Beyond the Blockchain: A Comparative Analysis of Educator and Non-Educator Perspectives on Web3 Technologies in Educational Contexts

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ABSTRACT
As Web3 technologies increasingly intersect with educational practice, understanding stakeholder perspectives becomes crucial for effective implementation. This study investigates how self-identified educators and non-educators within a Web3-focused educational community (Ed3DAO) differ in their attitudes, expertise, and knowledge regarding blockchain-based educational innovations. Through analysis of survey data collected during an education-focused Web3 unconference, this investigation reveals significant divergences in specific domains while challenging assumptions about general technological adoption patterns. Results demonstrate that educators expressed lower optimism regarding Web3's influence on teaching practices, while non-educators were more pessimistic about Web3's potential for student community building. Notably, both groups showed similar levels of technical, practical, and conceptual expertise, with conceptual understanding consistently outpacing technical proficiency across cohorts. These findings suggest that successful integration of Web3 technologies in education may depend less on professional background than on bridging the persistent gap between conceptual understanding and technical implementation—a finding that carries significant implications for professional development and technological integration strategies in educational settings.
Keywords: Web3 education, digital pedagogy, blockchain, non-fungible tokens, decentralized autonomous organizations (DAOs)

INTRODUCTION
Education has relentlessly moved online in recent years, in no small part thanks to COVID and the *big pivot*. In 2006, some 87% of institutions provided some online instruction (Kim & Bonk, 2006), whereas in 2020 it arguably became the standard (Gallagher & Palmer, 2020). This has led to structural changes in K-12 (Hurtt, Cohen, & Reed, 2021), policy changes in higher education research production (Marinoni, Van't Land, Jensen, et al., 2020), and the need for reconsidering and reworking otherwise experiential coursework (Gerhart, Jadallah, Angulo, & Ira, 2021). This move was accompanied by the increased use of new or rediscovered technologies like augmented reality (Vuță, 2020) and other immersive technologies. Regardless of the intention–education, leisure, or work–the generalized environment in which these exist has come to be known as "the metaverse." While "the metaverse" may be generally associated with extended reality, it has come to include a fuzzy collection of technologies and platforms (Rauschnabel, Felix, Hinsch, Shahab, & Alt, 2022). One cause for this is the increasing overlap of the physical and the digital. Virtual and augmented realities are the obvious examples, but as more of our experiences move into these digital spaces, so does the need for privacy, security, and agency. As such, with growing interest and popularity, "Web3" technologies are beginning to find themselves in the presence of augmented and virtual reality when "the metaverse" is discussed. Understanding these technologies, their pedagogical implications, and educators' perspectives on implementation has become increasingly crucial for advancing educational practice in the digital age.

WEB3
It is essential to distinguish Web3 from its predecessors: the user-generated content paradigm of Web 2.0 and the semantic web architecture of Web 3.0 (Allison & Kendrick, 2015). "Web3" initially centred on internet commerce through cryptocurrency (digital currencies) and user-focused ownership with a heavy decentralization emphasis (Garon, 2022). Web3, according to proponents of the paradigm shift, is well suited to make this possible through its reliance on blockchain technologies.

"Blockchain" is the catch-all term for immutable, decentralized ledgers of data transactions. When dealing with Web3 and blockchain transactions, identities are linked to "wallets," terminology that stems from the aforementioned cryptocurrency origins. Rather than signing into a platform with a username and password, a user instead will "sign" a transaction on the blockchain using an address and a private key. On the Ethereum blockchain, for example, rather than a user choosing an email for identification, they will be assigned a unique address, such as `0xA2088896De4e292A32708D397bbBe48C56e53297` (Ethereum Foundation, 2023b). While there is an option to purchase a more "friendly" address alias (myname.eth, for example), this is neither the default nor an option for many as, due to the rapidly fluctuating nature of cryptocurrency values (Powell, 2021), it may be prohibitively expensive. But cost isn't the only hurdle.

Criminal activity is of considerable concern when dealing with cryptocurrencies. A variety of legal issues and risks have been coming to light in recent years as the use of these platforms grows. This "shadow economy" as the "major institutional players in cryptocurrency jurisdiction-hop to avoid scrutiny, existing primarily online and individuals take part online, and anonymously if they wish" (Mackenzie, 2022, p. 1539). Risks run from simply making speculative investments in a volatile market to an entire cryptocurrency being wiped out overnight (Cuthbertson, 2022) to a variety of token-related scams related to non-fungible tokens.

While cryptocurrencies like Bitcoin are fungible, non-fungible tokens (NFTs) are, as the name suggests, one-offs and cannot be presumed to be of equal value to another NFT. An NFT can be thought of like a proof of ownership in many ways, sometimes acting as a trading card (PR Newswire, 2023), sometimes representation of artwork (McIntosh, 2022), other times with business utility like supply chain security and record keeping (High, 2020). NFTs can also be used as access cards, acting as the ticket to enter and engage with a community. These are typically known as *decentralized autonomous organizations* (DAOs) and can be considered a Web3-native form of community as they rely on Web3 technologies at their very core.

DAOs are alternatives to existing structural models like corporations and companies, with purposes ranging from pure charity to for-profit enterprises (Ghavi, Qureshi, Weinstein, Schwartz, & Lofchie, 2022). Ethereum Foundation, the non-profit organization that supports the Ethereum blockchain, simply describes a DAO as "a collectively-owned, blockchain-governed organization working towards a shared mission" (2023a). DAOs provide a range of governance models depending on that shared mission, whether a fully democratic, one-token/one-vote model or a system in which an internal utility token determines voting power, which has shown to be vulnerable to a range of challenges, be they logistical, technical, or simply a matter of balancing power within the group (Rikken, Janssen, Kwee, Bolívar, & Scholl, 2019). So-called "smart contracts" DAO governance are based on–algorithmic decision-making software that execute on the blockchain, are questionable in terms of their legality and enforceability, and present a variety of problems like their highly technical nature, adjudication, and immutability (Lipton & Levi, 2018)–are designed to streamline and democratize the community.

The range of DAOs' missions have expanded recently. While some DAOs may appear fanciful, perhaps even silly or uninformed of basic laws (Westenfeld, 2022), some focus on more humanitarian goals. One example, AthenaDAO, describes itself as "a decentralized community of researchers, funders, and advocates working to advance women's health research, education, and funding" (AthenaDAO, 2022). Similarly, VitaDAO sources "funding and advancing longevity science" via "decentralized drug development" (Golato & Kohlhaas, 2022). As DAOs gain traction, larger global organizations are also beginning to engage, such as United Nations Children's Fund (UNICEF), which has been been set up to receive cryptocurrency donations since 2019, and is exploring using these technologies to support development of "digital public goods" (Matsuda, 2023) to support its mission.

Demonstrably, many DAOs are designed to raise funds to achieve said mission. This can open them to potential fraud as these funds are generally fungible and cryptocurrency-based and, as such, vulnerable to related risks and scams (Rikken et al., 2019). While not fungible currency, NFT scams can be similarly serious. These are most often designed to make a quick profit for the NFT creator, though risks extend to bad-faith sales that run afoul of copyright or are simply, one could argue, digital forgeries (Bruch, 2022). NFT-related risks extend beyond being targeted, however. Sometimes the risk is as simple as losing a key. As wallet addresses are meant to be unique and the associated private key kept confidential, should a user lose that key, they will lose access to the address and whatever it contains. There is no recourse in this case, no "Forgot my password" option. For a wallet containing cryptocurrency funds, this means a permanent loss of these funds (Popper, 2021). For a wallet containing an NFT acting as proof of degree completion or educational records, the risk is different but equally concerning. Risks like this aside, there are other uses for blockchain wallets. Among them and gaining at least theoretical interest for educational purposes, is the implementation of blockchain technologies to solve a variety of problems in education, generally, and the issuing of persistent blockchain-based records known as non-fungible tokens.

Education and Blockchain
As these technologies continue to grow in influence and ubiquity, the education sector is increasingly included. The application of blockchain technologies has been explored academically for use in education for a number of

years and ranges well beyond general application. Fedorova and Skobleva (2020) reviewed *blockchain* literature to 2020, finding most references were book chapters, with "computer science" outnumbering the "education" discipline at nearly a rate of 10 to 1. At that point, according to their review, only 7 research articles, reports, and conference proceeding papers specifically addressed *education* in relation to *blockchain*. The authors identified eight areas blockchain research is addressing in education: certificates/credentials, identification, intellectual property protection, community development, portfolio creation, payment, accreditation, and administration. Since then, research into blockchain's potential in education has grown considerably.

Chivu et al. (2022) point out a number of universities and how they have implemented blockchain technologies into their systems: the University of Maryville creates blockchain-supported transcripts and diplomas, the University of Nicosia applies it to course certificates, and Southern New Hampshire University provides blockchain-based credentials. They further explore the reactions and opinions of Romanian blockchain-knowledgeable university professors, revealing a desire for practical pedagogical activities, with university students being more interested in blockchain-based verifiable credentials than cryptocurrency. Using blockchain to support credentials is sometimes referred to a "Blockcert."

While some universities like the Massachusetts Institute of Technology provide such "Blockcerts," these digital diplomas are just that: a digital version of a credential, leaving the proof of the knowledge and skills gained throughout that credential to be proven elsewhere in other ways (Lizcano, Lara, White, & Aljawarneh, 2020). One method being explored to address this is essentially gamification: the rewarding of competency-based learning outcome completion with a form of cryptocurrency. This process is often referred to as *learn to earn*.

Learn to earn (also known as *learn and earn*, *earn-and-learn*, and other variations) integrates a wide variety of blockchain technologies, from smart contracts to bespoke cryptocurrency to the use of NFTs as digital badges (Poser, 2022), but due to roadblocks like technical implementation and a lack of generally clear goals and needs, adoption has been somewhat lackluster (Park, 2021). This has not prevented a wide variety of communities and organizations from engaging in this space. Similar to Udemy, LinkedIn Learning, and other education providers, platforms like Invisible College[1], Crypto, Culture, & Society[2], and Women in Blockchain[3] gather curricula and make it available either for free as a public good or through "tuition" in the form of a purchased NFT. While cryptocurrency platforms like Coinbase and Binance provide cryptocurrency incentives to learn *about* cryptocurrencies, the *learn to earn* model in education is slightly different in that the tokens earned are awarded for meeting learning objectives set by the curriculum.

Regardless of the specific blockchain or curriculum, student motivation and engagement have been shown to improve when integrating novel technologies into the learning process, whether that is the on-chain content or immersive experiences like virtual or augmented reality (Bucea-Manea-Țoniş et al., 2021). Some blockchains are being conceptualized specifically for application in education, as well. The *Smart University*, for example, was conceived as a worldwide solution to problems arising from international communication, undocumented credentials, and quantifying credential quality (Aslan & Ataşen, 2020). Similarly, Massive Open Online Courses (MOOCs) are conceptualized as being backed and supported by blockchain technologies to improve the sharing and storage of educational materials, as well as evaluatory records (Chivu et al., 2022). The aforementioned "smart contract" is one integrated concept to achieve this by organizing consensus mechanisms, persistence, and transparency where appropriate. Deciding what and when is appropriate is still a matter of concern, however.

This concern stems mainly from the general lack of regulation (Rosenberg, 2022). This presents problems when dealing with, for example, intellectual property (Fenwick & Jurcys, 2022) or student records that are protected by federal law. Given this lack of regulation, ethical concerns are also to be expected. The near universally steep learning curve associated with Web3 presents a hurdle generally but especially for education. Not just for students, but for educators and administrators, as well. As such, engaging in the Web3 space in any meaningful way requires a basic understanding of the underlying blockchain technology and cryptocurrency.

Education NFTs and DAOs

The application of NFTs in education is one of considerable optimism to Web3-interested parties. As the relevance of Web3 in education appears to be centered around notions of ownership, the NFT is ostensibly the logical choice. One hurdle in the widespread educational adoption is simply the lack of "teacher educators who are willing to explore the development, implementation, and evaluation of Web 3.0 technologies and pedagogical strategies" (Ferdig, Cohen, Ling, & Hartshorne, 2022, p. 14). While there is clearly interest in the

[1] https://www.invisiblecollege.xyz/courses
[2] https://cryptosociety.notion.site/Crypto-Culture-Society-6a8dd5ee05b04684998b5206ae842195
[3] https://womeninblockchain.global/education

intersection of these technologies and education, it is possible logistical barriers are currently too great.

Examples of communities and organizations implementing NFTs for education-specific purposes are growing. In 2022, educational gaming company TinyTap raised 138.926 ETH (roughly US$228,000 at the time) in NFT sales to support teachers with a 50% profit share (PR Newswire, 2022). Ed3DAO's NFTs provide access to the community's unconference on education in Web3, workshops for educators, and inclusion in the DAO's governing structure, itself (Ed3DAO, 2022). GeniiDAO, the community developed to support TheGeniusSchool's micro K-12 "self-directed" schools, provides a range of NFTs related to the level and degree of engagement with the community, supporting notions of unschooling, deschooling, decolonized parenting, and providing access to groups, tools, and applications[4]. Other platforms like Youni (formerly Educoin) seek to take on higher education as a whole, with the goal to "reduce the costs of higher education by creating a direct to student marketplace for teachers and by creating the first decentralized skills database" (Dibattista, 2022). As opposed to NFTs focusing mainly on ownership and manufactured collective scarcity, these communities are focusing on the utility of the NFT, itself.

Communities like Ed3DAO and GeniiDAO are in the minority. Much like cryptocurrency platforms described earlier, education-based DAOs frequently focus on education *about* Web3 and cryptocurrency as opposed to *education* per se. DAO Central, a platform that lists and organizes DAOs, includes "Education" as a category, with every entry educating *about* Web3[5], often using Web3 tools as the means to do so.

Blockchain-based transcripts, microcredentials, and tokens as digital badges are becoming increasingly popular as means to ensure transparency, accessibility, and persistence, the ostensible banners of the Web3 movement. All of these concepts–NFTs, wallets, even ethical concerns like equity–are not just on the horizon for educators and education; rather, they are already here. This study explores precisely that: a movement known as Ed3.

Current Study

Given these myriad technologies and fields that converge on education, the current study seeks to understand how familiar and knowledgeable educators and those involved or interested in education are in this range of topics. It is well established that perceptions, opinions, and attitudes of educators tend to differ from non-educators in areas addressed here (Caliguri & Levine, 1967; Wholeben, 1988; Cai & Gut, 2020; Guo-Brennan, 2020). Research into educators' opinions into accepting new technologies or even new paradigms is common (Granić & Marangunić, 2019), though research focused on educators' understanding of and interest in these particular emerging technologies is limited and may prove enlightening when seeking to develop in, on, and with these platforms and concepts. The participants within this study were separated into two groups: educators and non-educators, determined by a demographic question in the instrument regarding their field or industry. Those self-selecting "Education" were placed in the former group and everyone else in the latter. The degree to which or type of "Education" field or industry participants were in was not gathered.

The following hypotheses were preregistered: first, participants' self-reported knowledge, predictions, and attitudes toward Web3 and metaversal technologies in relation to education will be dependent on a variety of demographics such as age, socio-economic status, location, gender, and profession. Second, those in education or education-adjacent fields will be more negative in their attitudes than those in other professions. Finally, the attitudes on various technical, ethical, practical, and security-related topics will vary by demographic group.

METHODS

Reported are how sample size was determined, all data exclusions (if any), all manipulations, and all measures in the study (Simmons, Nelson, & Simonsohn, 2012). The full collection of methods follows.

Procedure

The development of the research instrument was informed by a comprehensive review of extant literature and analysis of discourse within Web3 education-focused communities, with particular attention to three primary domains: pedagogical implementation, equity considerations, and technological infrastructure. Full instrument details are presented in the Materials section below. Participant recruitment was conducted through systematic, recurring announcements within the participating community, employing a structured distribution schedule to maximize reach and response rate. Social media (Twitter) was also used along with relevant hashtags. Potential participants were guided to a Qualtrics survey where, after agreeing to the consent form, they were met with a

[4] https://www.thegeniusschool.org/dao
[5] https://daocentral.com/explore/education

collection of demographic items prior to the instrument, proper. Upon completion, participants were offered the opportunity to submit a wallet address to receive compensation in the form of an NFT should their submission not be excluded. Institutional ethics board approval was obtained prior to beginning this study. Participants were provided the opportunity to withdraw from the study at any time with no risk.

Participants

Participants were identified through their engagement in a Web3-focused online community, Ed3DAO. Formed in 2021 and incorporated in 2022, Ed3DAO is described in its white paper as "the first DAO for educators, by educators, and owned by educators" (Saraf, 2022). The DAO engages in regular community events to gather like-minded people for collaboration and serves as a hub for those interested in the field. As with most, Ed3DAO provides start-up funding for education related Web3 projects like online coursework or podcasts. The current study coincided with the inaugural Ed3 Unconference[6] held in a virtual gamified space. The native Ed3DAO NFT served as the registration for the event, though attendees could also buy a ticket.

The call for participation was shared within the Ed3DAO community and by the community's social media accounts. All were welcome to participate. The instrument was provided in English only, and exclusion criteria were both programmatic and manual. These included noncompletion of the survey, selecting the same response for every item, duplication, submitting nonsensical responses, and so on. Using the pwr R package (Champely, 2020), a sample size of 263 was targeted. Two reverse-coded attention check items were included in the instrument to use as an additional exclusion criterion, but these were discarded when they proved unreliable. After these exclusion criteria were applied, the remaining participants (N = 136 of 184) numbered roughly half of the intended sample. A full demographic table of participants can be found in Table 1.

Table 1. Full demographics.

	Overall
	(N=136)
Race	
Black or African American	11 (8.1%)
Hispanic, Latinx, or Spanish Origin	12 (8.8%)
Multicultural or multiple response	11 (8.1%)
Other Asian	19 (14.0%)
Southeast Asian	11 (8.1%)
White/Caucasian	72 (52.9%)
Country	
Argentina	2 (1.5%)
Armenia	2 (1.5%)
Australia	4 (2.9%)
Austria	1 (0.7%)
Bahrain	2 (1.5%)
Brazil	1 (0.7%)
Canada	2 (1.5%)
China	12 (8.8%)
Colombia	1 (0.7%)
Greece	2 (1.5%)
Hong Kong (S.A.R.)	1 (0.7%)
India	1 (0.7%)
Indonesia	1 (0.7%)
Iran	2 (1.5%)
Kuwait	1 (0.7%)
Latvia	1 (0.7%)
Netherlands	2 (1.5%)
New Zealand	1 (0.7%)
Nigeria	2 (1.5%)
Norway	1 (0.7%)
Portugal	2 (1.5%)
Russian Federation	1 (0.7%)
Saudi Arabia	1 (0.7%)

[6] https://www.ed3dao.com/ed3unconference

	Overall
Serbia	1 (0.7%)
Singapore	1 (0.7%)
Spain	2 (1.5%)
Turkey	2 (1.5%)
United Arab Emirates	3 (2.2%)
United Kingdom of Great Britain and Northern Ireland	3 (2.2%)
United States of America	78 (57.4%)
Age	
18-24 years old	6 (4.4%)
25-34 years old	39 (28.7%)
35-44 years old	53 (39.0%)
45-54 years old	26 (19.1%)
55-64 years old	9 (6.6%)
65-74 years old	3 (2.2%)
Education	
Associates/Technical	3 (2.2%)
Bachelor’s degree	48 (35.3%)
Graduate or professional degree	77 (56.6%)
High school/GED	2 (1.5%)
Some college	6 (4.4%)
Income	
$100,000-$149,999	31 (22.8%)
$150,000 or more	23 (16.9%)
$25,000-$49,999	20 (14.7%)
$50,000-$74,999	20 (14.7%)
$75,000-$99,999	22 (16.2%)
Less than $25,000	12 (8.8%)
Prefer not to say	8 (5.9%)
Gender	
Cisgender Man	65 (47.8%)
Cisgender Woman	44 (32.4%)
Non-binary/gender queer	2 (1.5%)
Prefer not to respond	16 (11.8%)
Self-identified	6 (4.4%)
Transgender Man	2 (1.5%)
Two-spirited	1 (0.7%)
Sexuality	
Asexual	2 (1.5%)
Bisexual	8 (5.9%)
Gay/lesbian/queer	4 (2.9%)
Heterosexual/straight	104 (76.5%)
Pansexual	4 (2.9%)
Prefer not to respond	12 (8.8%)
Questioning	2 (1.5%)
Employment	
A homemaker or stay-at-home parent	3 (2.2%)
Other	7 (5.1%)
Student	8 (5.9%)
Unemployed and looking for work	7 (5.1%)
Working full-time	97 (71.3%)
Working part-time	14 (10.3%)
Industry	
Consulting	7 (5.1%)
Education	87 (64.0%)
Entertainment / Art / Music / etc	6 (4.4%)
Finance	8 (5.9%)
Health care	2 (1.5%)
Information services	4 (2.9%)
Legal services	2 (1.5%)

	Overall
Other (Please fill in)	8 (5.9%)
Prefer not to say	4 (2.9%)
Software development	7 (5.1%)
Utilities	1 (0.7%)

Materials & Measures

General demographics were gathered to identify the make-up of the sample's participants. These included race, country currently residing, age, educational attainment, income, identified gender, sexuality, marital status, military status, employment status, level and type of engagement in any Web3-based organization, and a range of professional fields (i.e., agriculture, finance, education). These were intended to identify unexpected trends that may lead to further study.

A 24-item Likert scale with self-directed, opinionated, and factual statements followed. These were worded in such a way that participants chose whether and to what degree they agreed with the statement. A standard range of responses for Likert-scale questions was implemented on a 7-point scale (1 = "Strongly disagree", 2 = "Disagree", 3 = "Somewhat disagree", 4 = "Neither agree nor disagree", 5 = "Somewhat agree", 6 = "Agree", 7 = "Strongly agree") including a "Don't know / No opinion" option. Two example statements are "Non-fungible tokens provide great social capital" and "I feel confident explaining Web3." These were followed up with open-ended questions to gather more nuanced, personal statements from participants, though due to their potentially identifiable content they are not included in this analysis. The instrument also sought self-reported expertise on these technologies in technical, conceptual, and practical realms to use as controls and grouping variables. The full instrument is available via the Open Science Framework (Straight, 2022).

Data analysis

All analyses were performed with R (R Core Team, 2022). Using the qualtRics package (Ginn, O'Brien, & Silge, 2022), raw survey data was programmatically downloaded from the Qualtrics servers for local analysis. Summary and descriptive statistical analyses were performed to understand the make-up of the population being surveyed. A variety of statistical tests were employed, including structural equation modelling in the form of principle component analysis, parametric and non-parametric measures of mean comparisons, and general descriptives. All results are described below.

RESULTS

Analysis of participant responses revealed nuanced attitudes toward Web3 technologies in education, particularly regarding implementation readiness and pedagogical utility. Recent comparative research by Uysal et al. (2024) employing their Web3 Awareness Scale helps contextualize the present findings, as their results similarly indicated varying levels of implementation readiness across educational practitioners. The consistently positive attitudes observed in this study align with Cui et al.'s (2023) findings regarding educator optimism toward Web3 integration, though this study found lower technical expertise self-reporting. The consistent gap between conceptual and technical expertise across both educators and non-educators ($\Delta M = 27.8$ and $\Delta M = 24.7$, respectively). This parallel differential suggests a systematic gap in technical implementation readiness that transcends professional boundaries, potentially indicating a broader structural challenge in Web3 education integration. Comprehensive results follow.

Demographics

Participants in this study were directly involved in, adjacent to, or had interest in the educational use of Web3 technologies by virtue of their exposure to the call for participation. They were not limited to a geographic location, profession, age, race, gender, or any other demographic. While a full breakdown of participant demographic responses is available in Table 1, it is enlightening to explore them in more depth. Of the 136 participants that were included in the final analysis, 53% identified as White/Caucasian ($N = 72$). Other racial identities were roughly equally represented, with Other Asian coming second at 14% ($N = 19$) and the remaining categories all between 8% ($N = 11$) and 9% ($N = 12$). Roughly the same majority distribution was true for residing country, with United States of America at 57.4% ($N = 78$) and China at 8.8% ($N = 12$). Most participants were between 25 and 34 (28.7%; $N = 39$), and 35 and 44 years old (39%; $N = 53$), totalling 67.7% of the sample ($N = 92$) and reported having either a bachelor's (35.5%; $N = 48$) or graduate/professional degree (56.6%; $N = 77$). Gender identification was mostly cisgender men (47.8%; $N = 65$) and cisgender women (32.4%; $N = 44$), with heterosexuality was the predominantly identified sexual orientation (76.5%; $N = 104$). Most participants work full time (71.3%; $N = 97$) in education-related fields (64%; $N = 87$).

Instrument
Principal component analysis revealed two robust components that together account for an exceptionally high proportion of total variance (92.92%; TC1 = 59.04%, TC2 = 33.33%). This unusually clear component separation suggests distinct attitudinal constructs within the Web3 education space. Component 1, accounting for 59.04% of variance, primarily encompasses items related to potential and optimism, while Component 2 (33.33%) clusters around implementation challenges and critical considerations. This clear delineation between optimistic potential and practical challenges provides valuable insight into how stakeholders conceptualize Web3's educational integration.

The PCA performed on the Likert survey instrument assisted in its interpretation and reduce dimensionality. The data proved appropriate for principle component analysis with KMO = 0.85 and Bartlett's test of sphericity showing sufficient significant correlation in the data for factor analysis ($\chi^2 = 1323.68$, $p < .001$). Using oblimin rotation, the 2 principal components accounted for 92.92% of the total variance of the original data (TC1 = 59.04%, TC2 = 33.33%).

The survey's Likert scales demonstrated sufficient internal reliability. Both the instrument as a whole and each component demonstrate sufficient internal reliability (whole $a = 0.86$; PC1: $a = 0.92$; PC2: $a = 0.70$). Only one item was identified that would increase a component's internal validity if removed: in component 2, "There should be more regulation and oversight" (a if deleted = 0.74). See Tables 2a, 2b, and 2c for per-component breakdown and Table 3 for the full instrument's reliability analysis.

Table 2a. Instrument reliability in principal components 1.

Row	Missing	Mean	SD	Skew	Item Difficulty	Item Discrimination	α if deleted
It is academically advantageous for minorities	2.21 %	5.29	1.49	-0.95	0.76	0.78	0.91
It is socially advantageous for minorities	2.94 %	5.11	1.55	-0.65	0.73	0.63	0.91
Students' educational experiences will improve	2.21 %	5.56	1.28	-0.89	0.79	0.83	0.91
Students will feel more ownership of their academic credentials	2.94 %	5.89	1.31	-1.42	0.84	0.72	0.91
Barriers to accessing education will be reduced	2.94 %	5.26	1.56	-1.02	0.75	0.69	0.91
I feel confident explaining Web3	1.47 %	5.2	1.55	-0.95	0.74	0.24	0.92
Teachers and students should be excited	0.00 %	5.95	1.38	-1.61	0.85	0.73	0.91
This will act to democratize education	2.94 %	5.48	1.49	-1.13	0.78	0.69	0.91
Teachers' and learners' privacy will be enhanced	1.47 %	5.02	1.43	-0.72	0.72	0.63	0.91
Assessment and feedback to students will be improved	5.88 %	5.35	1.45	-0.82	0.76	0.68	0.91

Cybersecurity in Web3 is the top priority	2.94 %	5.52	1.5	-1.1	0.79	0.42	0.92
Teachers can spend more time teaching	1.47 %	4.82	1.65	-0.58	0.69	0.54	0.92
Non-fungible tokens provide great social capital	2.21 %	5.23	1.54	-1.02	0.75	0.69	0.91
Non-fungible tokens could be used to a much greater effect	0.00 %	6.01	1.31	-2.02	0.86	0.60	0.91
Web3 can only change pedagogy for the better	3.68 %	4.66	1.91	-0.37	0.67	0.59	0.91

Mean inter-item-correlation=0.433 · Cronbach's α=0.917

Table 2b: Instrument reliability in principal components 2.

Row	Missing	Mean	SD	Skew	Item Difficulty	Item Discrimination	α if deleted
There should be more regulation and oversight	2.94 %	4.86	1.54	-0.58	0.69	0.14	0.74
Schools will be quick to adopt these new technologies	0.00 %	2.95	1.84	0.8	0.42	0.53	0.63
There is a reduction in access to quality educational materials	3.68 %	4.08	1.92	0.04	0.58	0.33	0.70
Student-to-student communications and community will suffer	2.94 %	3.08	1.69	0.8	0.44	0.42	0.66
'Cryptocurrency' and 'Web3' are essentially the same thing	0.74 %	2.5	1.75	1.15	0.36	0.58	0.61
'Web3' and 'the metaverse' are interchangeable	2.94 %	3.23	1.86	0.57	0.46	0.60	0.60

Mean inter-item-correlation=0.272 · Cronbach's α=0.701

Table 2c: Component correlation

	Component 1	Component 2
Component 1	α=0.917	
Component 2	0.139 (.145)	α=0.701

Computed correlation used pearson-method with listwise-deletion.

Table 3. Alpha levels.

Raw alpha	Standard alpha	G6(smc)	Average *r*	S/N	ase	Mean	SD	Median *r*
0.86	0.87	0.92	0.25	6.98	0.02	4.80	0.82	0.24

Attitudes

The current study hypothesized a variety of interactions and influences between participant demographics, self-reported expertise, and attitudes. First was an exploration of the general feeling participants had toward these emerging technologies and platforms. Significant differences between demographic groups in attitudes toward Web3 in education were preregistered. The hypothesis that educators would be less optimistic about Web3 in education than non-educators was also preregistered. Neither of these hypotheses were borne out in the data. See Table 4 for a full table of Likert item data and Figure 1 for a visualization of the Likert responses as broken down in the two principal components.

Table 4. Descriptive statistics of Likert responses.

	Mean	Std.Dev
'Cryptocurrency' and 'Web3' are essentially the same thing[3]	5.50	1.75
'Web3' and 'the metaverse' are interchangeable[3]	4.77	1.86
Assessment and feedback to students will be improved[2]	5.35	1.45
Barriers to accessing education will be reduced[1]	5.26	1.56
Cybersecurity in Web3 is the top priority[3]	5.52	1.50
I feel confident explaining Web3[3]	5.20	1.55
It is academically advantageous for minorities[1]	5.29	1.49
It is socially advantageous for minorities[1]	5.11	1.55
Non-fungible tokens could be used to a much greater effect[3]	6.01	1.31
Non-fungible tokens provide great social capital[3]	5.23	1.54
Schools will be quick to adopt these new technologies[2]	2.95	1.84
Student-to-student communications and community will suffer[2]	4.92	1.69
Students' educational experiences will improve[2]	5.56	1.28
Students will feel more ownership of their academic credentials[2]	5.89	1.31
Teachers' and learners' privacy will be enhanced[3]	5.02	1.43
Teachers and students should be excited[2]	5.95	1.38
Teachers can spend more time teaching[2]	4.82	1.65
There is a reduction in access to quality educational materials[1]	3.92	1.92
There should be more regulation and oversight[1]	4.86	1.54
This will act to democratize education[1]	5.48	1.49
Web3 can only change pedagogy for the better[3]	4.66	1.91

Note. Scale ranges 1 (strongly disagree) to 7 (strongly agree).
1: Equity category
2: Pedagogy category
3: Web3 category

Figure 1. Likert responses by component.

Cross-categorical analysis revealed significant interactions between expertise levels and attitudinal responses. Participants reporting higher technical expertise (>60 on the 100-point scale) demonstrated more nuanced attitudes toward implementation challenges ($M = 5.33$, $SD = 0.84$) compared to those with lower technical expertise ($M = 4.87$, $SD = 0.92$), regardless of their professional background ($t(134) = 2.89$, $p < .01$). Analyzing educator and non-educator cohorts revealed no statistically significant differences regarding the primary component (Component 1) ($\Delta M = 0.19$; 95% CI [-0.15,0.52], $t(118.5) = 1.10$, $p = .273$). Educators expressed significantly fewer negative feelings about Web3 in the more critical component #2 ($M = 2.96$) than non-educators ($M = 3.95$) ($\Delta M = 0.85$, 95% CI [0.38,1.32], $t(75.58) = 3.57$, $p = .001$).. Note that the items listed in component #2 are worded critically; lower scores represent positivity. Average Likert responses were consistently positive across all measures and groups. Educators were slightly less positive about equity (M = 5.03, SD = 0.99) and pedagogical potential (M = 5.06, SD = 0.98) than non-educators (M = 5.16, SD = 0.95; M = 5.22, SD = 0.80), while educators were slightly more positive about Web3's impact on education in general (M = 5.33, SD = 0.84) than non-educators (M = 5.24, SD = 0.66). None of these differences held statistical significance, however. When grouping Likert items by theme, no statistically significant prediction can be made regarding participants' involvement in education. Table 5 describes the full model. This finding suggests that technical proficiency may be more influential in shaping attitudes toward Web3 implementation than professional role.

Table 5. Full regression table exploring grouped Likert responses' prediction of industry.

Predictor	b	95% CI	t	df	p
Intercept	0.62	[0.02, 1.22]	2.04	132	.043
Equity	-0.03	[-0.14, 0.09]	-0.43	132	.668
Pedagogy	-0.07	[-0.20, 0.06]	-1.03	132	.306
Web3	0.10	[-0.03, 0.23]	1.45	132	.150

Expertise

Further analysis of expertise distributions revealed a consistent hierarchical pattern across both educators and non-educators: conceptual expertise consistently ranked highest (educators: 64.3; non-educators: 68.2), followed by practical expertise (educators: 59.7; non-educators: 62.7), with technical expertise notably lower (educators: 36.5; non-educators: 43.5). This consistent expertise hierarchy suggests a systematic pattern in how Web3 knowledge is acquired and internalized, potentially indicating natural progression points for professional development initiatives (see Figure 2).

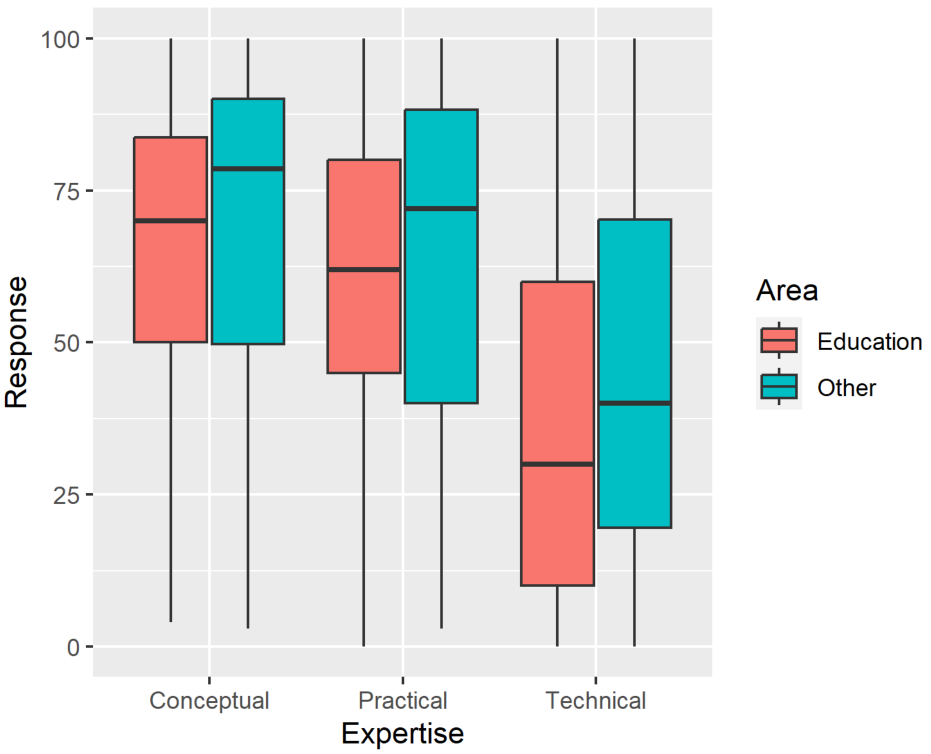

Figure 2. Boxplots of educators' and non-educators' expertise.

No statistically significant differences were found between educators and non-educators in terms of self-reported expertise (see Table 6): conceptual (W = 2,405.50, p = .214), practical (W = 2,340.50, p = .344), nor technical (W = 2,384.00, p = .253). Wilcoxon rank sum tests were performed due to non-normality of these data.

Table 6. Shapiro-Wilk test for normality in expertise.

Industry	Technical W	Technical p-value	Practical W	Practical p-value	Conceptual W	Conceptual p-value
Non-educator	0.93	0.01	0.90	0.00	0.88	0.00
Educator	0.92	0.00	0.95	0.00	0.93	0.00

The findings from this study both align with and diverge from previous research on emerging technology adoption in education. The generally positive attitudes toward Web3 technologies demonstrated by educators in this study parallel findings from Bucea-Manea-Ţoniş et al. (2021), who reported increased student motivation and engagement with blockchain integration. These results diverge from traditional patterns of technology adoption reported by Granić and Marangunić (2019), where educators typically exhibited higher levels of skepticism. The significant difference in attitudes regarding teaching time impact (ΔM=0.94, 95% CI [0.42,1.47]) aligns with findings from Chivu et al. (2022), who identified similar concerns among faculty regarding practical implementation challenges. Findings that educators were more optimistic about student community development than non-educators present an interesting contrast to previous research on technology-mediated learning communities (Park, 2021). The strong agreement regarding NFT utility (M = 6.01, SD = 1.31) extends findings from recent studies of blockchain adoption in higher education. While Lizcano et al. (2020) found limited application of blockchain credentials, these results suggest broader potential applications, particularly in the realm of educational credentialing and achievement verification.

DISCUSSION

This investigation examined the multifaceted perspectives, theoretical frameworks, and critical analyses surrounding Web3 technologies' integration into educational contexts. To this end, a community of educators and those interested in the intersection of education and Web3 were selected as the sample. The study reveals that educators and non-educators do not diverge in most areas related to education and Web3. Analysis revealed no statistically significant variations in demographic distribution or self-reported expertise levels between the examined cohorts. This may point to the general applicability of these findings regardless of profession. These findings align with recent research by Uysal et al. (2024), who developed and validated a Web3 Awareness Scale, finding that awareness and attitudes toward Web3 technologies were not significantly influenced by professional background. Similarly, Kıyak et al.'s (2024) investigation into Web3 awareness and privacy concerns demonstrated that technical understanding and professional domain were less influential than anticipated in determining attitudes toward Web3 adoption.

Both educators and non-educators expressed self-reported levels of technical, practical, and conceptual expertise in Web3 at statistically insignificant differences. This also lends credence to the interpretation that certain levels of expertise can be expected regardless of industry or area of employment when studying self-selected individuals with interest in Web3 technologies and education. This finding is particularly noteworthy when considered alongside Cui et al.'s (2023) MetaEdu framework research, which found that educators' technical proficiency was less crucial than their conceptual understanding of Web3's pedagogical applications. Results on self-reported expertise levels mirror recent findings that identified similar patterns in their investigation of undergraduate Web3 course development (Zdravković & Dimitrijević, 2024), where conceptual mastery consistently outpaced technical expertise among educational practitioners. This aligns with Hollaus and Grant's (2024) findings regarding exposure to these technologies and likelihood to engage in metaversal platforms.

These findings contribute significantly to our understanding of Web3 technology adoption in education. Previous studies have primarily focused on general blockchain implementation (Fedorova & Skobleva, 2020) or specific credential applications (Chivu et al., 2022). These results extend this work by revealing nuanced differences between educators' and non-educators' perspectives on practical implementation challenges. The tension between technological optimism and practical implementation concerns echoes similar patterns found in studies of other educational technology adoptions (Granić & Marangunić, 2019), suggesting that successful Web3 integration may require targeted approaches to address specific pedagogical and logistical challenges.

There was significant deviation in one area, however. Educators disagreed with more critical statements about Web3 at a significantly higher rate than non-educators. These findings suggest a fundamental optimism among educators regarding the pedagogical potential of Web3 technologies compared to non-educators in terms of the use and potential of Web3 technologies applied pedagogically. Interestingly, these opinions that formed the six Likert scale items in the second component were equally spread across the item categories between equity, pedagogy, and Web3, suggesting there may not be one single category where educators are more or less optimistic or pessimistic than non-educators.

The consistently positive attitudinal responses observed across most measures (M > 5.0) warrant careful consideration, particularly given the self-selected nature of the sample. When examined alongside the expertise differential patterns, these uniformly positive attitudes suggest either strong confirmation bias within the Web3 education community or indicate that those most knowledgeable about these technologies genuinely perceive substantial positive potential. This distinction carries significant implications for both research methodology and implementation strategy. The most highly scored item across participants dealt with the use of NFTs in education and them not being used to their fullest extent (M = 6.01, SD = 1.31). This suggests a more nuanced understanding of NFTs that keys in on potential, avoiding focus on nefarious, bad-faith actors. It also demonstrates solid agreement between educators and non-educators on the utility of NFTs. As educators expand more into this space, demonstrated by communities like Ed3DAO and GeniiDAO, novel and good-faith implementation of NFTs continue to evolve. Recent research supports this optimistic view of NFT utility in education. Razzaq (2024) demonstrated that blockchain-based assessment platforms can significantly enhance credential verification and portfolio development, while maintaining security and privacy. Furthermore, Ferraro et al. (2023) found that trust in Web3 technologies, particularly NFTs, increases when their implementation focuses on practical utility rather than speculative value—a finding that aligns with participants' high scoring of NFT educational potential.

There was considerable disagreement when it came to opinions on Web3's day-to-day influence on the act of *teaching*. Educators were significantly less optimistic about Web3 meaning "teachers can spend more time teaching" (ΔM = 0.95, 95% CI [0.42,1.47], $t(126.79) = 3.55$, p = .001). Non-educators were much more pessimistic than educators regarding the implications for developing a sense of community among students (ΔM = 1.02, 95% CI [0.35,1.68], $t(88.82) = 3.03$, p = .003). The differences between groups here suggests a disagreement about the logistical reality of being an educator, especially considering the hurdles in implementing new technologies. This is understandable as educators will necessarily have better insight into their day-to-day experiences than non-educators. It also demonstrates a measurable and identifiable difference between how educators and non-educators envision these technologies having tangible, real impacts on the profession. The significant divergence in perspectives regarding Web3's impact on daily teaching practices represents one of the study's most robust findings. This disparity between educator and non-educator expectations appears particularly meaningful when considered alongside the expertise distribution patterns. While both groups demonstrated similar expertise levels, their divergent views on practical implementation suggest that professional experience, rather than technical knowledge, may be the primary driver of implementation expectations.

The evolving landscape of Web3 in education is further contextualized by recent developments in decentralized educational platforms. The smart contract-based platform research demonstrates that educators' optimism about Web3's potential is not unfounded, as their implementation showed significant improvements in credential verification and educational resource management (Țigănoaia & Alexandu, 2024). This must be balanced against Filipčić's (2022) findings regarding DAO implementation challenges in research and education, which highlight the need for careful consideration of governance structures and technological integration—concerns that were reflected in participants' varied responses to questions about day-to-day teaching impact.

Acceptance of, attitude toward, and use of Web3 technologies like blockchain has been well studied regarding finance, business, and industry implementation (Arias-Oliva, Pelegrín-Borondo, & Matías-Clavero, 2019; Folkinshteyn & Lennon, 2016). The precise manner and degree to which these technologies will mature and find adoption by educators is still unclear. What is clear, however, is the optimism present in its proponents. Potential demonstrated here must contend with a variety of challenges: logistical difficulties, a constantly changing technical landscape, the presently inexorable tie to cryptocurrencies and related concerns, and, not least of all, an ever-souring and distrustful public. The sheer experiential difference—an ethereal, digital landscape of identities, credentials, and pedagogical artifacts—remains a monumental paradigm shift. Whether these technologies will or even truly have the capacity to lead to positive, significant, and meaningful changes in an increasingly digital society and online education system remains to be seen but will not be for lack of highly optimistic proponents.

CONCLUSION

This comprehensive investigation into Web3 technologies in educational contexts yields three pivotal findings that substantially advance our understanding of technological integration in pedagogical innovation. Through rigorous analysis of attitudes, expertise, and implementation perspectives among educators and non-educators, several significant patterns emerge with important implications for future practice and research.

First, this study challenges prevailing assumptions about technological adoption patterns by revealing remarkably consistent perspectives across educator and non-educator cohorts. Contrary to initial hypotheses, statistically significant differences were minimal between these groups, suggesting a more uniform technological outlook than previously theorized. This finding echoes recent scholarship (Uysal et al., 2024; Kıyak et al., 2024) that similarly indicated that professional background may be less determinative of technological attitudes than previously conceived.

Second, while overall attitudes remained consistently positive, educators exhibited a more nuanced approach to Web3 implementation, demonstrating lower levels of negativity about these technologies while maintaining measured skepticism about practical implementation challenges. This suggests that proximity to educational practice cultivates a more sophisticated, contextually grounded technological perspective. The findings indicate that educators' reservations primarily center on logistical implementation rather than theoretical potential, reflecting a pragmatic understanding of classroom realities.

Third, the research highlighted a consistent expertise hierarchy across both groups: conceptual understanding consistently preceded practical and technical knowledge. With conceptual expertise averaging 64.3 for educators and 68.2 for non-educators, followed by practical expertise and markedly lower technical expertise, these findings underscore the need for targeted professional development initiatives that bridge conceptual understanding with technical implementation.

The near-unanimous agreement regarding NFTs' educational potential represents a particularly compelling insight. This suggests a collective recognition of NFTs' transformative potential beyond current implementations, transcending the speculative narratives that have historically dominated cryptocurrency discourse. The significant divergence in perspectives regarding Web3's impact on daily teaching practices represents one of the study's most robust findings. This disparity between educator and non-educator expectations appears particularly meaningful when considered alongside the expertise distribution patterns.

These findings carry substantial implications for educational technology development and institutional adaptation. For developers and institutional leaders, this research suggests the critical importance of designing Web3 implementations that prioritize practical usability, address educators' concerns about classroom workflow, and provide clear, accessible pathways for technical skill development. The measured optimism demonstrated by educators signals not resistance but a sophisticated, calibrated approach to technological innovation in educational spaces.

As the digital entanglement between human and technology continues to evolve, especially in pedagogical spaces, understanding these perceptual nuances becomes paramount for thoughtful, ethical technological integration. This study contributes to a growing body of scholarship demonstrating that successful technological adoption depends less on the technology itself and more on the human systems, perceptions, and adaptability that surround its implementation. The findings provide a foundation for future research exploring the practical mechanisms of Web3 integration in educational settings while highlighting the importance of balancing technological innovation with pedagogical pragmatism.

LIMITATIONS AND SUGGESTIONS FOR FUTURE STUDY

As with any study, there are limitations here. First, the sample is entirely self-selected. Those likely to complete the survey are already interested in the topic, resulting in a degree of sampling bias. Second, roughly a quarter of all survey submissions suffered from non-completion, satisficing, maximizing, or optimizing, resulting in their exclusion. Finally, the language and concepts present are highly domain-specific and require considerable precursor knowledge to understand the content. Getting opinions and expectations from non-domain participants would take considerable education beforehand.

Several key areas warrant further investigation. Research examining the factors contributing to educators' optimism toward Web3 technologies could provide valuable insights for technology adoption in educational settings. Studies exploring the practical implementation challenges identified by educators could help bridge the gap between theoretical potential and practical application identified by Park (2021). Additionally, longitudinal research tracking the evolution of attitudes and implementation success as these technologies mature would provide valuable insights into their long-term viability in educational contexts. These findings suggest that, while Web3 technologies face significant implementation challenges in educational settings, there exists a foundation of cautious optimism among educators that could support their thoughtful integration into educational practices. As these technologies continue to evolve, understanding the nuanced perspectives of both educators and non-educators will be crucial for their successful implementation in educational contexts.

The implications of the present study are varied as they pertain to online teaching and learning. Certainly, a refined and more nuanced approach to using technologies like NFTs could divorce the pedagogical affordances from popular opinion. For example, a simple name change—a *rebranding*, essentially—could have tremendous impact on how and where they are used. A learner having a *digital backpack* to keep credentials, accomplishments, even examples of previous work like a portfolio, that fundamentally demonstrates ownership and agency may become the norm, rather than currently relying on a variety of credential-focused repositories.

These technologies may also have implications for teaching and learning in the age of large language models (LLMs) like ChatGPT[7]. Backed by the immutability and record-keeping nature of blockchain, it's possible highly personalized learning experiences generated through ChatGPT-like platforms could be verified as entirely unique to the student and the resultant student work as original. The use of NFTs in this context could also become important for the design and delivery of instructional materials in a way that is still nascent in many ways: verification of ownership. An instructor or designer minting an NFT of their original instructional materials could act as assurance that the content was human-generated. Whether these intersections will emerge is unknown and is likely to be a topic of considerable research going forward.

Technology aside, future research should also seek to identify underlying causes and impetus for, especially, the divergence in educators' opinions as compared to the general population. In this way, it is possible to better understand, design, and implement pedagogically sound and responsible content that leverages these technologies. A follow-up study intends to extend the instrument to a larger, more general collection of participants to increase generalizability and better understand how those outside the Web3 sphere may find utility in the technology, as well as implications of LLMs in this space.

Disclosure statement
The authors declare that they have no conflict of interest.

Compliance with ethical standards
An Institutional Review Board responsible for human subjects research at The University of Arizona reviewed this research project and found it acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

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