‘At the tip of data...’: Developing data literacy in educators’ professional development

‘AT THE TIP OF DATA...’: DEVELOPING DATA LITERACY IN EDUCATORS’ PROFESSIONAL DEVELOPMENT[1]

“IN PUNTA DI DATI”: PROMUOVERE LA DATA LITERACY NELLO SVILUPPO PROFESSIONALE DEGLI EDUCATORI

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Abstract. This paper presents the results of a study aimed at exploring the perceptions of effectiveness and relevance of a training course addressed to socio-pedagogical educators, to develop a critical-reflective sensitivity towards data. The study also investigates educators’ perceptions with respect to the nature of statistics and its contribution to educational professionals. The tool used for the study was an ad hoc questionnaire, which was filled in by 123 educators who participated in the course. The results indicate that the intervention was appreciated both from an educational and thematic point of view, even though the dimensions of interdisciplinarity and interactivity could be further improved. As regards the perceptions relating to data-based knowledge, with particular reference to statistics, a feeling of cautious optimism shines through, in which an open vision makes its way towards the contribution of quantitative data, without idealising its role as a univocal source of knowledge of reality.

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[1] Although the authors have jointly conceived the current paper, Maria Ranieri has written paragraphs 1, 2.1, 3.1, 3.2, 6, Gabriele Biagini paragraphs 3.4, 4.1, Stefano Cuomo paragraphs 3.3, 4.2, and Elena Gabbi paragraphs 2.2, 5.

KEY-WORDS Data literacy; Data perceptions; Data in education; Educators; Training needs.

Sommario. Questo articolo presenta i risultati di uno studio realizzato con lo scopo di esplorare le percezioni di efficacia e pertinenza di un percorso formativo indirizzato ad educatori socio-pedagogici, per sviluppare in essi una sensibilità critico-riflessiva verso i dati. Lo studio ha anche indagato le percezioni degli educatori rispetto alla natura della statistica e al suo contributo alle professionalità educative. Lo strumento utilizzato per lo studio è stato un questionario appositamente predisposto, compilato da 123 educatori che hanno partecipato al percorso. I risultati indicano che l'intervento è stato apprezzato sia dal punto di vista didattico che tematico, anche se le dimensioni dell'interdisciplinarietà e interattività sono ulteriormente migliorabili. Circa le percezioni relative alle conoscenze data-based, con particolare riferimento alla statistica, traspare un sentimento di cauto ottimismo, in cui si fa strada una visione aperta verso il contributo del dato quantitativo, senza idealizzarne il ruolo come fonte univoca di conoscenza della realtà.

PAROLE CHIAVE Alfabetizzazione ai dati; Percezioni sui dati; Dati in educazione; Educatori; Bisogni formativi.

1. INTRODUCTION

We come from a long tradition that has provided us with a monolithic and dichotomous representation of the epistemological nature of disciplines, through the opposition between scientific culture and humanistic culture, or *hard sciences* and *soft sciences*. The list of formulas could go on, but for some time now the philosophy and sociology of science have been questioning the epistemological assumptions on which this dichotomisation is based, to the point of reaching extreme peaks of epistemological anarchism as the Feyerabendian adage suggests: in science '*anything goes'*. Without arriving at such conclusions, the growing complexity of the world in which we live requires more permeable cognitive postures, capable not only of separating but also of connecting, capable of navigating between different knowledge and disciplines following trajectories that are not necessarily linear. This is well explained by Morin, the epistemologist of complexity, in *Les Sept Savoirs nécessaires à l'éducation du futur* (2000, p. 2, *our translation*), when he writes: "The supremacy of a fragmented knowledge in the various disciplines often makes us incapable of making the connection between parts and totality, and must leave room to a way of knowing capable of grasping objects in their contexts, in their complexes, in their wholes". But in order to train new

generations in complexity, the first step is certainly teachers' and educators' training. Starting with these premises, this contribution illustrates the outcomes of a research-intervention, carried out within the framework of the Training Course for the Qualification of "Professional Socio-Pedagogical Educator" (60 ECTS) at the University of Florence, academic year 2020-2021, with the aim, on the one hand, of raising educators' awareness of disciplinary fields and approaches that are often perceived as distant (e.g. statistics, quantitative research, data) and, on the other, of exploring their perceptions on this topic, especially in relation to the contribution that data-based research can offer to their profession. As will become clear from the analytical illustration of the research-education course implemented, the approach to data was proposed in a problematising manner, borrowing from the so-called humanities that critical posture necessary not only for *humanities* but for the *sciences*, more generally.

The work is divided into four main sections: in the first, the theoretical framework is presented, with a focus on the concepts of data, data literacy and data literacy in education; in the second, the context of the research-intervention and the instruments developed for the survey are described; in the third, the results are illustrated and, finally, the fourth discusses the main findings of the intervention.

2. DATA, DATA LITERACY, EDUCATIONAL DATA LITERACY

2.1. From *data* to *data literacy*

One of the main consequences of the digitisation of our societies is certainly represented by the uncontainable proliferation of data (Borgman, 2016). Indeed, the process of digital infrastructuring of our informational, cognitive, educational, communicative, recreational, etc. activities is producing an unprecedented phenomenon, namely the generation of huge amounts of data generated by human action within platforms (Van Dijck, 2014). As well known, two expressions are used in the literature to refer to these new phenomena, i.e. *platformisation* and *datafication.* The first, *platformisation*, is defined as "the penetration of the infrastructures, economic processes, and governmental frameworks of platforms in different economic sectors and spheres of life. […] we conceive of this process as the reorganisation of cultural practices and imaginations around platforms" (Poell, Nieborg & van Dijck, 2019, pp. 5-6). As for the second expression, *datafication*, it has been used to refer to that phenomenon through which digital platforms transform into data, practices and processes that have historically eluded quantification (Van Dijck, 2014; Mejias & Couldry, 2019). This process involves not only demographic and profiling data voluntarily released by users in surveys, but especially behavioural metadata, the collection of which takes place through platform-expanding

infrastructures such as apps, plug-ins, active and passive sensors, trackers (Nieborg & Helmond, 2019), devices that are now integrated into everyday technologies such as the smartphone, transforming virtually any occurrence of human interaction into data: assessing, paying, researching, watching, talking, socialising, dating, driving, walking, etc. (Poell, Nieborg & van Dijck, 2019). These data are algorithmically processed and, under certain conditions, are randomly made available to a wide variety of external actors.

With the progressive centrality acquired by the phenomenon of *datafication*, the concept of digital competence has been enriched with a new literacy, that is data literacy (Vuorikari, Kluzer & Punie, 2022), thus expanding the educational lexicon in the area of fundamental knowledge for future citizens. Following Carmi and colleagues (2020), indeed, data literacy is a new skill that is necessary not only for work, personal development and social inclusion, but also to mature citizens' awareness of the cultural, political, social, and economic implications of the progressive datafication of our societies. In this regard, we speak of *data citizenship* to be exercised at three levels: (1) data *thinking,* i.e. reading, collecting and critically understanding data on the part of citizens; (2) *data doing, i.e.* actions that can be undertaken in an active manner, such as requesting the deletion of personal data and using the acquired data in an ethical manner; (3) *data participation*, indicating proactive engagement in forms of civic activism and support for the spread of data literacy. In similar terms, Bhargava and D'Ignazio (2015, p. 1) propose a definition of data literacy as the acquisition of skills not limited to the development of technical-mathematical and statistical competences, including both the ability to read data, to create, interpret and manage them, and a critical level of understanding with reference to the representational nature of data, as it reflects a specific way of looking *at* and talking *about* the world (Borgman, 2016). Finally, with a specific focus on the topic of personal data, Selwyn and Pangrazio (2019) introduced the concept of critical data literacy, to refer to the critical ability to manage personal data, considering the following aspects: identification of data (e.g. understanding the type of data in question, whether voluntarily given or automatically extracted from the system), understanding of data (e.g. how they are handled and processed), data reflexivity (e.g., analysing the implications of personal data reuse), critical use of data (e.g. reading the Terms of Service, managing privacy settings, etc.), and tactical use of data, from the perspective of civic activism.

2.2. Data literacy and educational implications

The subject of reading and understanding data has also progressively entered the educational sphere. In particular, the consistent integration of teaching and learning process management platforms, so-called learning management systems, in the educational system has led to the

emergence of new fields of research, such as Educational Data Mining and Learning Analytics. Indeed, education is a field in which the process of data acquisition and the application of analysis techniques, performed by software and algorithms, can find significant feedback in terms of visibility and credibility (Williamson, 2017). However, in order to fully benefit from the data generated within instructional systems and more generally for active citizenship, user interest in the potential of digital tools and skills in data interpretation are key conditions along with clear and effective communication of data on the research side (Wolff et al., 2016). As Raffaghelli (2017) points out, there is an urgent need for educators and students to understand the opportunity to use data to support educational processes, developing technical skills in understanding, analysing and interpreting data, and gaining awareness of the social and educational implications associated with data collection and aggregation, in the broader perspective of active digital citizenship. In this regard, it is noteworthy that while the focus on data regulation policies is growing, there is not so much emphasis on building skills in the use of data that inform educational practice (Mandinach & Gummer, 2013). There are a number of professional development opportunities for teachers of different school levels, which relate to the skills of processing, assessing and monitoring learning outcomes to support school management (Raffaghelli, 2020). Furthermore, following the review of the literature on education professional development, Henderson and Corry (2021) made some recommendations in relation to data literacy programmes: (1) implement competence-focused programmes, (2) encourage collaborative opportunities for participants, (3) model the use of data from both quantitative and qualitative sources, and (4) investigate the role of technology and big data in data literacy. Another relevant aspect is related to the time and modalities required to develop data literacy, which cannot be acquired through short, extemporaneous training events: long-term collaborative approaches are more likely to lead to the desired results (Ebbeler et al., 2017). With regard to educators specifically, it can be observed how the inequality generated by the indiscriminate application of automated systems and algorithms also affects their work, as they find themselves in contact with some of the most disadvantaged segments of the population. Eubanks (2018), who has systematically investigated the impact of data mining and predictive risk models on the most economically disadvantaged groups in the USA, argues that some systems come to replace the decision-making process of frontline social workers. However, this does not result in adequate training aimed at equipping these professionals with an appropriate knowledge of the dynamics of data and their use.

3. RESEARCH CONTEXT

3.1. The Course for Educators and the session "At the tip of data..."

The research-intervention presented here took place, as anticipated, within the framework of the Training Course for the attainment of the Qualification of "Professional Socio-pedagogical Educator" (60 ECTS), launched during the academic year 2018-19, at the University of Florence and aimed at in-service educators (Fabbro et al., 2022; Ranieri et al., 2020; Ranieri & Giampaolo, 2018). The course was divided into six modules focusing on the following topics: relational dynamics in educational contexts (M1); theories of educational events and professional identity (M2); instructional design in social and organisational contexts (M3); analysis of educational needs and impact assessment (M4); facilitation of learning processes (M5); management of educational and training organisations (M6). In terms of methodology, the course was delivered in blended (or mixed) mode and each module was structured in four phases (Ranieri & Giampaolo, 2018), adopting appropriate approaches for adult education (Knowles, Holton & Swanson, 2012): from the initial activation of participants through the presentation of a problem scenario, to individual documentation on the constructs covered through video lectures, to the practical application of the knowledge acquired by means of online exercises, to the final reflection to foster knowledge transfer.

Due to the pandemic, in the academic year 2020-2021, all teaching activities took place completely online through a remodelling of the delivery methods. A novelty in comparison with previous years was the enrichment of the training course through a focused session, called "At the tip of data..." and curated by a Sociology lecturer. More specifically, for each day dedicated to synchronous online training, in place of the face-to-face events, there was a 1-hour training session, during which the lecturer showed data and statistics on specific topics of interest to the professional profile of the educator, commented on them and then discussed them with the trainees. There were seven events in total and they obviously also focused on the impact of Covid-19, since the activities took place in the middle of the pandemic period. The following table (Table 1) provides some detailed information on the events held, with references not only to time and theme but also to the source of data used.

Table 1 - Features of the 'At the tip of data...' heading

N.	Date	Title	Theme(s)	Data sources presented
1	21/11/2020	At the tip of data. Education and care in the time of the pandemic.	▪ Traditional, new and future poverty ▪ Educational poverty	▪ ISTAT2020 ▪ CARITAS2020 Report ▪ Save the Children 2020

			▪ Third Sector and Socially Responsible Business	▪ With Children/Openpolis 2020 ▪ PoieinLab Social Research 2020
2	19/12/2020	At the tip of data. Life will come back and will have other eyes: old, young, adults after the pandemic.	▪ Perceptions, moods and values by age ▪ Social representations of life stages ▪ Regulatory guidelines	▪ PoieinLab Social Research 2020
3	23/01/2021	At the tip of data. The Day After of social and educational policies: the Italian, German and English systems compared.	▪ Welfare systems compared: Italy, Germany, England ▪ Social expenditure on GDP and per capita	▪ EUROSTAT, PML database ▪ PoieinLab Social Research
4	20/02/2022	At the tip of data. Socio-educational work at the time of Covid-19.	▪ Remodelling of educational projects ▪ Role of technologies ▪ Educators' visions of change	▪ Empirical study on convenience sample (Gaggioli, Gabbi, Ranieri, 2021)
5	20/03/2022	At the tip of data. Children of a lesser god: who loses (and who wins) in labour markets at the time of Covid-19.	▪ The labour market ▪ Returning Poverty	▪ ML, ISTAT, INPS, INAIL, ANPAL (2021)
6	24/04/2021	At the tip of data. Between Starry Heaven and Moral Law: Schooling, education and cultural change at the time of the pandemic. An investigation by PoieinLab.	▪ Remote Education, quality of education	▪ PoieinLab Social Research 2020
7	08/05/2021	At the tip of data. Love in the time of cholera: friendship, romantic relationships, changing sexuality.	▪ Demography, natural balance ▪ Marriages and civil unions ▪ States of mind, friendship, affectivity	▪ ISTAT 2021 ▪ PoieinLab 2021

As can be seen, the different topics intertwine with each other, reflecting the extent of the economic, social and psychological distress generated by the Covid-19 pandemic through a data-based narrative that took the shape of *data storytelling* (Ojo & Heravi, 2018), a narrative technique that combines the use of data, images and words, transforming data analysis into a comprehensible storyline for a wider audience.

3.2. Objectives of the study and research questions

The study presented here aims to explore the perceptions of effectiveness and relevance of a training course oriented to the development of a critical-reflexive sensitivity towards data by social-pedagogical educators. It also aims to investigate the views of educators, in their different roles, with regard to the nature of hard science, namely statistics, and the contribution they can make to educational professionalism. The research questions (RQ) that the study sought to answer can be summarised as follows:

- RQ1. Whether and to what extent the training course was perceived as didactically effective and content-relevant?
- RQ2. What is the perception of educators with respect to hard sciences, with particular reference to statistics and data-based knowledge?

3.3. Data collection and analysis procedures

To answer the research questions, an ad-hoc questionnaire was constructed, which was first drafted by one researcher and then validated through discussion and analysis with two other researchers. The questionnaire was administered together with the final satisfaction questionnaire in the 2020-21 edition of the course. It included both open and closed questions with the dual purpose of surveying the course participants' enjoyment and investigating what the audience's perceptions of the usefulness, in a broad sense, of statistics were. In particular, beyond a section devoted to socio-demographic data, the questions examined, that were dedicated to the training session "At the tip of data", focused on the general degree of satisfaction with the themes of the session (a question consisting of 8 closed-ended items), going then into detail on perceptions relating to the themes of statistics and quantitative research and asking the learners to express their perceptions on them (a question consisting of 8 closed-ended items).

The answers to these questions were broken down according to a 10-value Likert scale from the minimum level 1 ("Not at all") to the maximum level 10 ("Completely") of agreement with the proposed statement. The questionnaire was administered online between June and July 2021 via the university's Moodle platform, where students were registered for course attendance. Data analysis was carried out with the support of the R statistical software. A descriptive statistical analysis was conducted for the closed-ended questions; see section four for details of the results.

3.4. Participants

The questionnaire was administered to a convenience sample, therefore neither probabilistic nor representative of the reference population, consisting of participants in the last edition of the course, i.e., educators working in the socio-pedagogical field. 123 educators (M=40, F=83) aged between 25 and 58 (average age= 41.3 years; SD 6.43) and with a prevalent length of service of between 10 and 15 years answered the questionnaire.

With regard to the level of education, over 48.78% have an upper-secondary-school diploma, 14.63% have a Bachelor's degree, 12.20% have a five-year degree and 16.26% a Master's

degree, finally, a small minority 7.32% have completed a postgraduate school and one participant (0.81%) also holds a doctorate degree.

The areas of intervention are mainly in the school sector with 21.21% of the participants and in the disability support sector in 18.61% of the cases. In addition to these, the areas of youth problems (10.82%), marginality and social exclusion (11.26%), reception and integration (9.09%), social welfare (4.76%) and social-health (7.79%), and parenting and family (3.46%) are also represented to a lesser extent. The remaining 17.40% is divided into other categories with percentages of less than 3%.

With regard to professional experience in education and social work, the largest number of participants have between 10 and 20 years of experience (48%) and 36% have worked in the sector for between 3 and 10 years, while 16% have more than 20 years of experience.

Finally, with regard to the professional roles they hold, 17.07% hold managerial roles such as Manager or Area Coordinator, while 78.04% hold operational roles such as Educator, Animator or Basic Assistant, 5% answered 'Other', with no further specifications.

4. RESULTS

4.1. Whether and to what extent the training course was perceived as didactically effective and content-relevant? (RQ1)

In response to the question "How personally satisfied are you - on a scale of 1 (not at all) to 10 (completely) - with the following aspects (see Table 2)?", a very high degree of general satisfaction was predominantly noted, as shown in Table 2 below, where 70% of the respondents expressed a satisfaction value of 7 out of 10 or higher.

Table 2 - Perceptions regarding the relevance of the themes covered

Item	M	D.S.	Median	7	8	9	10	Tot.	N/A
Timeliness of the themes	6.76	3.74	9	10 8%	11 9%	17 14%	45 38%	118	5
Relevance of themes to the work of educators	6.39	3.29	8	11 9%	23 19%	19 16%	22 19%	118	5
Relevance of selected data to the phenomenon discussed	6.67	2.96	7	13 11%	15 13%	27 23%	18 15%	118	5
Clarity of graphic representations (figures and tables)	6.60	3.01	7	24 21%	22 19%	18 15%	18 15%	117	6
Clarity of commentary captions	6.89	2.81	8	19 16%	24 20%	23 19%	17 14%	118	5

Clarity of presentation of the speaker	6.94	3.18	8	9 8%	14 12%	31 26%	27 23%	118	5
Speaker's ability to engage learners	6.58	3.17	7	15 13%	18 16%	23 20%	20 17%	115	8
Level and quality of the discussion	6.59	3.09	8	20 17%	27 23%	16 14%	19 16%	116	7

In particular, it can be seen that the most appreciated aspects were the clarity of the presentation, both from the point of view of the speaker (M=6.94; S.D.=3.18) and of the commentary material produced for the presentation (M=6.89; S.D.=2.81), while a lower agreement can be noted in relation to the relevance of the various themes dealt with in the training session with the specific professional field of socio-pedagogical educators (M=6.39; S.D.=3.29). It should also be noted that there is a high response variation within the same items, made visible by the rather high values of the standard deviation index. In fact, the higher the standard deviation, the higher the variation in the data, indicating that most of the data are not clustered around the average, but that the participants even expressed conflicting opinions. An example of this is the perception of timeliness of the themes outlined where, although it averaged a positive value (M=6.76; S.D.=3.74), 38% of the participants chose the value of highest satisfaction (10), while 15% expressed the opposite value of lowest agreement (1).

The learners were asked a further multiple-choice question, "If it were up to you, how would you have organised the rubric?", concerning satisfaction with the training session on both organisational and content aspects. The results, which are shown in Table 3, confirm the general satisfaction with the set-up given, although we can see a widespread demand for more in-depth thematic analysis, discussion opportunities and interdisciplinary approaches.

Table 3 - Perceptions of teaching effectiveness

General feedback	**Number of occurrences**	**Percentage (of respondents)**
The way the training session was organised was fine	45	38.6%
Evaluation of the organisational aspects	**Number of occurrences**	
I would have reduced the time: one hour is too long	11	8.9%
I would have spent more time on it: an hour is short	13	10.6%
Evaluation of the teaching content	**Number of occurrences**	
Less space for data presentation, more space for discussion	31	25.2%
I would also have included insights from qualitative data (research based on focus groups, life stories, in-depth interviews, etc.).	29	23.6%

A more interdisciplinary approach would have been appropriate (sociology, anthropology, psychology, pedagogy, history, economics, etc.).	31	25.2%

In fact, 38.6% of the respondents appreciated the general structure of the training session, without considering any particular changes necessary, although the interactive moments of the lesson were appreciated, which for 25.2% of the participants would have deserved greater emphasis. Another interesting answer was the agreement on the interdisciplinary approach to be emphasised more than what was provided (25.2%) and the proposal to expand the topics with presentations and explanations of qualitative research (23.6%), thus taking into account subjective and interpretative elements, as well as statistical-descriptive or inferential ones.

4.2 What is the perception of educators with respect to hard sciences, with particular reference to statistics and data-based knowledge? (RQ2)

With regard to the theme of educators' perceptions of quantitative research and statistical data, the following question was asked: "Based on your own ideas and experience, how much do you personally agree - on a scale of 1 (not at all) to 10 (completely) - with each of the following statements concerning quantitative research and statistical data (see Table 4)?". Table 4 below shows the participants' perceptions in relation to the second research question expressed as agreement with the following statements:

A. "In the end, statistics are always misleading: if I have eaten a chicken and you haven't, based on statistics, we have eaten on average half each".
B. "Numbers in themselves are not very useful: what is important is to understand more deeply the motivations of those involved in the phenomena than those that describe them quantitatively".
C. "Statistics are useful because they make it possible to understand the dimensions of phenomena and this is the first step towards finding the underlying reasons".
D. "True science is made up of numbers and mathematical calculations: any other information is too much at risk of bias and subjective interpretation".
E. "Quantitative research and statistical data are only useful if they dialogue with qualitative research and more introspective information, and vice versa".
F. "A number, when interpreted in the light of others, stimulates the imagination and also arouses emotions that are essential for learning and the desire to learn more".
G. "Knowing the quantitative dimensions of phenomena is essential not only for one's work but also for understanding the world in which we live and developing informed opinions".

H. “The objectivity of statistics is an illusion: numbers can always be processed to prove one’s beliefs”.

Table 4 - Perceptions of hard sciences and quantitative measurements of phenomena

Statement	M	D.S.	Median	1	2	3	4	5	6	7	8	9	10	Tot.	N/A
A	4.21	2.67	5	22 18%	14 12%	12 10%	7 6%	25 21%	16 13%	8 7%	9 8%	1 1%	5 4%	119	4
B	4.64	3.09	4	16 14%	18 15%	8 7%	14 12%	13 11%	9 8%	13 11%	8 7%	9 8%	9 8%	117	6
C	6.90	3.13	8	6 5%	2 2%	3 3%	5 4%	7 6%	11 9%	15 13%	21 18%	17 15%	29 25%	116	7
D	3.87	2.73	4	19 17%	19 17%	13 11%	13 11%	16 14%	13 11%	6 5%	10 9%	4 3%	2 2%	115	8
E	6.79	3.40	8	5 4%	3 3%	6 5%	3 3%	4 4%	7 6%	18 16%	20 18%	14 12%	33 29%	113	10
F	5.88	3.02	7	7 6%	5 4%	8 7%	8 7%	13 11%	13 11%	20 17%	16 14%	14 12%	12 10%	116	7
G	6.49	3.29	7	2 2%	5 4%	3 3%	5 4%	11 10%	15 13%	10 9%	16 14%	25 22%	20 18%	112	11
H	3.85	2,85	3	19 17%	21 18%	15 13%	12 10%	13 11%	15 13%	3 3%	9 8%	1 1%	7 6%	115	8

From these values, we can see that no clear agreement, or disagreement, emerges with the proposed statements, which, in fact, constitute contrasting opinions on and attitudes to the disciplines pertaining to hard sciences and data-based knowledge, particularly with reference to the elements of numerical-statistical measurement and evaluation. In general, the statements concerning more cautious and optimistic attitudes in relation to statistics (C, E, F, G) were those that met with good agreement among the participants. In contrast, the more extreme statements either in favour (D) or against (A, B, H) quantitative approaches received less agreement. However, even in the case of this question we can observe a high degree of variability among the answers, which are widely distributed over the whole range of agreement provided.

The statements that are most perceived as ‘true’ are C (M=6.90; S.D.=3.13), E (M=6.69; S.D.=3.40) and G (M=6.49; S.D.=3.29), from which it emerges that the quantitative (statistical) dimensions are essential for understanding the phenomena and for a critical approach to one’s profession (C, G), but also that these numerical dimensions are only useful, when integrated with a qualitative approach and with more introspective information (E). On the contrary, statements D (M=3.87; S.D.=2.73) and H (M=3.85; S.D.=2.85) were considered to be ‘falser’. It is thus observed that the educators do not express a perception of science linked purely to numerical values (D), but that they, nevertheless, consider these measurements to be characterised by a high degree of objectivity (H).

Finally, for purely descriptive purposes, we calculated the average agreement with the proposed statements by distinguishing between managerial (i.e. Managers, Coordinators) and operational

(i.e. Educators, Animators, Base Assistants) roles, the values of which are shown in Table 5 below.

Table 5 - Comparison on values from 1 to 5, of the agreement between operational roles and management to the proposed statements

Statement	Mean for Workers (n=96)	Mean for Leaders (n=21)	General mean (n=123)
A. Statistics are ultimately always misleading [...].	4.4	3.1	4.2
B. Numbers in themselves are not very useful [...].	4.7	3.6	4.6
C. Statistics are useful [...]	6.8	6.9	6.9
D. True science is about numbers and mathematical calculations [...].	3.7	3.9	3.8
E. Quantitative research and statistical data are only useful if they dialogue [...].	6.5	7.7	6.7
F. The number, when interpreted in the light of others, stimulates the imagination [...].	5.8	5.3	5.8
G. Knowing the quantitative dimensions of phenomena is essential [...].	6.7	5.8	6.4
H. The objectivity of statistics is an illusion [...].	4	2.9	3.8

Although we are aware that the low sample size (particularly with regard to management roles) does not allow for a systematic evaluation of these results, there is nevertheless substantial agreement between the values in the two professional role categories. It is interesting to observe how, where the deviation is larger, in particular for statements A, B and H, the management roles show greater trust in statistics and research based on quantitative methodologies, disagreeing more on the items concerning the deceptiveness and illusory nature of statistics and the uselessness of numbers (per se), than the operational roles. On these items, management roles expressed themselves more strongly than statements, as well as in relation to the necessary dialogue between qualitative and quantitative research for an appropriate understanding of phenomena (E). In addition, the response to question G, where operational roles expressed greater agreement with the statement that knowledge of the quantitative dimensions of phenomena is essential for one's work and understanding of the world, than managerial roles did, is in contrast.

5. DISCUSSION

This research aimed to investigate perceptions of the effectiveness and relevance of the "At the tip of data" training session, which was carried out in order to develop socio-pedagogical educators' critical-reflexive sensitivity towards data and explore their views of the nature of statistics and the contribution it can give to educational professionalism. Through the administration of a questionnaire on the evaluation/satisfaction of the initiative (ex-post), the aim was to investigate the extent to which the training session was perceived as didactically effective and content-relevant and what the educators' perceptions of hard sciences, with particular reference to statistics and data-based knowledge, were.

In general, the didactic and, to a large extent, also the thematic dimensions of the proposed intervention were appreciated by the participants, emphasising not only the relevance and clarity of the contents, but also the qualities of interdisciplinarity and interactivity to be further refined. More space, in fact, is required for discussion, an essential ingredient of adult education for better negotiation and personalisation of content (Knowles, Holton & Swanson, 2012), and greater openness to qualitative-interpretive aspects that appear fundamental for contextualising data in relation to social, cultural and educational phenomena.

Turning to the perception of the hard sciences by educators, a picture emerges of cautious optimism, without incurring in excessive devaluation of quantitative data, but neither in its opposite idealisation as the sole reference for knowledge of reality. Measurements and statistical processing are considered useful above all because they make it possible to understand the dimension of phenomena, as a first step to direct the subsequent search for causes and possible interpretations. The difference in role, whether operational or coordinating, can highlight different perspectives from the point of view of the professional relevance of quantitative information that educators encounter in their daily lives. Educators in close contact with beneficiaries report, in fact, a greater degree of agreement with the need to also know the quantitative dimension of phenomena in order to improve their professional practice, probably to integrate the more subjective view that prevails in the individual or small group relationships they manage. On the other hand, management roles also show a clear agreement with the need to integrate the two perspectives, in relation to their commitment to monitor, design and coordinate interventions.

This generally positive response with regard to the use of data-based knowledge in the educational professions seems to indicate an evolution of the conceptions typically associated with the figures of the socio-pedagogical educator and the coordinator of socio-pedagogical services (with reference to the managerial roles that emerged from the questionnaire): it is well known how the centrality of the relationship for the exercise of these professions has sometimes

led to opposing the educator's profession to "numbers" or "technologies", both cold entities when compared to the warmth of social ties and human relationships (Ranieri, 2020). There is no doubt that, on a pedagogical level, the relationship is and remains an essential condition for the construction of an effective educational path. Nevertheless, as we have already pointed out, the responses of educators and managers reveal interesting perspectives on the role of quantitative knowledge in their professional practice. Such perspectives need to be nurtured and supported through targeted training interventions with the aim of enabling these figures, who often operate in disadvantaged social contexts, to master cognitive dimensions that would risk being removed from the control of human intelligence, becoming the exclusive prerogative of automated decision-making systems (Eubanks, 2018; Raffaghelli, 2020).

6. CONCLUSIONS

Humanistic culture and scientific culture have long been pitted against each other in the Western tradition. This opposition is reflected in the educational paths of old and new generations as well as in the way the professions themselves are conceived. Yet, in a world increasingly dominated by algorithms, continuing to propose a disconnected vision of knowledge risks compromising our possibility of a profound understanding of phenomena. Indeed, through the flatness of our social living, actions and interactions give rise to a proliferation of data that, if, on the one hand, elude human control - either due to a lack of awareness of the new digital grammars (Selwyn & Pangrazio, 2019) or due to objective cognitive differences in terms of processing capacity - on the other hand, represent the raw material of algorithmically governed profiling mechanisms (Poell, Nieborg & van Dijck, 2019; Van Dijck, 2014). Such mechanisms affect not only the world of consumption, but also that of education in its different articulations, from formal contexts such as school and university, to the non-formal contexts where social educators typically operate. Nevertheless, in the training of educational professionals, the topic of data and the educational implications associated with it still remains largely absent (Mandinach & Gummer, 2013). The study presented in this contribution shows how, when appropriately anchored to the professional interests of educators, the topic generates attention. In particular, the request made by the participants to give the training intervention a more markedly dialogic slant reveals a view of data in which the interpretative element defines its meaning. Data not as facts to be observed, but as representations to be discussed (Borgman, 2016). At the same time, it confirms how collaborative approaches can be more effective (Ebbeler et al., 2017), albeit according to different declinations in relation to the specific professional function. This critical-reflexive sensitivity, in fact, is accompanied by a perception of the hard sciences, in particular statistics, as a form of data-based knowledge that can provide

useful elements for educators as a complement to their knowledge of the particular situations with which they are confronted on a daily basis, and for the coordinators of educational services as a basis for more effective planning. That said, it should be emphasised that, given the characteristics of the sample, these conclusions cannot be universally generalised. More studies in this direction are needed to further investigate the topic and to foster the development of appropriate conditions for the implementation of effective educational data literacy paths (Raffaghelli, 2017, 2020).

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