frontiers | Frontiers in Education

TYPE Original Research
PUBLISHED 13 October 2023
DOI 10.3389/feduc.2023.1202442

OPEN ACCESS

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RECEIVED 08 April 2023
ACCEPTED 12 September 2023
PUBLISHED 13 October 2023

CITATION
Agrati LS (2023) Tutoring in the metaverse. Study on student-teachers' and tutors' perceptions about NPC tutor.
Front. Educ. 8:1202442.
doi: 10.3389/feduc.2023.1202442

Tutoring in the metaverse. Study on student-teachers' and tutors' perceptions about NPC tutor

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Introduction: The metaverse is defined as a new frontier for anyone's everyday life and a new challenge for the training and the professional development. The extended reality of the metaverse offers a new learning environment in which additional educational roles intervene to support the teaching and learning processes.

Methods: The work explores some aspects of the metaverse as a support for the initial training of teachers. It presents a study on the perceptions that student-teachers and school tutors of a teaching qualification path have, specifically, of the so-called 'non-player characters' (NPC) tutor and peers, in the metaverse. Quantitative and qualitative data were collected via mixed questionnaire and analyzed via descriptive statistics and QDA.

Results: The analysis found some differences in expectations between student-teachers and school tutors with respect to the metaverse, to the new educational roles related and, specifically, to the NPC tutor role. The triangulation of the early data is highlighting a general new look at the possibilities offered by the metaverse – in monitoring the learning program and in decision-making practices – as well as expectation about the teachers training – Artificial Intelligence relationship.

Discussion: The results of study regarding the perceptions of student-teachers and school tutors on the metaverse and on the role of the NPC tutor are offered as insights to be explored, through further investigations, to those responsible for teacher training courses and to the research that today investigates the learning effects of the metaverse as a potential professional training environment.

KEYWORDS

metaverse, tutoring, teacher training, mixed study design, not-played characters

1. Introduction

1.1. Meanings of metaverse

The term "metaverse" was coined by Stephenson (1993) in his science fiction novel "Snow crash" to refer to the three-dimensional space – the operating system called "Black Sphere" – in which the characters of the novel can do what they want and express the social class based on the best resolution of your avatar and the possibility of exclusive access (Duan et al., 2021). The metaverse is "a new computer-mediated environment consisting of virtual worlds in which people act and communicate with each other in real-time via avatars" (Hennig-Thurau et al., 2023). In a broader sense, metaverse is defined as "a 3D digital space mixed with the real world and the virtual world" (Zhang et al., 2022, p. 2; Colazzo and Maragliano, 2022).

The *physical* reality, not digital, is the one in which the person experiences through his/her motor, perceptive and cognitive functions; the *virtual* one, in which experiences are simulated and made immersive by means of specially created technological systems – software, interfaces and peripherals (cybertute, visor, earphones, wired gloves, etc.); the *augmented* one, compared to the previous ones, uses superimposed and computer-generated sensory information. Finally, *mixed* or "hybrid" reality is defined as the mixing of physical and digital reality (Pimentel and Teixeira, 1993; Wu et al., 2013; Di Tore et al., 2020). Thanks to the integrated use of emerging technologies (digital twins, block chain, holography, IoT) (Center for Journalism Studies of Tsinghua University, 2021; Kang, 2021; Lv et al., 2022; Park and Kim, 2022; Prieto et al., 2022), the metaverse is nowadays assumed as *extended* reality (XR), that effectively integrates and overcome the simple sum of *augmented*, *mixed* and *virtual* reality technologies (Park and Kim, 2022; Tu et al., 2023 – see Figure 1). Specifically, in the metaverse interaction performance, evaluation and user emotional responses would be made more vivid by an interaction-feedback system guided and mediated by artificial intelligence that analyzes numerous data in real time (Hennig-Thurau et al., 2023) – see Figure 2.

A number of general considerations have been advanced about the metaverse; many of them are animated by forecasts on the technological market and only partially based on actual research works (Kim, 2021). Among the first, the expectation that "nearly 30% of people will spend two hours a day in the metaverse for work, entertainment, education and socializing by 2027" (Wiles, 2022) is noteworthy. Interest in the metaverse as a work and learning opportunity has increased; perhaps also for this reason, the existing literature on the metaverse is inconsistent, without effective synthesis or consensus (Cho et al., 2023). The critical points would concern the forces of mediation and moderation (flexibilities of algorithms, risk of manipulation, etc.) as well as the interactional formats (user's ability to modify inputs) and will be taken as an object for future investigations especially in the area of humanities and education (Crain and Nadle, 2019; Cusumano et al., 2021).

1.2. Metaverse as new learning environment

The metaverse has heralded as a trend of future education with great potential specially in reference to the overcoming of the limits of space and time and the boundaries of the physical world (Zhang et al., 2022). The need to overcome the space-temporal limits of the traditional, excessively "controlled and circumscribed" learning environment (Kumpulainen and Mikkola, 2015, p. 13), was already expressed in the first reflections on the "extended learning environment" described as "new forms of configurations space-temporal educational approaches that resonate with students" learning lives in and out of school (…) "in which students are engaged in ubiquitous, multimodal and multidimensional, technology-mediated creative learning practices".

From such general learning perspective, the metaverse has been defined also a "new educational environment" (Suzuki et al., 2020; Prieto et al., 2022; Rospigliosi, 2022; Zhang et al., 2022) provided it assures the learner: (a) use of wearable devices; (b) overcoming of limits of time and place, (c) use of digital identities.

One of the typical frameworks of the metaverse in education (Kang, 2021; Zhang et al., 2022, p. 5–see Figure 3) describes the learner's entry into extended reality by means of access (wearable device and avatar) and with the support of technological infrastructures – communication and networks, computing and analysis, modeling and rendering, interaction, authentication – which provide learning "resources" and "scenes" as well as intelligent "not-player character" (NPC).

Focusing on some better detailed definitions of:

- *learning environment* – "complex of apparatuses – conceptual, psychological and social (even before technological and

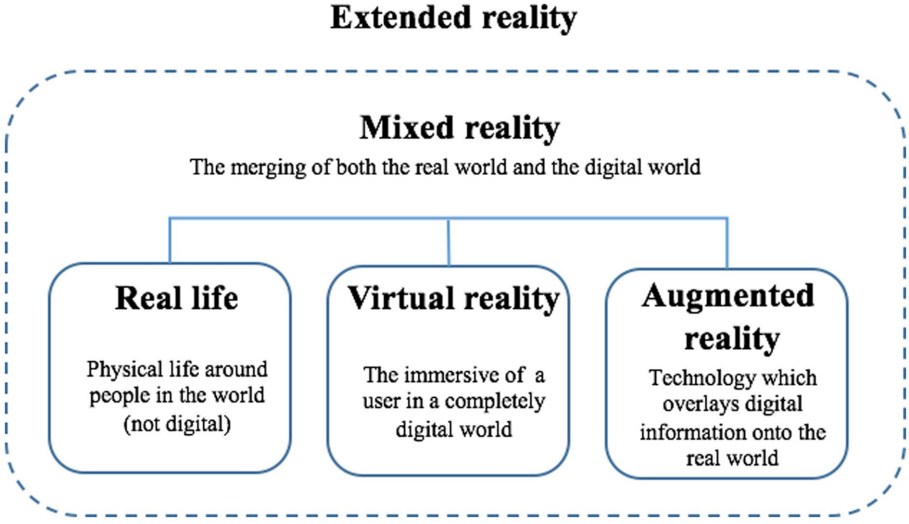

FIGURE 1
Extended reality (adapt.: Simpson, in Prendes-Espinosa and González-Calatayud, 2019).

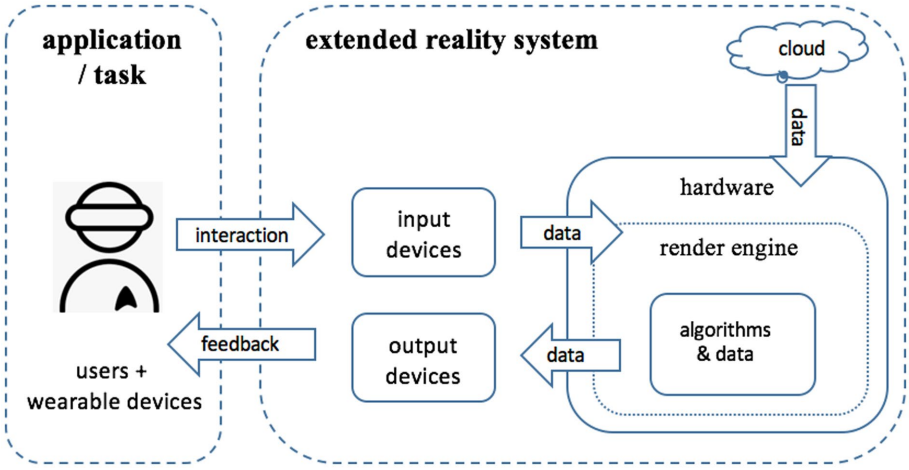

FIGURE 2
Metaverse as system of extended reality (adapt. from 'Major components of an extended reality system' - XR4all, 2023).

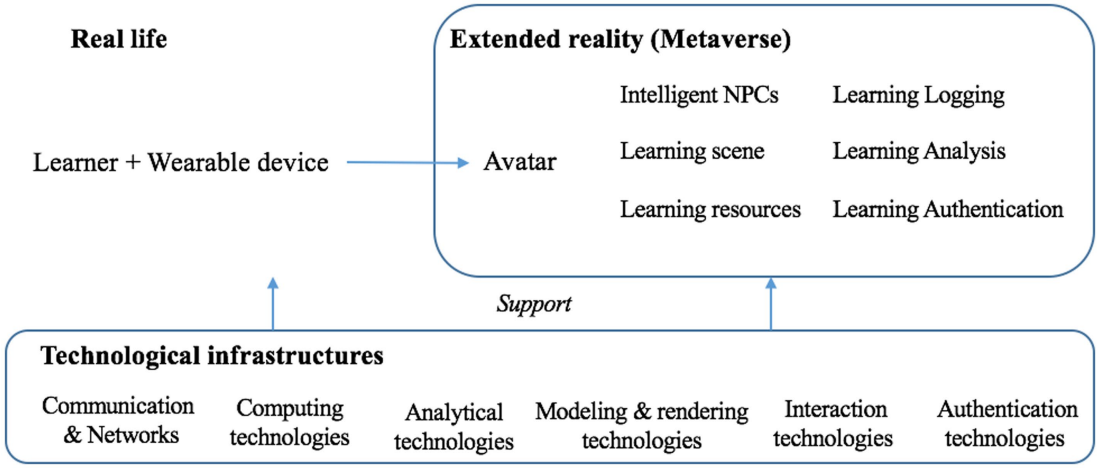

FIGURE 3
Framework of metaverse in education (adapt.: Zhang et al., 2022, p. 5).

instrumental) – suitable for facilitating the occurrence of learning processes through authentic experiences, forms of problem solving, collaborative activities with multi-perspective visions of the studied environment" (Bonaiuti et al., 2017, p. 233);
- *learning context* – "segment of the world occupied by the same people, but in different roles, simultaneously striving for different ends" (Shulman, 1986),

more complex implications emerge linked to the metaverse, assumed as technologically mediated learning environment. The extended reality of the metaverse, by virtue of the technical-technological characteristics as a transmedia environment (Jenkins et al., 2013; Limone, 2021) – similar roles but from different levels, common contents but from different perspectives, will allow each single learning event to take place along ever more extensive meanings, according to potentialities that cannot be definitively predicted but possibly converging. However, metaverse, as new object of educational investigation, needs new theoretical paradigms, conceptual heuristics and learning theories capable to explain the material, social and symbolic aspects involved in learning and knowledge construction processes. The most recent reflections propose eco-systemic (Bearzi, 2022), co-enactive (Pireddu, 2022), simplex (Di Tore, 2022) models.

Among the investigations related to the potential applications of the metaverse in education and, specifically, in teachers training, there are those on the effects of extended learning educational environments on the performance and perceptions of learning of the learners (Hwang and Chien, 2022).

2. Metaverse and teachers training

Among the potential research issues of the metaverse in education, teachers training and, specifically, the professional development of teachers are noted (Zhang et al., 2022). As known, the professional development of teachers is the continuous path that a

teacher carries out to increase his/her teaching expertise within real contexts and through effective relationships with students, expert teachers and other actors of the education system (O'Brien and Jones, 2014; Darling-Hammond et al., 2017; Boeskens et al., 2020; Perla, 2022). The metaverse could offer various opportunities to teachers as an emerging educational technology, especially in order to achieve good preparation – both initial and in-service – which is in itself "a complex and multifaceted undertaking" (Jeon and Jung, 2021).

As already found by the first systematic review (Vasarainen et al., 2021), design, remote collaboration and training would, in general, be the main research application areas of XR. As regards the on-the-job training, the few existing studies concern three areas: collaboration, working practices and evaluation of knowledge transfer (Barreau et al., 2015; Haavik, 2016; Sanchez-Sepulveda et al., 2019).

Such studies focus on different hardware, resort to specific methodologies and innovative ways of collecting research material (e.g., recording the movement of users in virtual reality) in such a way as not to allow an effective comparison. For this reason, still today, after about two years from having assumed extended reality and the metaverse as a learning and professional training environment, one should only speak of "significant potential" rather than "general advantages" clearly confirmed in the working life (Vasarainen et al., 2021, p. 22).

2.1. Metaverse and "new" educational roles

As stated by Jeon and Jung (2021), between the several factors that distinguish the online meeting and the metaverse platform (Table 1) the role of the instructor is the most characterizing: she/he is no longer the leader of the process but an actor with limited possibilities for intervention. This happens because the entire teaching-learning process would in fact be managed by means of new roles – the so-called "non-player characters" (NPCs) – guided by AI to support the arbitration, the simulation and the decision-making process that carry out interventions personalized and improve the interaction of those who participate (Hwang and Chien, 2022; Jovanović and Milosavljević, 2022). Therefore, within the metaverse, the educational support would be given by the roles set by the AI, among which are distinguishable:

- NPC tutor or advisor – "wise" or "expert" support, which offers advice to the user, especially involved in professional contexts and linked to the resolution of complex problems – think of the need for a trainee teacher to continue progressing of the educational program, to monitor the pace of learning of the students, without however losing sight of the timing of each student;
- NPC tutee/student – simulation of a student-teacher relationship, mainly involved in pre-service teacher training – think of the need for a trainee teacher to exercise his or her class management skills without any errors damaging the real student learning;
- NPC peer – peer-to-peer support between learners-users that fosters interaction and discussion underpinning socio-constructivist learning processes.

The most interesting and formatively more delicate aspect is twofold. In the metaverse, the system governed by the AI processes the input data and data coming from the cloud and, through complex algorithms (see Figure 3), provides the user with a more or less extensive repertoire of possible interactive situations (Hajjami and Park, 2023) by which NPCs interact with trainees. Such pre-ordered situations, on the one hand, would have the advantage of focusing the trainee teacher's attention on specific aspects of broader skills – e.g. within the framework of the broad competence of class management, deciding when and whether to interrupt the lesson in progress to intervene on disturbing behavior on the part of some pupils – and thus to encourage reflection in decision-making, not always possible in effective contexts of action. Such a "metadata archive" can help education for at least 4 reasons: it creates an engaging and realistic online classroom, encourages communication, supports immersive learning and enriches the experience through gamification (Çengel and Yildiz, 2022).

However, on the other hand, the educational situations pre-ordered by AI would exclude aspects in any case present in training environments (see internship, practicum), provide safer but less complex experiences, which less stimulate the ability to manage multiple variables simultaneously.

For these reasons NPC roles may appear, on one hand, useful to trainee teachers in terms of supporting their own and students' learning processes (Hwang and Chien, 2022), on the other hand, they could be experienced with anguish on the part of teachers, without the necessary reflection and educational guidance (Zhang et al., 2022). Some recent studies have deepened the perceptions of educators and instructors on the metaverse-based education (Han and Noh, 2021; Çengel and Yildiz, 2022; Gurkan and Bayer, 2023). In the study by Han and Noh (2021), 30 higher education educators were involved who consider the metaverse an appropriate tool for complementary delivery and student-centered learning. The limitations noted by them relate to systems and support for a classroom environment, including curriculum and information related to teaching and learning strategies. The study by Çengel and Yildiz (2022) investigated the attitude of 301 computer science teachers toward metaverse technologies with the aim of validating a three-factor scale (perceived benefit, preparation, and satisfaction), to be developed for further investigations. Gurkan and Bayer (2023) found that about half of 122 teachers involved associates the metaverse more with gaming and

TABLE 1 Difference between online and metaverse platform (adapt.: Jeon and Jung, 2021).

Factors	Online platform	Metaverse platform
Leadership	Teacher > student	Teacher = student
Roles	Event control instructional materials available	Event control not completed co-built educational materials
Formats	Teacher-centered learning knowledge transfer and sharing	Student-centered learning seeking and accessing information
Participation	Available only by teacher	Continuous

entertainment, over half is unaware of the benefits of the platform in education and that all feel the need for adequate training in this regard.

3. A study on student-teachers' and tutors' perceptions of NPC roles in the metaverse

The broader study "Metaverse near future" is conducted at the Department of Human and Social Sciences of the University of Bergamo, starting from January 2023: it aims to formulate some emerging questions about the use of the metaverse in teacher education. A mixed method design was followed (Creswell, 2013; Cameron, 2015) with a sequential system having an "exploratory" phase I of collection of qualitative-quantitative data (through questionnaire), an "incorporated" phase II of collection of qualitative data (via in-depth interview) and a final stage of meta-inference synthesis, still ongoing.

The first phase of a mixed design explanatory study focused on personal considerations that people involved in the teachers training processes – teachers, student-teachers and tutors – are developing with regards to the metaverse as "brand new: virtual space and the possibility for new relationship – intentional o eco-systemic (Bearzi, 2022) – between students, colleagues and trainers.

This paper faces, in particular, the student-teachers' and tutors' perceptions regards the artificial "roles" in the training processes – see NPC tutor/advisor, NPC tutee, NPC peer, programmed by Artificial Intelligence (Hwang and Chien, 2022). The fact-finding survey involved 30 service teachers, as tutors in the qualification courses for primary, middle and high school, and 31 student-teachers enrolled in the Master degree enabling teaching in primary school.

3.1. Research questions

This study addresses the following questions:

(1) What general utility do school tutors and student-teachers perceive with regards to the "new" instructional roles (NPC "tutor", "tutee", and "peer") available in the metaverse?
(2) What specific utility do school tutors and student-teachers perceive of the NPC "tutor" for their teaching and learning?

which were investigated through the analysis of the answers nos. 1–3 in the c. section of the questionnaire – see Table 2.

3.2. Methods

The data was collected through a mixed questionnaire that included closed and open-ended questions concerning the following main sections: (a) sociometric-professional information, (b) general knowledge on metaverse, (c) perceptions about the "new" instructional roles teacher (NPCs "tutor", "tutee", and "peer"), (d) personal considerations – Table 2. This mixed collection tool allowed to obtain at the same time quantitative and qualitative data subjected to triangulation to decide which type is more likely to provide the desired information (Creswell, 2013).

The questionnaire was designed based upon previous works defining the features and the functions of the "new" instructional roles (NPCs "tutor", "tutee", and "peer") available in the metaverse (Hwang and Chien, 2022; Jovanović and Milosavljević, 2022). In order to avoid excessive differences in understanding, these characteristics and functions were summarized in the initial part of the questionnaire and the people involved were invited to read them before answering the questions.

The questionnaire was administered by e-mail between March and April 2023 using random criterion to all tutors of the qualification courses for primary, middle and high school (no. 50) and all student-teachers who followed the Didactics III course within the Master degree enabling teaching in primary school (no. 130). No. 30 responses from school tutors (60%) and no. 31 from student-teachers (2.8%) were received.

3.3. Participants and data analysis

As for the participants, 64.9% of school tutors and 91.2% of student-teachers are female. School tutors are 41.6 years old on average, student teachers 21.5. Most school tutors have master degree (63%) and a diploma (18.5%) while, among student-teachers, 81% have a diploma and 19% a bachelor degree. In terms of experience, participant tutors served in schools as teachers between 5 and 10 years (37%) or over 10 years (37%), while they served as tutors for about 4 years (3.8). Over half of school tutors works in secondary schools (59.3%) and just under a third in primary school (29.6%), while all student-teachers have completed at least 4 years of practicum in primary school.

Quantitative data were analyzed using SPSS (v. 28). Specifically, statistical significance was analyzed with respect to question no. B2, C2, and C3 and a statistical correlation was verified between question no. A3 (qualification) and C2 (specific perceived utility of NPCs "intelligent" tutor role).

TABLE 2 Questionnaire sections and questions, data types.

Section	Information	Data
a. Sociometric-professional information	1. gender, 2. age, 3. qualification, 4. type of school, 5. length of service (*for tutors*), experience at school (*for student-teachers*)	Quantitative
b. General perceptions on metaverse	1. personal definition, 2. agreement with generic expectations on metaverse in education, 3. considerations regarding features and educational challenges	Quantitative
c. Perceptions on the NPCs instructional roles	1. general perceived utility of NPCs instructional roles, 2. specific perceived utility of NPCs "intelligent" tutor role, 3. specific perceived utility of NPCs "intelligent" peer role	Quantitative
d. Personal consideration	1. on metaverse as learning environment	Qualitative

TABLE 3 Agreement with general educational expectation.

Question no. B2 – *How much do you agree with the following statement: "the metaverse will change the way we educate"*		School-tutors	Student-teachers	Total
Strongly disagree	*a.v.*	*4*	*0*	*4*
	%	13.33%	0.0%	6.55%
Disagree	*a.v.*	*7*	*4*	*11*
	%	23.33%	12.90%	18.03%
Quite agree	*a.v.*	*11*	*8*	*19*
	%	**36.66%**	25.80%	31.14%
Agree	*a.v.*	*5*	*15*	*20*
	%	16.60%	**48.38%**	32.78%
Strongly agree	*a.v.*	*3*	*4*	*7*
	%	10.00%	12.90%	11.47%
Total	*a.v.*	30	31	61
	%	100.0%	100.0%	100.0%

*Statistical significance $p < 0.05$. The highest percentage values are in bold.

The text of the open answers (no. D1) was analyzed through a Qualitative Data Analysis (Creswell, 2013), inspired by the Grounded Theory (Charmaz, 2008), a bottom-up procedure that allows to know the investigated phenomenon through the emerging meanings from what was expressed by the people involved. In particular, the coding followed the three typical phases:

1. open coding – carries out a first grouping of textual data into significant text units, with relative identification of labels;
2. axial coding – with the aim of identifying recurring macro-categories that emerge from the significant text units, with relative indication of the number of occurrences;
3. selective coding – by means of the hierarchical ordering of the recurring macro-categories, it allows the final emergence of the "core" categories.

3.4. Findings

The results are presented below by type of data: first the quantitative data collected through closed questions of the questionnaire, then the qualitative ones obtained through the open question.

3.4.1. Agreement that the metaverse will change educational practices

Table 3 shows the absolute values and the response percentages to question no. B2: on one hand, school tutors consider themselves quite in agreement (36.66%), while student teachers mainly indicate an agreement (48.38%), with the prediction that the metaverse will change the world and educational practices.

Table 4 shows the average and standard deviations of the answers to question no. B2. Student-teachers agree more than school tutors that the metaverse will change educational modalities (3.61). However, their dispersion is higher (1.16).

TABLE 4 Average and standard deviation question no. B2.

			School-tutors	Student-teachers	Total
Intelligent "tutor"	Average	.	2.86	3.61	3.24
	Std. dev.		1.16	0.88	1.09

3.4.2. General perceived usefulness of the NPC "tutor"/"peer"/"tutee"

Table 5 shows the absolute and percentage values of perceived utility regarding the NPC, "tutor", "peer", and "tutee" roles – see question no. C1. The NPC role deemed potentially most useful by both school tutors and student-teachers is the "tutor" (37.70%), followed by the "peer" (29.50%). While compared to the NPC "tutor" there is a substantial agreement between school tutors (36.60%) and student-teachers (38.70%), compared to the NPC "peer" and the NPC "tutee", the perceptions are inverted: slight prevalence of the "peer" among student-teachers and of the "tutee" among school-tutors.

3.4.3. Specific perceived usefulness of the NPC "tutor"/"peer"

Tables 6, 7 show the absolute and percentage values of the utility perceived by school tutors and student-teachers regarding, specifically, the NPC roles of "tutor" and "peer" – see question nos. C2 and C3.

Overall, the role of the NPC "tutor" is considered quite useful (47.54%), specifically by two-thirds of the school tutors (66.33%) and by one-thirds of student-teachers (32.26%). It is considered also useful (35.48%) by one-thirds of student-teachers (35.48%). Even the role of the NPC "peer" is considered, overall, quite useful (36.06%), specifically, by a third of school tutors (33.3%) and by just over a third of student teachers (38.70%).

Table 8 shows the average and standard deviations of the answers to question nos. C2 and C3. Student-teachers agree more than school tutors on the usefulness of NPC "tutor" (3.90) and "peer" (3.87). The dispersions for both are quite large, specifically for "intelligent" peer (0.96).

TABLE 5 Perception of usefulness of NPC roles.

Question n. C1 – *Which of the following NPC roles do you think will be useful for your teaching/learning?*		School-tutors	Student-teachers	Total
NPC "tutor"	*a.v.*	*11*	*12*	*23*
	%	**36.60%**	**38.70%**	**37.70%**
NPC "peer"	*a.v.*	*7*	*11*	*18*
	%	23.33%	*35.48%*	29.50%
NPC "tutee"	*a.v.*	*7*	*6*	*13*
	%	*23.33%*	19.35%	21.31%
None	*a.v.*	5	2	7
	%	16.60%	6.45%	11.47%
Total	*a.v.*	30	31	61
	%	100.0%	100.0%	100.0%

*Statistical significance $p < 0.05$. The highest percentage values are in bold.

TABLE 6 Perception of usefulness of NPC "tutor".

Question n. C2 – *How useful do you think the support of the NPC "tutor" will be for your teaching/learning?*			School-tutors	Student-teachers	Total
NPC "tutor"	Very low	*a.v. (%)*	4 (13.33%)	0 (0.0%)	4 (6.56%)
	Low	*a.v. (%)*	4 (13.33%)	1 (3.23%)	5 (8.20%)
	Quite useful	*a.v. (%)*	**19 (63.33%)**	**10 (32.26%)**	**30 (47.54%)**
	Useful	*a.v. (%)*	2 (6.67%)	**11 (35.48%)**	13 (21.31%)
	Very useful	*a.v. (%)*	1 (3.33%)	9 (29.03%)	9 (16.39%)

*Statistical significance $p < 0.05$. The highest percentage values are in bold.

TABLE 7 Perception of usefulness of NPC "peer".

Question n. C3 – *How useful do you think the support of the NPC "peer" will be for your teaching/learning?*			School-tutors	Student-teachers	Total
NPC "peer"	Very low	*a.v. (%)*	2 (6.66%)	0 (0.0%)	2 (3.27%)
	Low	*a.v. (%)*	9 (30%)	1 (3.22%)	10 (16.39%)
	Quite useful	*a.v. (%)*	**10 (33.3%)**	**12 (38.70%)**	**22 (36.06%)**
	Useful	*a.v. (%)*	1 (26.66%)	8 (25.80%)	16 (26.22%)
	Very useful	*a.v. (%)*	1 (3.33%)	10 (32.25%)	11 (18.03%)

*Statistical significance $p < 0.05$. The highest percentage values are in bold.

Table 9 shows the correlation between the average answers to the question no. A3 (qualification) and no. C2 (specific perceived utility of NPC "tutor"). The average of the answers is inversely proportional to the increase in qualification.

The analysis highlights a statistically significant difference between the agreement expressed by school tutors and student-teachers on the general educational expectation on metaverse (see Table 2): tutors seem more cautious than student-teachers about the educational innovativeness of the metaverse and more "compact" in believing it (see Table 3).

The analysis therefore highlights that the NPC "tutor" would seem to be the role on which the general expectations of school tutors and student-teachers are mainly concentrated (see total data in Tables 4, 6). Nevertheless, the student-trachers seem to grasp the educational potential both of NPCs "tutors" and "peers" better than school tutors (see Tables 5, 7).

TABLE 8 Average and standard deviation questions nos. C2 and C3.

		School-tutors	Student-teachers	Total
NPC "tutor"	Average	2.73	**3.90**	3.32
	Std. dev.	0.91	0.87	0.89
NPC "peer"	Average	2.90	**3.87**	3.39
	Std. dev.	0.99	0.92	0.96

The highest percentage values are in bold.

This is, moreover, confirmed by the data on the mean and the standard deviations expressed in Tables 8, 9 on the correlation between data and qualification would also seem to suggest that expectations on the educational potential of the NPC "tutor" decrease as the level of education increases.

As regards the analysis of qualitative data, they were obtained through question no. D1 on personal thoughts on the metaverse. Table 10 shows categories and codes, with relative numbers of occurrences, emerged through a Qualitative Data Analysis of the text corpora (question no. D1) on the "new roles" in the metaverse.

The most quoted NPC role is the "tutor" – see no. 18 occurrences from school-tutors and no. 25 from student-teachers. The school-tutors explain the "tutor" role only by a program-related aspect – support in monitoring the entire learning process of the student-teachers (see Table 9, open coding, "monitoring"). Instead, student-teachers describe the tutor" through three different aspects: one linked to the practicum period (decision-making support), two linked to the program (deadlines and exchange of experiences).

Table 11 specifically shows the most quoted extracts relating to the NPC "tutor" role.

From the texts produced by the school tutors emerge references exclusively addressed to the NPC tutor; from the theses produced by the student-teachers, however, references to both the "tutor" and the "peer" emerge (see Table 10, axial coding). Furthermore, while the school tutors associate the role of the NPC tutor exclusively with the support in monitoring the learning processes of the student-teachers, the student-teachers instead associate this role with more diversified tasks, such as support in decisions during the internship, in meetings the deadlines that mark the training course, in the collection of explanatory evidence of the practicum.

School tutor express a stable image of NPC "tutor": a sort of graphical-analytical interface which helps real tutor to observe and value the progress of the student-teachers (see Table 10). The student-teachers seem, however, to recognize this role having more multifaceted functions ranging from support in the practicum activities (see Table 11, open coding, "decision making") as an expert colleague capable of intervening in complex situations, to support in the collection of documentation relating to the training program (see Table 9, open coding, "collecting documentation").

TABLE 9 Correlation between questions nos. A3 and C2.

Qualification	Diploma	Bachelor degree	Master degree	Ph.d.
Average	3.53	3.20	3	2

4. Discussion

Unlike the study of Gurkan and Bayer (2023), where teachers predominantly associated the metaverse with gaming and entertainment and were unaware of the benefits, the population involved in the present study expresses clear expectations and

TABLE 10 Categories and codes from school tutors' and student-teachers' text corpora ("new roles").

Respondents	Core category	Axial coding	Open coding	No. textual occurrences
School tutors	New roles in the metaverse	NPC "tutor" (No. 18)	Support in monitoring (program)	18
Student-teachers		NPC "tutor" (No. 25)	Support in decision-making (practicum)	12
			Deadline timing (program)	7
			Support in collecting documentation (program)	6
		NPC "peer" (No. 6)	Sharing experience (practicum)	6

TABLE 11 Categories and codes from school-tutor and student-teachers' text corpora (NPC "tutor").

Respondents	Core category	Axial coding	Open coding (no textual occurrences)	Example excerpts
School tutors	New roles in the metaverse	NPG "tutor"	Support in monitoring (program) (No. 18)	"Sometimes it is difficult to keep under control the student teachers' learnings. There is a need for a tool that monitors development and helps me" "I would like you to help me organize the meetings, checks and reports (…) so it would be easier to monitor the progress"
Student-teachers			Support in decision-making (practicum) (No. 11)	"When I do not know how to handle a problem in front of me, I would like someone to suggest me at least some alternatives" "The real effects of interventions are not all predictable. Rather: they are predictable, but from the expert. But I'm not an expert yet. This is why I would like a friendly voice to guide me especially in complex situations"

noteworthy opinions about the metaverse as a new learning environment: cautious on the part of the school tutors, open on the part of the student teachers. The difference could be associated with the functions assumed: school teachers, in the study by Çengel and Yildiz (2022), tutor of future teachers and student teachers – who are assumed to be more sensitive to training processes – in the study just presented. Further studies could offer data and evidence to support or not this hypothesis.

The triangulation on early qualitative-quantitative data is highlighting a general new look at.

the possibilities offered by the metaverse – in monitoring the learning program and in decision-making practices – as well as expectation about the teachers training – Artificial Intelligence relationship. Unlike what is highlighted by reflections and studies on the metaverse regarding the difficulties and disorientation by users in accessing and using technologies (Park and Kim, 2022; Tlili et al., 2022), both groups involved seem to feel no anxiety imagining what new things the metaverse will bring to teacher education. In particular, the school tutors do not report possible interferences of the new "roles" with respect to the trainer's work and the need to intervene on this, however they share more measured expectations, both with respect to the metaverse, in general, and with respect to the role of the NPC "tutor". Student-teachers, on the other hand, communicate slightly higher expectations regarding the metaverse as a professional learning environment and broader expectations regarding the role of the NPC "tutor".

(1) *What general utility do school tutors and student-teachers perceive with regards to the "new" instructional roles (NPC "tutor", "tutee", and "peer") available in the metaverse?*

The analysis carried out on perceptions in the first phase of the study allow to detect some aspect.

In general, the population involved in the study expresses expectations especially regarding the function of "tutor", little regarding the function of "peer", even less regarding the function of "tutee". The "tutee" function is never mentioned in the open answers, while the reference to the "peer" function is mentioned only in the student-teachers' texts.

Differences in expectations between school tutors and student-teachers with respect to the metaverse and the new educational roles related have been found. School tutors seem to be little more cautious regarding the possibilities offered both by the metaverse and by the new educational roles (Table 3, 36.66%), while future teachers show a slightly higher level of expectations, compared to the metaverse in general (Table 3, 48.38%) but above all regarding the new roles related (Table 5, 38.70 and 35.48%). Even the representations regarding the NPC "tutor" that emerged from the analysis of the qualitative data is different: more identifiable and linked to the "program", for the student tutors, more varied and linked to both the program and the practicum, for the student-teachers (Table 11).

This seems to confirm the study by Han and Noh (2021), from the point of view of the teachers. As those 30 higher education educators consider the metaverse an appropriate tool for complementary delivery and student-centered learning but express doubts about the support in the effective management of the classroom, the student tutors involved in the study also attribute to the NPC tutor only a support role in process management, with no link to practice.

(2) *What specific utility do school tutors and student-teachers perceive of the NPC "tutor" for their teaching and learning?*

The expectations of both school tutors and student-teachers seem to converge on the role of the NPC "tutor" (Table 5, 36.60 and 38.70%; Table 6): it is perceived as quite useful for teaching and learning processes (Table 4, 49.18%); by student-teachers it is perceived as fully useful for learning processes (Table 6, 47054). Specifically, the qualitative data offer clues on the functions related to the role of the "intelligent" tutor: as for school tutor, support for monitoring the entire training program of student-teachers; as for student-teachers, support for decision-making in the practicum activities. More moderate expectations, indeed, converge on the role of the NPC "peer" from both school tutors and student-teachers (Table 7, 36.06%). The qualitative data analysis confirms and highlights that only some student-teachers think about the role of the NPC "peer" – associated with the sharing of practicum experiences.

Therefore, a different representation clearly emerges between school tutors and student-teachers regarding: a. NPC instructional roles in the metaverse – school tutors centered only on the "tutor", student teachers also open to the "peer"; b. the function assumed in particular by the NPC "tutor" (for school tutors, only in the supporting of the training process, for student teachers also of support in the practicum practices) (Table 11).

A possible reason for this difference that emerged could be found in the correlation established between the answers and the data on the "qualification" and expressed in Table 9. It turned out that the expectations on the educational potential of the NPC "tutor" decrease as the level of education increases. This suggests that the higher qualification would offers tools and reasons to be wary of the metaverse as a learning environment and of the NPC "tutor" as an effective support to the training processes.

Another reason that would justify this difference would be linked to the type of answers given, both closed and open ones. In fact, it is possible to note that school tutors think of the training process in its overall vision, while student teachers enter into the specifics of practices, first of all the practicum. This different perspective of the training process could influence the idea that tutors and student teachers are developing the NPC "tutor". Also in this case, further studies could offer data and evidence to support or not this hypothesis.

5. Limitation and prospect of the study

The present study addressed the representations that school tutors and student teachers are building regarding the potential of the metaverse for the training of teachers, in particular the new roles governed by AI, such as NPCs "tutor" and "peer". It took the exclusive perspective of teacher training – especially in the construction of the questionnaire and in the implementation of the data analysis. However, the literature referred to at the moment on the metaverse is not specific to teacher education. For this reason, the discussion could be limited in the meanings that emerged and recalibrated thanks to the contribution of future research.

The second limitation concern some characteristic of the population involved. First, the smallness of this population does not allow us to generalize or extend what emerged from the analysis but only suggests some traits that could be better investigated in its second phase and though further more extensive study. Furthermore, the two sub-groups involved are descriptively not comparable. From a

methodological point of view, a convenience sampling was carried out which allowed the student-teachers of the teaching qualification course in primary school to be more easily reached (by sending the questionnaire by e-mail), and, therefore, to become involved in the investigation. Instead, the school tutors were contacted on two occasions and belong to two different schools, primary and secondary schools, respectively. Due to the descriptive non-comparability of the population involved, a descriptive, non-inferential data analysis was performed.

The further limitation of the study is related to the unit of analysis. The perceptions shared by student-teachers and school tutors regarding the metaverse and the NPCs roles are mainly based on second-hand information – articles, videos, discussions, etc. – not on experiences of immersion in the metaverse and interaction with the NPCs roles. The positive attitudes that emerged could therefore denote a personal disposition in favor, not yet a judgment linked to some feedback. However, what emerged is useful to know at least what student-teachers and school tutors need as support in their teaching and learning processes, as already emerged in the study of Gurkan and Bayer (2023).

6. Conclusion for tutoring in teachers training

The present work explains the first results of a study that investigates the representations of school tutors and student teachers on the educational potential of the metaverse, in particular on the roles of the so-called "non-player characters" (Zhang et al., 2022). The first phase of the study finds that the population involved has good expectations, especially regarding the role of the NPC "tutor" – mainly expected as support for monitoring the entire training program, by school tutors, and as support in decision making within the practicum, by student teachers.

The presented study brings out the support needs for professional learning that tutors and student teachers imagine to satisfy through the NPC roles possible by means of AI: in monitoring the learning process of the student-teachers, by school tutors, and in intervening expertly in complex situations in the practicum, by the student-teachers. Such needs expressed by tutors and student teachers could be taken into account by course managers to improve training programs.

Such considerations open scenarios on the limits and potential of AI in supporting and managing professional training processes through the metaverse and, more generally, on the rules and principles of the metaverse in education (Zhang et al., 2022). The choice to establish role-setting in the arbitration, the simulation and the decision-making of the process that favors personalized interventions and interactions (Hwang and Chien, 2022; Jovanović and Milosavljević, 2022) aimed at professional development allow to think about the type of preparation – educational and professional – of the integrated software developer and the necessary collaboration with those responsible for the path, on a professional level. This would prevent the software developer from being seen as a sort of impersonal and imponderable "creator" (Hwang and Chien, 2022).

This level of issues should be addressed not only by the managers and planners of teacher training courses but also by the tutors and student-teachers involved; this would prevent the metaverse from being perceived as yet another "*deus ex machina*" solver of the problems of progress of the educational path. The addiction, as one of the main risks associated with the metaverse, is given by the sensation of total immersion and hyper-reality (Choi and Kim, 2017; Weech et al., 2019; Kye et al., 2021), which especially reaches young students when they lack self-discipline and self-control.

In a broader framework of prevention of false "spiritual satisfaction associated with technologies" (Colazzo and Maragliano, 2022), the presented study warns about the effective preparation of student-teachers and teachers' tutors regarding both the opportunities and the risks which could pose the professional training contexts set up in the metaverse.

The implementation of the metaverse, as learning environment also for the teachers training and professional development, is stimulating and eagerly awaited (Park and Jeong, 2022; Park and Kim, 2022; Thomason, 2022). However, it should be avoided that too high expectations from specific professional profiles – such as teachers, so needy of support in the daily educational work – favor.

idolatrous attitudes toward the metaverse.

As stared by Zhang et al. (2022), teacher professional development is among possible future research directions on the educational valence of the metaverse. In the framework of an eco-systemic development (Bearzi, 2022) of the learning environment, the possibilities of co-evolution between users (tutors and student teachers) and NPCs (intelligent "tutor" and "peer") of the metaverse should be explored. "One can imagine that the NPC characters in the metaverse can learn (be trained)" after interacting with users and "grow" along with the timeline (Hwang and Chien, 2022, p. 2; Zhang et al., 2022). It will be the close collaboration between AI software developers and educators that will make this possible in the not too distant future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because The study does not require approval because the data collected is strictly anonymous. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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