

ANALYZING SCHOOL PHOTOGRAPHS IN THE AGE OF ARTIFICIAL INTELLIGENCE

Combining quantitative techniques, qualitative methods, and computer vision

Analisando fotografias escolares na era da Inteligência Artificial:
Combinando técnicas quantitativas, métodos qualitativos e visão computacional

Analizar fotografías escolares en la era de la Inteligencia Artificial:
Una combinación de técnicas cuantitativas, métodos cualitativos y la visión por ordenador

SJAAK BRASTER^{1*}, MARÍA DEL MAR DEL POZO ANDRÉS²

¹Erasmus University Rotterdam, Rotterdam, The Netherlands. ²Universidad de Alcalá, Alcalá de Henares, Spain. *Corresponding author. E-mail: sjaak.braster@gmail.com.

Abstract: Our objectives are to explore the intersection of large-scale digitized historical photographs, the application of advanced statistical techniques for their analysis, the integration of these quantitative methods with qualitative approaches, the incorporation of AI-driven computer vision, and the humanistic interpretation that ties these elements together. Our approach combined two social science methods: content analysis and multiple correspondence analysis. By integrating these methodologies, we were able to analyze large sets of photographs systematically. In the age of artificial intelligence this mixed-methods approach should also incorporate the possibilities that AI offers us; in this article we have used the computer vision for coding existing photographs, and we have criticized the results generated by AI.

Keywords: photography; History of Education; visual analysis; generative AI.

Resumo: Nossos objetivos são explorar a interseção entre fotografias históricas digitalizadas em larga escala; aplicar técnicas estatísticas avançadas para sua análise; integrar desses métodos quantitativos com abordagens qualitativas; incorporar a visão computacional orientada por IA e interpretar humanisticamente o que une esses elementos. Nossa abordagem combinou dois métodos das ciências sociais: análise de conteúdo e análise de correspondência múltipla. Ao integrar essas metodologias, conseguimos analisar grandes conjuntos de fotografias sistematicamente. Na era da inteligência artificial, essa abordagem de métodos mistos também deve incorporar as possibilidades que a IA nos oferece; neste artigo, utilizamos a visão computacional para codificar fotografias existentes e criticamos os resultados gerados pela IA.

Palavras-chave: fotografia, História da Educação, análise visual, IA generativa.

Resumen: Nuestros objetivos son: explorar la intersección de largas series de fotografías históricas digitalizadas, la aplicación de técnicas estadísticas avanzadas para su análisis, la integración de estos métodos cuantitativos con enfoques cualitativos, la incorporación de la visión por ordenador impulsada por la IA y la interpretación humanística que vincula estos elementos. Nuestro enfoque combina dos métodos de las ciencias sociales: el análisis de contenido y el análisis de correspondencias múltiples. La integración de estas metodologías nos permite analizar sistemáticamente grandes conjuntos de fotografías. En la era de la inteligencia artificial, este enfoque de métodos mixtos también debería incorporar las posibilidades que ésta nos ofrece; en este artículo hemos utilizado la visión por ordenador para codificar las fotografías existentes y criticado los procedimientos generados por la IA.

Palabras clave: fotografía; Historia de la Educación; análisis visual; IA generativa.

INTRODUCTION

“L'historien de demain sera programmeur ou il ne sera plus” (The historian of tomorrow will be a programmer or will no longer exist). This prophetic statement by Emmanuel Le Roy Ladurie, made in a 1968 newspaper article titled “The Historian and the Computer,” highlights the profound impact of technology on history as an academic discipline (Ladurie, 1968). In the 1950s and 1960s, the French *Annales* school of historians, to which Ladurie belonged, was already pioneering the use of quantitative methods to study historical processes. Ironically, the *Annales* school moved away from quantitative history in the 1970s (Burrows, 2023). Yet, over half a century later, Ladurie's vision is more relevant than ever in an era shaped by artificial intelligence (AI) and big data.

The rapid digitization of historical sources and the rise of computational history – a new interdisciplinary approach to studying the past – have significantly expanded the methodological toolkit available to historians (Jost, 2023). Historians have begun using advanced technologies such as computer-assisted quantitative narrative analysis, natural language processing (NLP), and data visualization to uncover new dimensions of the past (Franzosi, 2017). The public release of the groundbreaking artificial intelligence tool ChatGPT in 2022 gave an even stronger impetus to cliometrics, the quantitative branch of history, compelling historians – particularly those working with vast amounts of historical sources – to seriously consider AI as a virtual research assistant (Braster, 2025).

Among the many sources available to historians of education, school photographs stand out as valuable artifacts that capture the evolution of educational practices, classroom materialities, and societal values over time (Grosvenor et al., 1999). Traditionally, these images have been analyzed qualitatively, with historians of education extracting meaning through denotation and connotation of images and iconographic and iconological analysis (Barthes, 1967; Panofsky, 1970; Del Pozo & Braster, 2020). However, the vast number of digitized photographic collections now available calls for the adoption of quantitative methods to detect patterns, trends, and variations that qualitative approaches alone might overlook. It also necessitates exploring the possibilities that AI tools offer for analyzing school photographs. These new tools are not only capable of generating realistic, lifelike images based on written prompts (text-to-image) but are also adept at analyzing existing images to interpret denotation and connotation (image-to-text).

Although technological advancements will inevitably lead to increased attention to the quantitative analysis of visual image databases and an expanding role for AI in coding images through computer vision, the historian's interpretative role remains crucial for crafting historical narratives. School photographs are more than mere data points; they embody cultural, social, and emotional dimensions that require nuanced understanding. A balanced methodological approach that

synthesizes AI-driven analytics with human interpretation is essential to preserve the necessary context for historical inquiry. This also implies that we should integrate qualitative hermeneutic methods to the advanced quantitative statistical techniques when analyzing school photographs in the history of education. To come to valid conclusions about the past, an approach that combines both quantitative and qualitative methods is preferable to focusing on only one side of the methodological coin (Tashakkori & Teddlie, 2010; Creswell, 2018). In the age of artificial intelligence this mixed-methods approach should also incorporate the possibilities that AI offers us; in case of analyzing visual images, we especially consider the advantages of computer vision for coding existing photographs. In sum, in our present days there are more roads for studying the past than cliometrics or narrative history (Fogel & Elton, 1983).

Our objectives in this article are to further explore the intersection of large-scale digitized historical data, the application of advanced statistical techniques for their analysis, the integration of these quantitative methods with qualitative approaches, the incorporation of AI-driven computer vision, and, last but certainly not least, the humanistic interpretation that ties these elements together.

Our research focuses on analyzing large collections of school photographs found in archives and online repositories. To conduct this analysis, we will primarily explore multiple correspondence analysis (MCA) as a statistical algorithm, and content analysis as a qualitative method. These two approaches are not new. MCA was applied in the work of the French sociologist Pierre Bourdieu (1984), who relied on the assistance of the French statistician Jean-Paul Benzécri for his data analysis (Benzécri, 1973; Benzécri, 1992). Historian Louis Galambos was a pioneer in using content analysis to examine newspaper articles in the 1970s (Galambos, 1975). Similarly, analyzing several hundred photographs in historical research was not unprecedented – George Dowdall and Janet Golden conducted such a study in a mental hospital in the 1980s (Dowdall & Golden, 1989).

However, the large-scale analysis of school photographs in the history of education has rarely been undertaken (Margolis, 1999; Nóvoa, 2000). Moreover, the combination of MCA as a technique and content analysis as a method in historical research remains relatively novel (Braster, 2011). In this regard, our work – drawing inspiration from the growing number of digitized datasets and the rapidly increasing power of AI to translate visual images with computer vision into text and codes – aims to be groundbreaking in advancing the analysis of large collections of visual images.

The research questions addressed in this article focus on two topics in two countries during distinct periods: (a) *To what extent traditional teacher-centered instruction in primary education in the Netherlands was replaced by a child-centered approach between 1945 and 1985?* and (b) *To what extent the educational ideals of the central government in the Second Republic of Spain were perceived in practice through the*

establishment of children's colonies from 1936 to 1939? Although these cases are unrelated, they serve as examples of how large visual datasets can be analyzed to (a) quantify images and construct empirical scales to measure complex concepts like child-centeredness, and (b) to construct a conceptual typology based on multiple photographs taken in children's colonies in Spain.

CONTEXT: THE VISUAL TURN IN HISTORY

“Visual images”, according to David D. Perlmutter, “typically have been either absent from historical research or employed for purely decorative purposes. Images have not been used analytically and critically as source material, data, or evidence” (Perlmutter, 1994, p. 167). For a long time, historians have used words, and especially written documents, as source material. These documents constitute “the historian’s stock in trade” (Tilly, 1990, p. 689). In the 1960s, however, there has been a growing interest for quantitative sources. Images in those days were not considered to be valid or reliable sources to study the past, although Philippe Ariès would use medieval paintings in his influential book *Centuries of childhood* to illustrate the changing conceptions of childhood between the fifteenth and eighteenth centuries (Ariès, 1962).

Oil paintings were also studied by art historians, who developed new methodologies for analyzing images that were extensively used in later decades (Panofsky, 1970; Gombrich, 2014; Berger, 1972). However, the interest of art historians in the visual did not inspire historians in general to pick up the methodological challenge of analyzing images. In 1982 James Borchert concluded that “while the growing interest in new sources and methods, especially quantitative ones, was institutionalized in the founding of the *Historical Methods Newsletter* in 1967, the journal *Historical Methods* has had no articles on historical photographs and the methods available to analyze them” (Borchert, 1982, p. 35).

Historians were informed about the usefulness of images for writing histories as early as 1940, the moment when the American Historical Association reported about the potential of a cultural approach in history (Del Pozo & Braster, 2020). However, historians did not delve into image archives. This began to change with the cultural turn in the 1970s, inspired by, among others, the work of anthropologist Clifford Geertz (1973). This turn followed the well-known linguistic turn in the 1960s (Rorty, 1967), which impacted disciplines like anthropology, sociology, and history. Subsequently, both turns paved the way for a pictorial or iconic turn in the 1990s (Mitchell, 1994; Boehm, 1994).

In 1989, Lynn Hunt showed that in the “new cultural history” the emphasis was on the “close examination – of texts, of pictures, and of actions – and an open-mindedness to what those examinations will reveal, rather than on elaboration of new

master narratives or social theories” (Hunt 1989, p. 22). Like art historians before them, new cultural historians also began to examine pictures. It became evident that if a historical study involved cultural or social artefacts, having visual images of such objects was useful for “objectively” describing them in detail, while also allowing for the search for symbolic meanings with the help of visual semiotics. If the social world could be studied like a text, so could images. Following this postmodern position, a picture could even prove to be worth much more than a thousand words.

Especially after Mitchell in the USA and Boehm in Germany made their case for a visual turn in 1994, the number of books published about visual culture increased (Mirzoeff, 1998; Evans & Hall, 1999; Sturken & Cartwright, 2001; Howells & Negreiros, 2003). In response to this growing interest in the visual, new journals appeared, like *Visual communication*, the *Journal of visual culture*, and *Visual studies*. Alongside a few works about understanding visual culture, several handbooks on conducting visual research were published at the beginning of the twentieth-first century (Kress & Leeuwen, 1996; Prosser, 2000; Banks, 2001; Pink, 2001; Leeuwen & Jewitt, 2001; Rose, 2022). Cultural historian Peter Burke (2005) also contributed with a book about the uses of images as historical evidence.

The visual turn produced a vibrant market for texts in the twentieth-first century. Nowadays, there are works about visual research methods (Pauwels & Mannay, 2020), visual sociology (Harper, 2023), and visual history as applied in the field of education (Mietzner et al., 2005; Allender et al., 2021; Comas et al., 2022). In our present time, the visual is recognized as a new approach in history and historical writing. The abundant literature about the visual also produced a seemingly extensive overview of methodological strategies for analyzing images, although it must be noted that most of these methods and techniques were already available in the methodological toolboxes of the social sciences and humanities: quantitative and qualitative content analysis, semiology and social semiotics, psychoanalysis, discourse analysis, and ethnography (Rose, 2022).

The twentieth-first century has witnessed rapid progress in the development of image recognition software, enabling the search of large collections of digital images and generating textual descriptions of these images (Rose, 2022). AI-driven computer vision is now accessible to anyone interested in translating images into text. Machines have learned to apply methodological concepts like denotation and connotation to visual images. However, AI-tools can make mistakes, which is why human interpretation remains essential to ensure that historical research maintains high validity and reliability.

DATA AND METHODS: CONTENT ANALYSIS AND MULTIPLE CORRESPONDENCE ANALYSIS

In this article, we will test the abilities of AI-driven computer vision by analyzing two databases of photographic material we had previously collected and analyzed before coding visual images with such technology was possible. Our first corpus of images consists of 193 classroom photographs gathered to investigate the transition from teacher-centered to child-centered approaches in Dutch primary schools between 1945 and 1985 (Braster, 2011). These photographs, available in a digital format, were downloaded from a social media website where former pupils of Dutch primary and secondary schools reconnect, share memories, and post old photographs: <http://www.schoolbank.nl>.

The second corpus comprises images found in various places to explore educational practices in children's colonies in Spain during the period 1936–1939, amongst them the *Archivo General de la Administración* (AGA) [General Archive of the Administration] in Alcalá de Henares (Spain), the *Biblioteca Nacional* (BN) [National Library] in Madrid, the International Institute of Social History in Amsterdam (the Netherlands), and the Memorial Marx Library in London, England (Braster & Del Pozo, 2015, p. 464–467).

The coding of these images was conducted manually by both authors, using pencil and paper at desks within the archives where the images were found. Such time-consuming research activities remain necessary because many archival documents have not been digitized, and some archives do not permit researchers to make digital photographs of the documents in their possession. Therefore, to write historical narratives about both corpora, we first manually coded the images and then applied a statistical algorithm from social science research. These two steps correspond to the methods explained in the next paragraph: content analysis and multiple correspondence analysis.

Content analysis is a well-established social science research method used for analyzing various forms of communication (Krippendorff, 2004). Initially developed as a quantitative technique for examining news media in the 1940s, it has since evolved into a versatile method applicable to a wide range of sources, including personal documents in both written (e.g., diaries, letters, autobiographies) and visual forms (e.g., photographs, photo albums, postcards, other visual artifacts). It is also used to analyze official documents from public or private sources, mass media outputs (e.g., newspapers, journals, television programs, films, textbooks), and digital content (e.g., Instagram and other online resources).

The goal of content analysis is to systematically quantify content based on theoretically defined categories or classify it through inductively developed categories or codes. In other words, content analysis can follow either deductive logic, which

starts with theoretical concepts, or an inductive approach, where constructs emerge from empirical data. The former focuses on manifest content, elements that are visible and easily observable, while the latter delves into latent content, uncovering deeper symbolic meanings.

Applied to the analysis of visual images – such as those related to the history of education – manifest coding involves recording the presence of material educational objects (e.g., school benches, blackboards) or counting the number of pupils and teachers in a scene. Latent coding, on the other hand, explores symbolic meanings embedded in material objects and teacher-student interactions. In both cases, content analysis serves as a valuable method for image analysis, as demonstrated in handbooks on visual methodologies (Bell, 2001; Bock, Isermann, & Knieper, 2011).

The coding of visual images can be particularly challenging, especially when seeking to uncover underlying meanings in photographs. Fortunately, qualitative research offers a range of strategies to address this challenge. One of the most widely used is the grounded theory method, originally developed by Glaser and Strauss in 1967 (Glaser & Strauss, 2006). Later, Strauss and Corbin (2007) formalized a structured coding procedure that involves three key phases: (a) open coding, i.e. breaking down data into categories; (b) axial coding, i.e. reorganizing data by establishing connections between categories, and (c) selective coding, i.e. refining the data by identifying core categories (Boeije, 2010).

This process of segmenting and reassembling visual data results in a set of codes and categories for each image. To identify empirical patterns within these coded datasets, we took a second step in the visual analysis: the application of *multiple correspondence analysis* (MCA), a statistical algorithm specifically designed for analyzing multiple nominal variables simultaneously (Greenacre, 2016).

Nominal, categorical, or non-continuous variables are common in social sciences research. One basic approach to examining relationships between such variables is by presenting a contingency table and applying a Chi-square test to assess statistical independence. Correspondence analysis extends this by visually representing the categories of two nominal variables in a two-dimensional space, without the constraints of inferential statistics.

It was not until the 1970s that category plots generated by MCA gained prominence, particularly through the work of Pierre Bourdieu. In *La Distinction*, Bourdieu (1984) graphically illustrated the relationships between nominal variables such as occupation, education, and social class on one hand and various indicators of cultural taste on the other. Interest in exploratory, descriptive, and non-inferential analysis of the social world was not confined to France. Scholars at the Department of Data Theory at Leiden University (Netherlands) followed developing statistical algorithms for non-linear multivariate analysis using alternating least squares under the pseudonym Albert Gifi (1981, 1990). One of these statistical techniques was later

incorporated into SPSS, the widely used data analysis software. The technique, initially known as Homogeneity Analysis with Alternating Least Squares (HOMALS), became one of the dimension reduction techniques in SPSS and was renamed Multiple Correspondence Analysis (IBM, 2019).

MCA offers several advantages for analyzing coded visual images in content analysis. First, there are no strict requirements regarding the measurement levels of variables. All variables can be treated as nominal, with HOMALS assigning numerical values (category quantifications) that are plotted in a two-dimensional space. A second strength of MCA is its ability to visually represent clusters of categories, allowing researchers to detect emerging patterns in the data. Categories positioned close together in the plot indicate similarities. A third advantage is that MCA generates object scores, which are plotted as data points. In our study, these object scores represent classroom photographs and aggregated images of school colonies. Analyzing their spatial distribution can provide further insights into underlying patterns in the data.

In essence, the combination of content analysis for coding visual images and MCA for spatially representing these codes or categories can be seen as a quantification of qualitative data. In other words, the qualitative analysis of multiple images produces a new image, just as Bourdieu transformed survey data into a visual representation of society as a social space. To demonstrate how these methods can be applied to real historical data, we return to the two cases mentioned earlier: the transition from teacher-centered to child-centered education in Dutch primary schools (1945–1985) and educational practices in children’s colonies in Spain (1936–1939).

CASE 1: CHILD-CENTEREDNESS IN PRIMARY SCHOOLS IN THE NETHERLANDS (1945-1985)

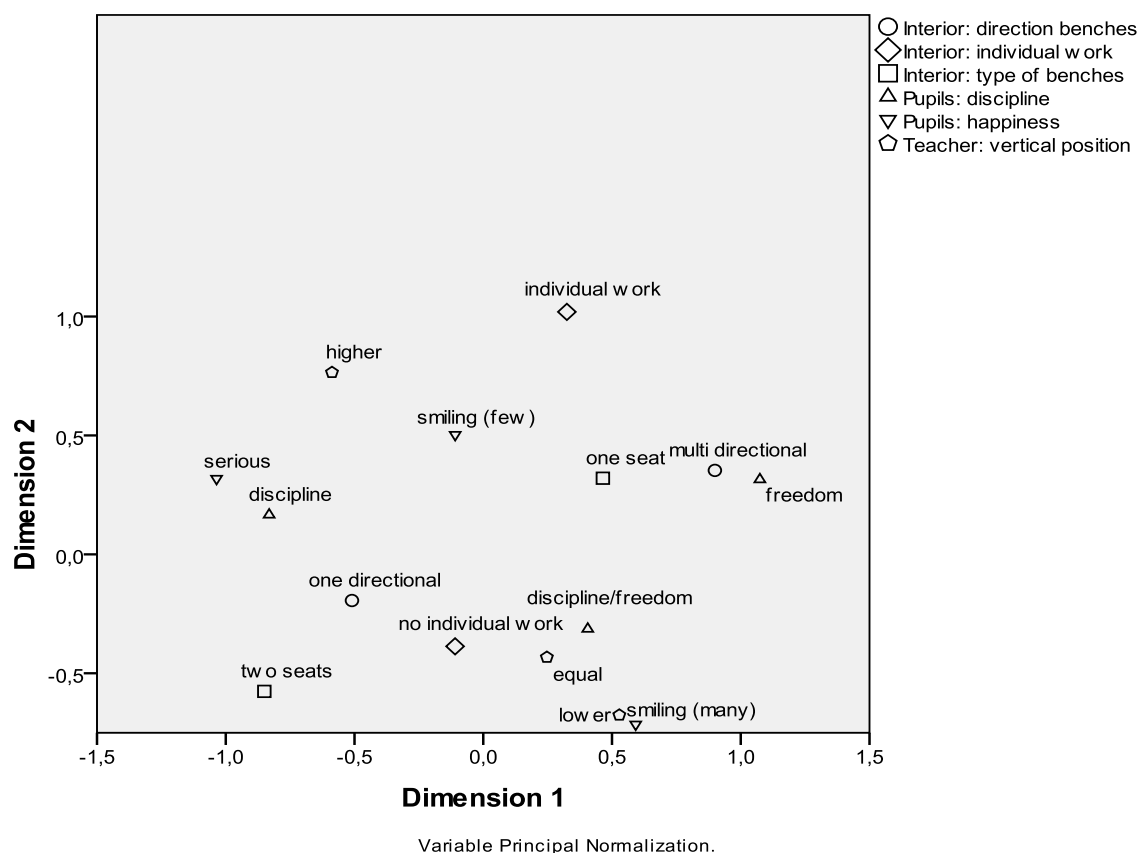
Despite the emergence of progressive, child-centered education at the beginning of the twentieth century, the core structures of schooling did not change dramatically (Tyack & Cuban, 1995). While paradigmatic shifts in educational thought have occurred, the school system has been resistant to sudden changes in direction. Graded schools and teacher-centered approaches have remained firmly in place, despite the ongoing advocacy for child-centered learning. Larry Cuban (1990) illustrates this continuity in his book *How Teachers Taught*, where he examines American classrooms from 1880 to 1990 using a variety of sources, including historical photographs of teachers and students. These visual sources generally highlight the persistence of teacher-centered instruction throughout the last century. We take up the challenge of using the same type of source material to examine whether a similar conclusion can be drawn for primary education in the Netherlands between 1945 and 1985. Specifically, we investigate whether Dutch classrooms continued to adhere to

teacher-centered practices or whether signs of child-centered approaches began to emerge after World War II.

Our analysis of Dutch classroom photographs started with a “theoretical selection” after which we continued with coding the set of photographs by “constant comparison” (Glaser & Straus, 2006). After several passes through the data, the following categories and codes emerged that were be used as descriptions for the “teacher- or child-centeredness” of a classroom image: 1. Interior: 1.1. Type of school benches: one seat, two seats; 1.2. Direction of school benches: one direction, multi directions; 1.3. Individual work: present, not present. 2. Pupils: 2.1. Activity pupils: discipline, freedom, mix; 2.2. Happiness pupils: looking serious, few smiling, many smiling. 3. Teacher: 3.1. Vertical position: equal position as pupils, lower position, higher position.

After compiling this list of categories and codes, the next step was to examine their mutual relations by means of a multiple correspondence analysis. In this analysis we have plotted the subsequent categories to see what patterns emerge (Figure 1).

Figure 1. *Spatial relationships between the axial codes assigned to 193 classroom pictures from the period 1945–1985: results of a multiple correspondence analysis.*



In the category plot that is produced by the multiple correspondence analysis (Figure 1), we see clustering of “teacher-centered” categories on the left side, a clustering of “child-centered categories” on the right side, and a clustering of intermediate categories in the middle of the plot. If we look at the category scores for the first dimension, we see the following categories that are placed close together (which indicates similarity between them): serious looking children – school benches with two seats – discipline among pupils – a teacher that is positioned higher than the pupils – school benches that all point in one direction (towards the black board). Figure 2 is an example of a classroom photograph where we see all these things. It is also a visual image with a high negative object score on the first dimension, which means that it will be located on the left side of the plot.

Figure 2. *Image 1 – Classroom photograph with a high negative object score on the first dimension (=teacher-centered).*



Note. Source: Schoolbank (<https://www.schoolbank.nl/>).

On the right side of the plot (Figure 1) we find the following categories, ranked-ordered from higher till lower category scores: freedom among children – school benches that point in several directions – many children that are smiling – a teacher that is positioned lower than the pupils – school benches with one seat. Figure 3 is an example of a classroom photograph where these characteristics are combined. The image itself can be found on the right side of the plot with a high positive object score on the first dimension.

Figure 3. *Image 2 – Classroom photograph with a high positive object score on the first dimension (=child-centered).*



Note. Source: Schoolbank (<https://www.schoolbank.nl/>).

In sum, the category plot in which all variables were treated as if they were variables with a nominal measurement level, shows a ranking with teacher-centered categories on one side, and child-centered categories on the other. There are no clusters of categories that indicate that there are several types of classroom photographs. In other words, the categories that are plotted in a two-dimensional space can be interpreted as positions on a one-dimensional numerical measurement scale with a teacher-centered position on the left side, and an opposite child-centered position on the right side. This conclusion means that we have the possibility to add the object scores on the first dimension to all 193 classroom photographs, where positive objects scores indicate child-centeredness, and negative object scores teacher-centeredness.

After creating this measurement scale by saving the object scores on the first dimension, we can correlate this scale with the two context variables we have defined previously: the year in which the classroom photograph was taken, and the denomination of the school where the picture was made. The results are presented in table 1.

Table 1. *Object scores for child-centeredness, split by denomination of the school and year. (N=193).*

	[1945 -	- 1965 -	- 1985]
Public/neutral schools	-0,671	0,091	0,533
Catholic schools	-0,536	0,124	0,700
Protestant schools	-0,645	0,151	0,684
New Education schools	1,157	1,190	0,879

Table 1 shows the relations between the child-centeredness of a classroom photograph and the decade in which the photograph was taken for schools with four different denominations: (1) public and private-neutral schools, (2) Catholic schools, (3) Protestant schools, and (4) New Education schools that follow the pedagogical principles of educators like Maria Montessori, Helen Parkhurst, Rudolf Steiner, Peter Petersen, and Celestin Freinet. Positive scores indicate child-centeredness, and negative scores indicate teacher-centeredness.

The table shows that both public/neutral and private religious schools in the Dutch education system experienced a shift from teacher-centeredness towards child-centeredness during the period 1945-1985. However, images from New Education schools do not show such a shift over the years. These school pictures could not, either before or after the Second World War, be characterized in terms of teacher-centeredness. The conclusion is that the images of mainstream schools in the Netherlands in the 1980s are identical to the images of New Education schools in the 1950s. In other words, our image analysis, based on content analysis and multiple correspondence analysis, shows a convergence towards a child-centered image of the classroom, with individual tables arranged in groups, a teacher positioned at the same level as the pupils, and a general atmosphere of freedom and happiness.

The conclusion that Cuban draws for the USA in the period 1880-1990 does not apply to the Netherlands in the period 1945-1985. Of course, comparing a period of 100 years is not the same as one of 40 years. It would be interesting, however, to see if a secondary analysis of the visual material used by Cuban, applying the methodology presented in this article, can confirm whether his conclusion is still correct. At this point, however, it is sufficient to state that we aim only to demonstrate a way of transforming qualitative data in the form of visual images into numerical scores that could be correlated with the dimension of time – nothing more, but also nothing less.

For validating our manual coding of the classroom photographs, we uploaded two examples – one of a child-centered classroom (Image 1) and one of a teacher-centered classroom (Image 2) – into the AI-tool ChatGPT-o1. We then posed the following question: “Analyze and compare the following two photographs [=Image 1 and Image 2] with the concepts denotation and connotation to draw conclusions about the child-centeredness of classrooms.” The answer generated by the chatbot, in the form of two separate analyses of each classroom photograph and a comparison between the two images, can be found below (OpenAI, 2025a).

[AI-driven Computer Vision of Image 1]

Denotation: (a) Physical setting: Rows of wooden desks, a stove at the back, a cupboard, large windows; (b) Student posture: Nearly all children have their arms folded and are facing straight ahead toward the camera; (c) Teacher placement: The teacher stands in the back, somewhat separate from the students; (d) Expression: Most of the children appear subdued or neutral; no one is visibly smiling or engaged in an activity.

Connotation: (a) The rows of desks in straight lines suggest a teacher-centered arrangement; students face forward rather than one another; (b) The folded arms and the somewhat rigid posture may connote discipline, obedience, and a structured or formal atmosphere; (c) With the teacher at the back, it implies an authoritative presence “overseeing” rather than engaging interactively in the learning activity; (d) A lack of visible activities, resources, or student work on display hints that this classroom may revolve around direct instruction and attentiveness to the teacher rather than hands-on exploration.

Taken together, these connotations point to a more traditional, teacher-directed environment in which children are expected to remain still, attentive, and compliant.

[AI-driven Computer Vision of Image 2]

Denotation: (a) Physical setting: A larger classroom with maps on the wall, a display case or shelves with educational materials, and what appear to be paint jars or art materials on tables; (b) Arrangement of furniture: While still in rows, the desks/tables look larger and may accommodate multiple children side by side; (c) Student activity: Several students have papers and paint jars in front of them; they seem to be in the middle of a painting or craft activity; (d) Teacher presence: The teacher (and possibly an assistant) stands off to one side, and other adults are toward the back, observing or overseeing.

Connotation: (a) The presence of maps, educational posters, and materials in plain view suggests a classroom that includes visual aids and possibly more diverse learning activities.; (b) The children holding painting or craft supplies connotes active engagement, pointing to instruction that may go beyond recitation or lecture; (c) The teacher being closer to the group (and at roughly the same “level” in the photograph) may suggest more interaction with the students rather than standing apart in a purely supervisory position; (d) Although the desks are still in rows, the presence of shared materials indicates potential for group work or at least more hands-on tasks.

These elements imply a somewhat more child-centered or at least more activity-based setting than the first photo. Students appear to

have some autonomy in what they are doing (painting, working on projects), hinting that the teacher might be facilitating rather than simply lecturing.

[AI-driven comparison of Image 1 and Image 2]

Image 1 strongly connotes a traditional, teacher-centered style: strict posture, emphasis on discipline, minimal visible materials, and a setup geared toward passive listening.

Image 2 shows signs of a shift toward child-centered or at least activity-oriented learning: the presence of learning materials, map displays, and a more communal setup for art or craft work. Children appear engaged in an activity rather than strictly observing a teacher.

While neither photo would be considered “progressive” by modern standards, the second photograph contains more markers of child-centeredness –hands-on materials, visible educational resources, and the teacher’s more integrated position– than the first. The connotations of each point to different relationships between teacher, students, and learning: one highly structured and teacher-led (Image 1) and one that at least accommodates more student engagement (Image 2).

Our conclusion is that ChatGPT is quite capable of helping us with finding indicators of child-centered or teacher-centered codes and categories in the two classroom photographs. The computer sees things not fundamentally different than we did after browsing through the image database several times. There is an eye for the arrangement of the furniture, the placement of the teacher, and the expressions of the pupils. More elaborate descriptions can also be generated. The technical problem so far is that we could not upload more than four images at the same time, so a full analysis of all 193 photographs is for the moment a bridge too far. With respect to content, we note that the description of the image is rather superficial in comparison with the manual coding done by two coders. These coders know about context and can discuss with each other about what they see (and do not see); the chatbot does not know context. Furthermore, it has missed mentioning a typical element that is present in Dutch primary schools of the past: the wallchart.

We must also note that if we ask ChatGPT to describe the two images with the classification into six categories we have constructed ourselves, the answers are basically correct, although there is doubt about the classification of the school benches that can have one seat or two. The answers are as follows (OpenAI, 2025b):

The codes for Image 1 are: 1.1. Type of school benches: One seat; 1.2. Direction of school benches: One direction; 1.3. Individual work: Not present; 2.1. Activity pupils: Discipline; 2.2. Happiness pupils: Few smiling; 3.1. Vertical position teacher: Higher position. And the codes for Image 2 are: 1.1. Type of school benches: Two seats; 1.2. Direction of school benches: Multi directions; 1.3. Individual work: Present; 2.1. Activity pupils: Mix (some discipline, some freedom); 2.2. Happiness pupils: Many smiling; 3.1. Vertical position teacher: Equal position as pupils.

CASE 2: EDUCATIONAL PRACTICES IN CHILDREN'S COLONIES IN SPAIN (1936-1939)

The second set of visual images we analyze with a combination of content analysis and multiple correspondence analysis contains photographs made during the period of the Civil War in Spain, 1936-1939. We will not delve into the extensive body of literature that is available on this topic. For our purpose we consider it sufficient to point out the relevance of a specific theme in this tragic civil conflict. This theme is related to the task of the government of the Second Republic to give shelter to the children in the Spanish cities that were under attack by the rebel troops lead by general Franco and bombarded with aerial support provided by the German and Italian governments lead by respectively Hitler and Mussolini.

Soon after the bombardments started, the schools were closed, and children were evacuated to residences on the east coast of Spain. These residences became known as children's colonies. The main objective for setting up these colonies was obviously to provide a safe haven for the urban youth, but the leftist government of Spain also aimed for other goals: the socialization of the future generation of Spaniards (Braster & Del Pozo, 2015). In policy documents of the government, we can read how this task was going to be accomplished. The residences on the east coast should be set up as work communities of mainly children and a few adults, following models that were applied in revolutionary Russia. The socialization of children in these colonies should be in line with educational ideas and practices that were developed by protagonists of the New Education movement in the first decades of the twentieth century (Braster & Del Pozo, 2015).

If we take a closer look at the photographs that were included in the policy documents that were produced by the Republican government, we get an idea of how these children's colonies should look like in the eyes of the responsible authorities: children were housed in beautiful villa's; they received education in small groups under the trees; they were doing gymnastics in the open air; they were participating in workshops; they were playing games together; they were swimming in pools; and finally, they were portrayed having fun posing in front of blossoming almond trees.

It is important to note that the photographs in policy documents and other material distributed by the public authorities were taken by professional photographers commissioned by the government. In fact, during the Civil War a professional group of photographers was travelling around Spain to visit the residences at the east coast, and to map the daily life of children and their caretakers in the colonies. By doing so, they produced a large amount of images (sometimes iconic) that were selected to be used in posters, leaflets, reports, journals, and newspapers, or that were even to be printed as postcards. This bulk of visual material is available for analysis in public and private archives in Spain, England, and the Netherlands. Especially the original photographs that were used for propaganda purposes in several media, are of interest here, because they can give an answer to the question if the children's colonies, set up by the leftist government in the Second Republic in Spain in the period 1936-1939, were successful in accomplishing the ambitious objectives of the State or not.

All in all, our search for photographs in several archives and libraries in Spain, England, and the Netherlands resulted in a collection of 1.120 different photos of 92 children's colonies, excluding those that were printed two or more times. Contrary to the previous set of classroom photographs, we have more than one photograph with information about our unit of analysis: the children's colony. That means that we had to aggregate the data that could be extracted from every individual image into one code that could subsequently be assigned to every one of the 92 colonies for which we have visual information. This implied that we had to use individual photographs of children's colonies as units of observation. It did not release us from the task of coding all the 1.120 photographs, but after this process we had to aggregate them into one single score for every colony. The procedure for doing this is described in the first article written about this topic by the authors of this article (Braster & Del Pozo, 2015, p. 468-470). This work resulted in the following list of categories (or axial codes) that were introduced as variables into a data matrix that could be analyzed with IBM-SPSS.

1. Educational activities: 1.1. Classroom visible; 1.2. Teacher present; 1.3. Blackboard present; 1.4. Children are writing or drawing on tables. 2. Social activities: 2.1 Social interaction between adults and children; 2.2 Dancing in a circle (a typical Spanish group game known as *corro*); 2.3. Playing games (except *corro*); 2.4. Artistic activities: making music, theatre, dancing (except *corro*). 3. Work activities: 3.1. Handicrafts, including sewing; 3.2. Household tasks: housekeeping, cleaning, making the beds; 3.3. Fieldwork: working in fields, gardening, farming, woodwork.

These eleven categories (coded as 1 = absent and 2 = present) were analyzed simultaneously with multiple correspondence analysis. The statistical algorithm based on HOMALS included as a subprogram of the general statistical software IBM-SPSS. The output of this analysis is presented in Figure 4.

Figure 4. *Spatial relationships between the axial codes assigned to 92 Spanish children's colonies from the period 1936-1939: results of a multiple correspondence analysis.*

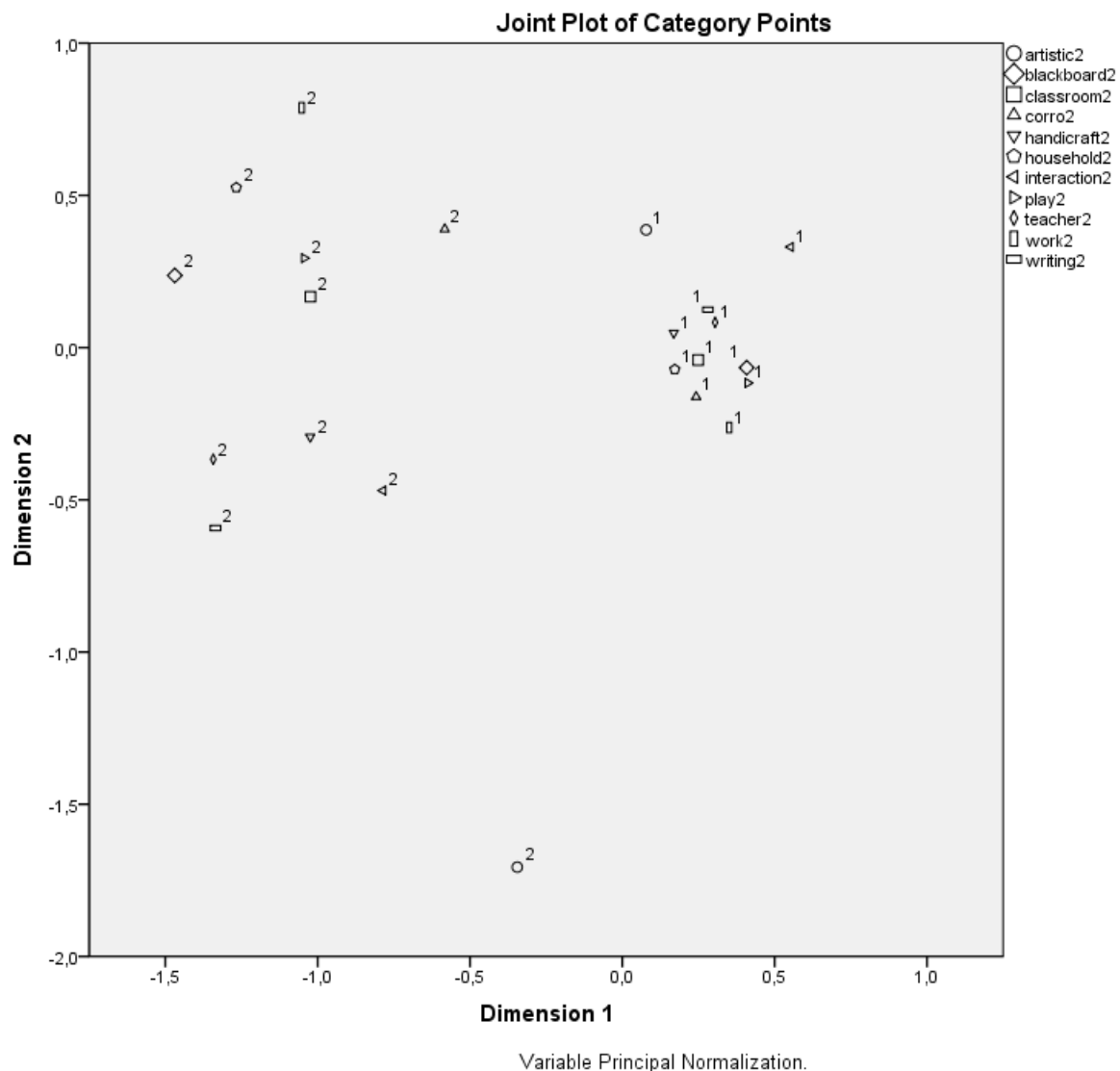


Figure 4 shows a two-dimensional space where three clusters of colonies appear: on the first dimension (X-axis) a distinction could be made between colonies where most of the community-related activities were lacking and some of these activities were present (CLUSTER 1); on the second dimension (Y-axis) a distinction could be made between two types of colonies where two different combinations of activities were present. In the top left of the plot we see a cluster of the following activities: (a) fieldwork; (b) household tasks; (c) the presence of a blackboard; (d) a visible classroom; (e) playing games; (f) playing *corro* (CLUSTER 2) and in the bottom left of the plot we see a cluster of the following categories: (g) the presence of a teacher; (h) children writing or drawing on tables; (i) handicrafts; (j) social interaction between adults and children (CLUSTER 3). On the bottom side of the plot there is a “lonely”

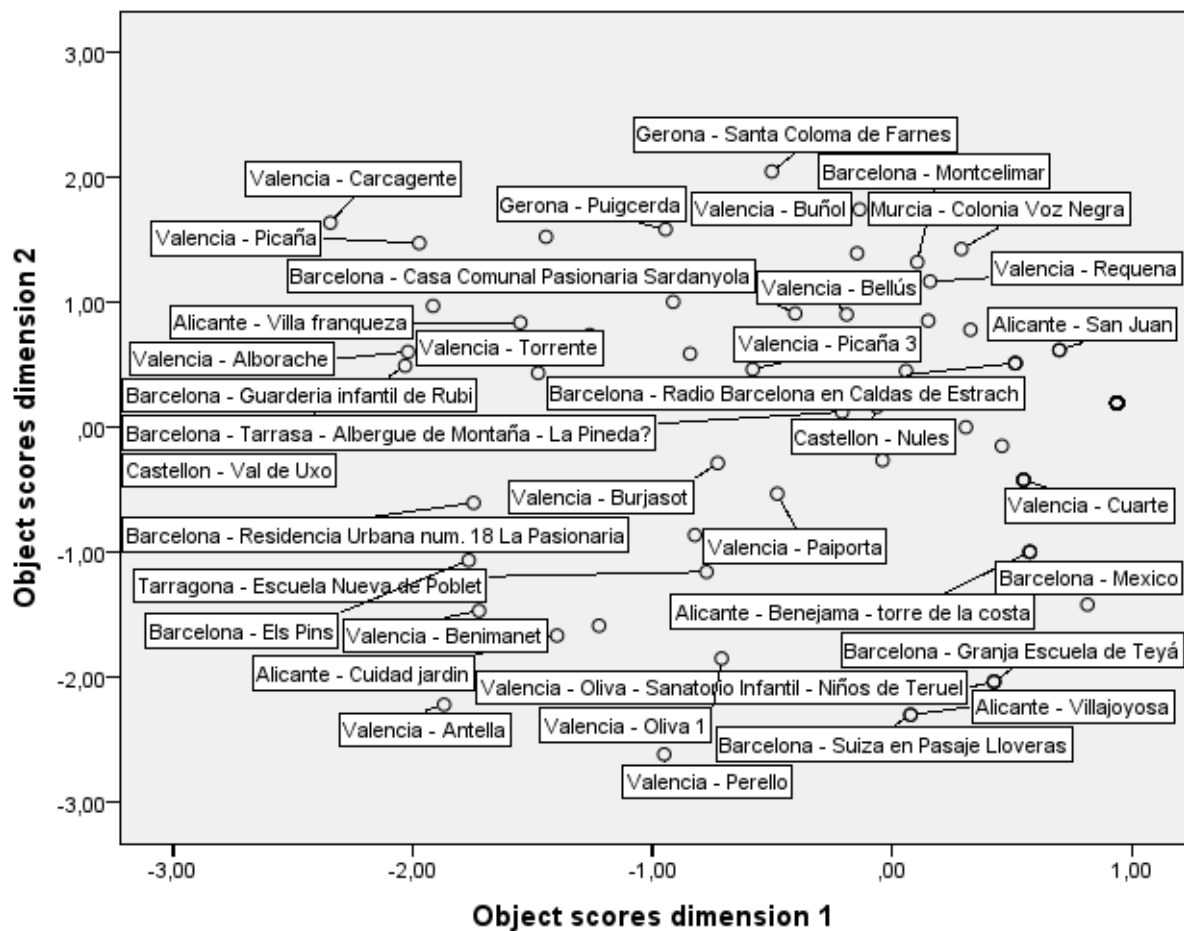
category labelled “artistic activities”. Its position indicates that artistic activities are a relatively exceptional feature of children’s colonies (CLUSTER 4).

For helping us with the interpretation of these four clusters of categories, we present Figure 5 in which all 92 children’s colonies are plotted as data points (labeled with their name). This plot is based on the object scores on two dimensions that were calculated for each of the 92 children’s colonies. These object scores are mathematically related with the category points that were plotted in Figure 4. The category plot (Figure 4) and the object plot (Figure 5) are in fact two layers of the same two-dimensional space that is produced by the statistical algorithm HOMALS. Based on the object scores in Figure 4 it is possible to classify each children’s colony as belonging to one of the three clusters of categories we have described above. Colonies on the right side of Figure 5 can be assigned to CLUSTER 1, colonies on the top left side to CLUSTER 2, colonies on middle left side to CLUSTER 3, and colonies to the bottom left side to CLUSTER 4. We can break down the object scores into groups to give an indication of how many of the 92 colonies belong to a specific cluster. These four clusters can be described as follows.

The largest group of children’s colonies is CLUSTER 1 (N=65). We have labelled this cluster as *leisure communities*. That is because we see little evidence of educational or work activities in the photographs that were taken in this type of colonies. The activity that we see most frequently in comparison with all the other possible activities are social interactions among children and adults, and children (mostly girls) playing a game known as *corro*.

We have labelled the children’s colonies in CLUSTER 2 as *work communities* (N=15). In the photographs we mainly see children engaged in fieldwork. We also notice the presence of teachers, classrooms, and blackboards, which could indicate a more formal, teacher-centered pedagogical approach. The image that emerges looks a lot like the ideal model the leftist government was propagating, and that was following Soviet examples.

Figure 5. Representation of 92 Spanish children's colonies from the period 1936-1939 as object points based on their scores on the first and second dimension calculated by multiple correspondence analysis.



Note. Due to lack of space not all names are printed in the figure.

The colonies within CLUSTER 3 (N=7) and CLUSTER 4 (N=5) are much alike, except for the prevalence of artistic activities in the last and smallest group of colonies. Together we have labelled them as *family communities*, referring to a model that was developed by the Spanish pedagogue Ángel Llorca, who was one of the Spanish schoolteachers that was applying the principles of the New Education movement in his school in Madrid (Llorca, 2008). In there, relatively few working activities were going on, and scenes of work being done in the fields are quite exceptional. Interaction between adults and children, having a meal together, for instance, are shown in almost all these communities. Children can also be seen making music, performing theatre, and dancing. Another aspect that seems to be typical of the family communities is the fact that the children shown doing schoolwork, such as writing or drawing, tend to be sitting together at ordinary tables instead of at classroom desks. This likely indicates a more informal organization of the educational process, consistent with the fact that blackboards are far less common in family communities than in work communities.

To check the validity of our empirical typology we made a comparison with qualitative information about specific colonies that was available in observational reports, and those published in illustrated journals. We classified as working communities those colonies that, based on qualitative evidence, could be characterized either by Soviet-inspired models with a strong emphasis on agricultural labor—such as Alborache in Valencia (Figure 6)—or by international self-government initiatives, as exemplified by Sueca, in Valencia, and the Children’s City of Puigcerdá in Barcelona (Figure 7). We classified as family communities both the children’s colony directed by Ángel Llorca in El Perelló, Valencia (Figure 8), as well as the colony of Antella, in the same province, which was described in pedagogical journals as a “home school.”

The apparent match between quantitative and qualitative information in these specific cases, and in several other known cases as well, gives us reason to believe in the validity of the procedure we have followed in classifying colonies based on visual information. It leads us to the conclusion that the overall image of the children’s colonies is somewhat grim and clearly stands in contrast to the popular image of happy children being educated in beautiful villas near the Mediterranean Sea. It is just a small minority of colonies that based on the visual material we have analyzed can be described as successful in the sense that they were setting up meaningful activities related with education and work, next to offering children a safe place to stay in residences close to the Mediterranean Sea.

Figure 6. *Image 3 – School Colony Alborache in Valencia, Spain, 1938* [courtesy of the *Archivo General de Administración*]



Note. Source: Archivo General de Administración, 51/21132/20/2.

Figure 7. *Image 4 – School Colony Puigcerdá in Gerona/Barcelona, Spain, 1938* [courtesy of the *Biblioteca Nacional*]



Note. Source: GC, caja /47/32.

Figure 8. *Image 5 – School Colony in El Perello, Valencia, Spain, 1937* [courtesy of the *Archivo General de Administración*]



Note. Source: Archivo General de Administración, 51/21132/35/3.

As a second validity check, we have asked the AI-tool ChatGPT to analyze Image 3, Image 4, and Image 5 with computer vision. The specific prompt was: “Analyze and compare the following three photographs with the concepts denotation and connotation.” It must be noted that we did not deliberately specify what is the source of these images to get an answer that was not based upon Internet knowledge about school colonies in Spain. The answers can be found below (OpenAI, 2025c).

Image 3. Children Seated in a Circle Peeling Produce

Denotation: A group of young children, mostly wearing simple dresses or shirts, are sitting on rustic wooden chairs arranged in a circle. They appear to be peeling or preparing some type of produce—perhaps potatoes or apples—collected in baskets at the center.

Connotation: (a) Communal Effort: The children are sharing a collective task, hinting at a sense of cooperation or a community-based environment (such as a school, orphanage, or a communal household); (b) Simplicity/Hardship: The rustic chairs, the outdoor setting, and the activity itself may connote a humble, perhaps rural or frugal environment; (c) Child Labor vs. Practical Education:

Depending on context, we might associate this with either helpful chores, skill-building, or the necessity for children to contribute due to economic hardship.

Image 4. Children Playing in the Snow in a Circle

Denotation: A group of children, dressed in dark winter attire, form a ring around a central figure standing on a snow mound. The children appear to be dancing or playing in a circle, holding hands in a snowy outdoor setting.

Connotation: (a) Joyful Communal Activity: Circling around a central figure is reminiscent of group games or folk dances, connoting unity, camaraderie, or perhaps a holiday or festival; (b) Coordination and Ritual: The symmetrical circle may hint at a structured group exercise or tradition, possibly part of a school or organizational recreation; (c) Childhood Innocence: The snowy setting and the ring dance evoke classic images of carefree play and community spirit.

Image 5. Children (and a Few Adults) Eating at a Long Table

Denotation: A group of children and at least two adults sit around a long table covered in a checked tablecloth. Each child has a cup or small bowl, and they appear to be eating or drinking something, possibly soup or tea.

Connotation: (a) Nurture and Care: Adults present at the table, guiding the meal, connotes a setting where children are under supervised care—again suggesting a school, orphanage, or group home; (b) Routine/Institutional Setting: The uniformity of cups and bowls and the large communal table can suggest a structured, possibly institutional environment, as opposed to a casual family meal at home; (c) Togetherness and Order: Everyone is seated neatly, which conveys discipline, shared routines, and a sense of collective life.

Comparing Across the Three Images

Shared Denotation: In all three photographs, groups of children are engaged in communal activities—whether it's preparing food, sharing a meal, or playing together. Adults or caretakers are present in at least two of the images, suggesting a supervised environment.

Shared Connotation: (a) A recurring theme is collectivity: the images collectively suggest children living, learning, and playing in group settings rather than isolated family units. (b) There is a structured or institutional element that runs through them all, implied by the matching chairs, the long communal table, and the seemingly organized outdoor activity in the snow. (c) They collectively convey a sense of togetherness and possibly resilience—these children are

shown supporting one another, whether by helping peel produce, sharing a communal meal, or joining hands in a circle.

Differences in Connotation: (a) The first photo (peeling produce) emphasizes work and practical cooperation. (b) The second highlights the routine of daily life—specifically mealtime—and nurturance by adults. (c) The third focuses on play and recreation, highlighting children’s social bonding in a more carefree, active setting.

Overall, while the denotation of these images shows children doing everyday tasks and games, the connotation ties them to a broader narrative of communal upbringing, structured group life, and shared experience.

At first glance, the answers produced by the AI-tool look like impressive, but after closer inspection we must conclude that the descriptions lack knowledge of the image’s context. It raises the question about the possibility of a deep analysis of photographs if the context of production is unknown. More specifically, in Image 4 the chatbot does not recognize the communist salute of the boy in the center of the image. Neither does it understand the concept of the *corro* as an activity with a cooperative and uniting human experience. With respect to Image 5 we must make the remark that this image of a shared meal of pupils with their teachers was at the time produced to explicitly visualize the idea of children finding a home in exile. Instead of capturing this idea, the chatbot interprets the photograph as a structured, institutional environment in an orphanage, opposed to a family setting.

FINAL REMARKS

The two cases presented in this article demonstrate how visual materials can serve as valuable sources for historical research. Our approach combined two well-established social science methods: content analysis and multiple correspondence analysis (MCA). By integrating these methodologies, we were able to analyze large sets of visual data systematically while remaining grounded in qualitative and theoretical frameworks. This hybrid approach allowed us to uncover patterns and trends that might otherwise have remained obscured.

Our analysis began with an exploratory approach, focusing on the data itself rather than formulating hypotheses derived exclusively from theory. Nonetheless, our work was informed by key theoretical concepts, such as teacher-centeredness versus child-centered education and the distinction between work and family communities. By blending inductive and deductive reasoning, we transformed rich qualitative materials – such as classroom photographs and propaganda images – into a

quantitative measurement scale for teacher-centeredness and a qualitative typology of children's colonies. This integration of methodologies enabled us to identify broader temporal and spatial patterns in historical education practices.

The combination of content analysis and MCA proved particularly effective in addressing the challenges posed by large visual datasets. While qualitative coding provided a nuanced understanding of individual images, MCA allowed us to aggregate and visualize these insights on a broader scale. Importantly, this iconographic approach does not preclude semiotic or interpretive analyses of the images. On the contrary, delving into individual, sometimes iconic photographs in our database often revealed deeper cultural, emotional, and social dimensions that complemented our quantitative findings. With the help of the AI-driven computer vision we gained some insights into how a “model audience” looks at an image. With respect to the usefulness of integrating AI in our visual analysis, we conclude –for the moment– that AI is capable to generate an “average” interpretation of an image. But this is not sufficient for research that scores high on trustworthiness: AI still misses contextual information, or in other words, the intellectual backpack of an experienced researcher. But this disadvantage of producing an “average” interpretation also has an advantage: the interpretation by the machine makes the researcher question what he/she sees in an image. And by discussing with other researchers, the machine interpretation can provide us in the end with more insights into the images than we had before

AI tools such as machine learning and computer vision have the possibility to automate the coding and analysis process by describing and identifying visual elements in photographs, thereby increasing efficiency and scalability. However, the historian's interpretative role remains essential to contextualize and humanize these results. Translating qualitative information from numerous images into numerical scores and general patterns is one aspect of the work, but telling the unique story of an individual image remains a vital and illuminating endeavor. Just as narratives can emerge from large-scale text analysis, they also hold power within the examination of visual histories, providing depth and richness to our understanding of the past.

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SJAAK BRASTER: Associate professor of Sociology at the Erasmus University Rotterdam and emeritus professor of History of Education at Utrecht University. From 2002 to 2024 he is a member of the Executive Committee of the International Standing Conference for the History of Education. Recent publications are: *Out of the Shadows, into the Light: The Role of Historians of Education in the Production of Public Knowledge* (Special Issue *History of Education Review*, Vol. 46, No. 1, 2026) and *Artificial intelligence: a new grammar or the end of knowledge? Lessons for historians of education* (*Educació i Història*, No. 45, 2025).

E-mail: sjaak.braster@gmail.com
<https://orcid.org/0000-0002-2507-3340>

MARÍA DEL MAR DEL POZO ANDRÉS: Professor of History of Education at the University of Alcalá (Spain) and Director of the Antonio Molero Museum of Education at the same university. President of the Spanish Society for the History of Education (SEDHE), from 2021 till 2025. Member of the Executive Committee of the International Standing Conference for the History of Education (ISCHE) (2006-2012). Since 2022, she has been Co-Editor-in-chief of *Paedagogica Histórica*. Her main lines of research are the history of urban education, the reception and transfer of international educational trends, the role of education in the construction of national identities, visual studies in education, and the public history of education.

E-mail: mar.delpozoandres@gmail.com
<https://orcid.org/0000-0001-9476-2281>

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RESPONSIBLE ASSOCIATE EDITOR:

Olivia Moraes de Medeiros Neta (UFRN)
 E-mail: olivia.neta@ufrn.br
<https://orcid.org/0000-0002-4217-2914>

DOSSIER PROPONENTS:

Maria Ciavatta (UFF)
 E-mail: maria.ciavatta@gmail.com
<https://orcid.org/0000-0001-5854-6063>

Maria Augusta Martiarena (IFRS)
 E-mail: augusta.martiarena@osorio.ifrs.edu.br
<https://orcid.org/0000-0002-1118-3573>

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