal system (e.g., of the socioeconomic cycle) is illustrated highlights certain aspects and ignores others, and that the flowchart presented to them

is only one possible way to illustrate the system. Similarly, and even more importantly, students need to understand that the system itself is a human construction. A society's economy, as well as a democratic system, could be constructed in several different ways and could thus be changed by human activity. Accordingly, if students are to reason about a societal system in a qualified way with the help of a flowchart, they must understand that structures can change through human activity and that the way the structures are visually illustrated may affect how we think about them. Similarly, for scatterplots, it proved to be important for students to discern that the pattern illustrated is not deterministic, but that *the relationships illustrated are dynamic*. This implies that qualified reasoning about a societal issue using a scatterplot does not conclude with understanding and problematising the pattern in light of contextual factors (as explained above). To further qualify students' reasoning about societal issues with the help of scatterplots, students also need to discern that the pattern is not set but can change through actions on different levels of society (individual, group, societal). When students had discerned this, they were able to reason about how systems, structures, and conditions can change, which in turn also causes the relationships between the factors illustrated to change. Consequently, it proved to be critical in relation to both flowcharts and scatterplots that teaching facilitates students' reasoning beyond what is explicitly illustrated in the visual representations. When students discern the changeability, or the agency aspect, there seems to be great potential for qualified reasoning about the systems and issues illustrated.

When students had discerned agency, their reasoning was characterised by a *critical examination and challenging of existing relations*. This means that their reasoning not only focused on contextualising the illustrated relationships and explaining them in light of other factors and variables (as was the case in the examples in relation to expansion). They also problematised the existing relationships and discussed what could be done to change them. In relation to the flowchart, this would, for instance, mean that students would focus on how the system could be changed, for example, within the framework of the current democratic system or by someone intervening in the system in some way. An example where the experience can be glimpsed is in a conversation between two upper secondary school students discussing what distribution of power would be reasonable in society (see quote [5]). In relation to the scatterplots, students would, for instance, discuss what could be done to change the injustices in the world related to the two factors illustrated in the graph (see example in quote [6]).

[5]

B: So, in that case, the authorities and the people, they are the ones who should have a kind of 50–50 split of what we do with any opinion.

(...)

A: I guess you could say that it's important that the Swedish National Agency for Education listens to what students and parents say about this.

(Upper secondary school, flowchart illustrating the Swedish democratic system)

[6]

A: Do we have any plan on how... How are we going to get these countries over here to have longer education and fewer children? What can we change? How can we help them? I'm thinking more countries need to become democratic.

B: Yes.

A: Women need to get proper rights, which can be done maybe by... Maybe we can send teachers in some way who can help the children.

B: Yes, that's a good idea.

(...)

A: In many countries, it might be about changing the culture and getting women educated, because then they can... I mean, if you only get a two-year education, of course, you can't support yourself with your own job. Then you're dependent. So, we, as the somewhat richer countries, might be able to help them by trying to provide proper healthcare.

(Year 6, scatterplot illustrating the relationship between the number of years women go to school in different countries and the number of children they have)

In quotes [5] and [6], the students show signs of having discerned the dynamics and changeability in both the flowchart and scatterplot, and they are able to critically discuss and challenge the existing relations. In quote [5], student B describes how the National Agency for Education, as an authority, should not be given individual decision-making power in a matter such as how mobile phones may be used in school, but that the people should be involved in deciding on this. Student A specifies the relevant people who should have a say in the matter—pupils and parents. In quote [6], the students discuss what could be done to change the conditions for countries with few years of education for girls and high fertility rates, suggesting interventions such as strengthening democracy, strengthening human rights, and improving health care.

In summary, we argue that agency is an important aspect of civic visual literacy that needs to be addressed when reading and using visual representations in SSE. This probably becomes especially important when static representations are used to illustrate dynamic and changing systems and issues.

5.2 Model-specific aspects of civic visual literacy

We have identified aspects that appear to be generic for developing civic visual literacy, particularly in relation to visual representations illustrating relationships. However, the analysis also indicates that some aspects are model-specific in terms of being crucial for students to discern in relation to one particular model type. Those aspects thus seem to be unique to that particular representation (see aspect 2 in Figure 1). In relation to flowcharts, the *mutuality* in the arrows seems to be crucial for students to discern. Rather than reading a flowchart with bidirectional arrows as a stepwise process where A leads to B, which in turn leads to C and D, and then back again, students need to read flowcharts in SSE as a system where different actors or entities simultaneously and mutually affect each other through reciprocal relationships. The quotes below illustrate conversations where students have not yet discerned mutuality and thus read the flowchart as a stepwise process (quote [7]) and where they have discerned mutuality and, rather, read the flowchart as a system (quotes [8] and [9]).

[7]

A: The people, they have an election for the parliament.

B: And the parliament talks to the government, or...?

A: The parliament... they come up with laws, which the government ensures are implemented.

B: And then, the government…

A: …gives a task to the authorities, for example, the Swedish National Agency for Education, to follow them.

B: Yes.

A: And then the official authority enforcement, that has to be ensured so that people follow it, so that the system keeps running. Then it goes back, and I think it goes the other way around. (Year 6, flowchart illustrating the Swedish democratic system)

[8]

A: Here, from the households… you pay taxes to the municipality.

B: To the state. And then from this official… [meaning the state] it goes to public services and benefits for households. Public services. That's like if you need services, like room service or something.

A: Yeah. Now I'll explain it. You know how...

B: But look here. Households can receive wages from companies, and companies can get labour from households.

A: So, households can work for companies.

B: Yes.

A: Yes, if you work, you get a salary, and if you get a salary, you have a job. Goods and services are provided to households by companies.

B: And payments go from households to companies. (Year 6, flowchart illustrating the Socioeconomic system)

[9]

A: I still think that the people have the biggest influence.

B: Do you think so?

A: Yes, considering that everyone is against it [the bill] except for the Swedish National Agency for Education. And teachers, politicians, and the people—together, we are many, many more than the Agency. Because I also think that… the different political parties still have to keep the people happy to make sure they get votes, since that's how our system works in Sweden.

B: Hmm, and if politicians abuse their power, they can be removed. (Year 6, flowchart illustrating the Swedish democratic system)

In quote [7], students discuss the Swedish democratic system in terms of a stepwise process and have thus not yet discerned the mutuality between the actors involved. In quotes [8] and [9], however, mutuality has been discerned. In the former, this mutuality is explicitly expressed in terms of the mutuality between households and companies and between households and the state/municipality. In the latter, mutuality is more indirectly expressed in terms of the relation between the government and agencies and between the people and the parliament.

The model-specific aspect identified in relation to scatterplots involved *deviations*. When deviations were overlooked, students tended to understand the pattern as constant or determined (that high GDP *always* correlates with high CO^2 emissions). However, noticing deviations helped students to understand the pattern as general (that high GDP *often* correlates with high CO^2

emissions, but not always). Noticing deviations from the pattern also facilitated students to discuss underlying causes for countries' placements in the diagram, which in turn qualified their reasoning about the societal issue in focus. The quotes below illustrate conversations where the students overlook (quote [10]) or notice (quote [11]) deviations.

> [10]
>
> A: The further to the right, the higher the income level; you can actually see that in this scatterplot.
>
> B: Yes, but also the further up, the more carbon dioxide. So you can see that the rich countries are up to the right and the poorer ones are down to the left.
>
> (Year 8, scatterplot illustrating the relationship between GDPs per capita and CO2 emissions per capita)

> [11]
>
> A: Yes, but Mongolia shows the opposite. That, um… You don't need to have a very high income to…
>
> B: …have higher carbon dioxide emissions. Yes, that's true.
>
> A: Congo. They are very poor. They don't emit…
>
> B: There is a difference, yes, but money plays a big role.
>
> A: Yes, absolutely - the richer the country, the more carbon dioxide emissions.
>
> B: Access to all sorts of things.
>
> A: Yes, but not only that.
>
> (Year 8, scatterplot illustrating the relationship between GDPs per capita and CO2 emissions per capita)

In quote [10], the students identify that there is a pattern between the two factors on the axes—that a higher GDP is related to higher levels of carbon dioxide emissions—and they seem to understand this relation as constant and determined. However, in quote [11], the students have discovered that Mongolia and the Netherlands have different income levels but the same level of CO2 emissions. The discovery of this deviation helps them to nuance the relation between GDP and CO2 emissions, and it facilitates a conversation about other factors influencing the relationship between the two factors. They draw the conclusion that wealth matters, but not exclusively.

What seems to be similar in relation to both model-specific aspects is that they enable students to *specify the relationships* illustrated. They are able to specify the relationships depicted in flowcharts as mutual and interdependent, and those depicted in scatterplots as being general rather than constant.

In summary, developing civic visual literacy requires both discernment of model-generic aspects (such as entirety, expansion, and agency) and discernment of model-specific aspects (such as mutuality and deviation). This means that developing civic visual literacy involves both aspects and that proficiency in interpreting one type of visual representation in SSE does not automatically translate to proficiency with other types.

5.3 Content-specific aspects of civic visual literacy

In addition to what has been presented above, the analysis shows that it is not only the model type that affects how a visual representation is read. Findings related to both the scatterplot and the flowchart suggest that the content itself affects how the model is being read (see Holmén et al., 2024). For instance, the mutuality in the relationships was easier for students to discern in the flowchart illustrating the socioeconomic system (where economic transactions between two parties are often understood as mutual and simultaneous) than in the flowchart illustrating the Swedish democratic system (which was rather read as a stepwise process going both ways). Also, the entirety of the system was easier for students to recognise in relation to the democratic system than in relation to the socioeconomic system (where they rather tended to focus on pairwise relationships). The influence of the content in scatterplots was particularly evident in relation to students' discernment of the overall pattern, where students' prior (content) knowledge about the relationship between consumption and high CO^2 emissions often resulted in simplified conclusions about high GDP *always* corresponding to high CO^2 emissions. The tendency to understand the overall pattern as deterministic was much less pronounced in relation to the relationship between girls' education levels and fertility rates per woman, where students also had less prior knowledge.

In summary, civic visual literacy appears to be partly content-specific because the ability to read and use a visual representation depends in part on what is being illustrated. Hence, the ease or difficulty of reading a particular model type can vary depending on what content is illustrated. Consequently, although it is possible to outline model-generic aspects as well as model-specific aspects of civic visual literacy generally, it is also crucial to consider the content being visualised and how it influences the reading of the model. All three aspects are thus important components of civic visual literacy.

6 DISCUSSION

The aim of this paper was to empirically qualify and specify the meaning of visual literacy within the context of SSE, and thus the meaning of civic visual literacy—both to deepen the understanding of the meaning of visual literacy in a specific subject context, and to inform teaching about the key aspects to focus on to facilitate the development of students' civic visual literacy. Based on the results presented, we argue that civic visual literacy should be understood as partly model generic, partly model specific, and partly dependent on the content visualised. We also argue that entirety, expansion, and agency are three aspects that students must discern if they are to develop a more qualified civic visual literacy and thus be able to reason about societal systems and issues in a qualified way, using visual representations as a tool. This means that these aspects must function as focal points in SSE teaching when visual representations are used.

Two conclusions based on the results are discussed further below: the importance of understanding visual literacy in light of the specific school subject, and the importance of going beyond the model itself in the reading of models. The question of generalizability will also be raised, and some methodological reflections are offered.

6.1 The importance of understanding visual literacy in light of the specific school subject

One conclusion that can be drawn from the results is that the contextual and subject-specific aspects of visual literacy are important to emphasise, which is in line with earlier research (see, e.g., Lake, 2002). Results showed that the subject content illustrated affected the reading of the

model, because some aspects were easier or more difficult to discern depending on the content (as explained in Section 5.3). It is thus important to take the content-specific aspects into consideration when discussing visual literacy and when helping students develop a qualified understanding of the models used in teaching. Learning to read and use a visual representation is thus not an ability that should be considered purely generic. Rather, it is an ability that needs to be taught and learnt in relation to different school subjects and to some extent even in relation to specific subject content. It thus seems relevant and important to talk about civic visual literacy as a specified kind of visual literacy, colored by the characteristics and content of civics and SSE. This, in turn, highlights the importance of helping students develop visual literacy in different school subjects, not assuming that reading a certain model in one subject or context means that it can be understood and used in a qualified way in another subject or context.

6.2 Civic visual literacy as going beyond the model itself

Another conclusion that can be drawn from the results is that a central part of reading visual representations in SSE, thus of civic visual literacy, is moving beyond the model itself. The first aspect identified as model generic was entirety—reading the visual representation as a whole. This aspect could be considered to be "within" the model itself. As has been identified in earlier research, decoding both the model itself and its separate parts is central in visual literacy (see, e.g., Avgerinou & Pettersson, 2011; Bamford, 2003; Bresciani & Eppler, 2015; Glazer, 2011; McTigue & Flowers, 2011; Wennersten, 2020). However, going beyond the model seems just as central in civic visual literacy as decoding the model itself, if not even more so. The two other model-generic aspects identified in the study, expansion and agency, could be understood as doing just that. Discerning expansion creates the possibility of going beyond the model in terms of understanding the model in light of factors and actors not explicitly illustrated, yet of great importance for understanding the societal system or the issue illustrated. Discerning agency does this in terms of enabling the understanding that the relationships, patterns, and structures illustrated are dynamic and therefore can be changed by citizens at the level of the social collective, the group, or the individual. The results thus emphasise the importance of deconstructing and critically examining models and visual representations as part of civic visual literacy in SSE teaching. This relates to earlier research that pinpoints the challenges with static models that represent dynamic systems or issues (see, e.g., Cohn et al., 2001; P. Davies & Mangan, 2013; Derbentseva et al., 2007; Reingewertz, 2013; Wheat, 2007).

A conclusion drawn from this study is that it is not necessarily the design of the models themselves that is crucial for the kind of reasoning students are able to develop in relation to the models, although that of course may matter as well (see, e.g., Jägerskog, 2020, 2021; Wheat, 2007). Rather, it is the opportunities that students are given to learn how to decode, deconstruct, and challenge the models that are crucial, and thus, the extent to which students are given the opportunity to discern those aspects that are considered central. Of course, the teacher plays a central role in ensuring that the models do not become a ceiling for how far one can think and reason about the systems and issues illustrated, but rather a starting point for qualified discussions that go beyond the model itself (Holmén et al., 2024). The aspects that this study identifies as critical could thus function as starting points for the design of SSE teaching when flowcharts and scatterplots are being used so that students can develop qualified reasoning about societal systems and issues. As a complement to previous research on visual literacy that emphasises the inclusion of skills such as producing images and models to communicate a message (Avgerinou & Pettersson,

2011; Bamford, 2003; Bresciani & Eppler, 2015; Metros, 2008), we want to emphasise the importance of deconstructing and critically examining models and representations as part of civic visual literacy in SSE teaching.

6.3 Model-generic aspects in relation to other visual models and content

Only two types of visual representations were investigated in this study—scatterplots and flowcharts. When talking about model-generic aspects, we thus talk about aspects relevant for flowcharts and scatterplots. Nevertheless, it could be argued that it is possible, or even likely, that the aspects identified as critical for students to discern in relation to those two types of models would also be relevant for other models that illustrate relations, processes, and causality in SSE. Similarly, only content related to two different flowcharts (the Swedish democratic system and the socioeconomic system) and two different scatterplots (the relationship between countries' GDPs per capita and their CO^2 emissions per capita, and the relationship between the number of years women go to school in different countries and the number of children they have) were investigated in this study. Future studies should look into whether the three potential model-generic aspects identified in this paper also hold for other types of visual representations and other subject content focused on in SSE.

6.4 Methodological reflections

The data were collected using recorded small-group discussions. It is possible that we may have gained even richer data had we interviewed students individually, because individual interviews enable in-depth and follow-up questions that could further deepen the understanding of individual students' different experiences. Also, interviews may have strengthened the students' individual voices because all students would have received equal space, something that is not always the case in a group discussion. However, had we conducted individual interviews, we would have lost the dimension of individual students' experiences being challenged by those of other students. Also, the empirical data were collected from students ranging from year six in secondary school to year one in upper secondary school because we were interested in examining the experiences of a broader group of students. If the empirical data had only focused on one of the age groups, the aspects identified as critical for students to discern may have emerged somewhat differently. Future studies could focus on refining a particular age group's reading of visual models further. Also, as mentioned above, four particular models were used in the study. Future studies should investigate the extent to which the results hold in relation to different subject content and other types of models.

6.5 Conclusions

The ability to analyse, critically reason about, and constructively address problems related to societal issues and systems is central to what it means to become a citizen and could be considered to be at the core of SSE (Tväråna, 2019). This paper suggests that developing students' civic visual literacy is an important aspect in the effort to equip students to become proactive citizens who can both analyse and constructively address present and future challenges in society. However, as has been pointed out in earlier research, visual literacy should not be understood as something that is automatically mastered, but as an ability that needs to be learnt and developed through teaching (Cruz & Ellerbrock, 2015). Our hope is that the results presented in this paper, in specifying and

qualifying the definition of civic visual literacy, can inform SSE teaching so that the use of models can contribute to the development of students' civic agency, something that is fundamental to the subjectifying purpose of SSE. Through understanding that societal systems can be challenged and through seeing themselves as capable of bringing about change, students can develop this agency. Thus, a key aspect of civic visual literacy is the ability to critically analyse and question models used in social science education and use them to imagine solutions and alternative futures.

ACKNOWLEDGEMENTS

We would like to thank our university colleagues Mattias Björklund and Max Strandberg, as well as social science teachers Sara Carlberg, Patrik Gottfridsson, Therese Juthberg, Robert Kenndal, Bodil Kåks, Maria Larsson, Marie Losciale, Jenny Rosengren and Per Sahlström, without whom the project would not have been possible. The project was financed by ULF-avtal.

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