Promoting Inclusiveness and Fairness through NFTs: The Case of Student-Athletes and NILs

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ABSTRACT

Recent regulatory changes have enabled NCAA student-athletes to profit from their name, image, and likeness (NIL), departing from previous policies requiring those athletes to maintain their amateur status. However, despite the changes, it is unlikely that all the approximately 500,000 NCAA student-athletes will profit from NIL contracts. Within this context, we study how to design a fair and inclusive solution that may help all student-athletes secure NIL financial resources. Following a design science approach, we define design requirements after interviewing student-athletes. Subsequently, we derive three design principles: inclusiveness, fairness, and transparency. Thereafter, we suggest a blockchain-based artifact that satisfies all design principles. Our idea lies in designing collectibles as non-fungible tokens (NFTs) that pay different royalties whenever a transaction (purchase or exchange) happens in different markets (primary or secondary). Finally, we evaluate our solution by discussing its features with current student-athletes.

CCS CONCEPTS

• **Information systems → Information systems applications**.

KEYWORDS

blockchain, design science, fairness, inclusiveness, NFT

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1 INTRODUCTION

College sports are an inherent aspect of many higher-education institutions. Some of the athletes, also known as *student-athletes*, are simultaneously full-time students and amateur players. To compensate for the amateur aspect of college sports, student-athletes may receive *athletic scholarships* to attend universities. In the United States, athletic scholarships are regulated by organizations such as the National Association of Intercollegiate Athletics (NAIA) and the National Collegiate Athletic Association (NCAA). At the time of writing, there are around 500,000 active NCAA student-athletes [20].

Until recently, to be an NCAA athlete, student-athletes should be in good academic standings and maintain their amateur status, *i.e.*, they could not receive monetary prizes or salaries. Being an amateur in this context creates several challenges. For example, most scholarships student-athletes receive do not fully pay for tuition, fees, room, and board [13]. Moreover, due to athletic responsibilities, student-athletes might not have the same opportunities as other students, *e.g.*, access to summer internships. That absence can jeopardize their future careers outside sports since 98% of NCAA student-athletes do not become professional athletes after college [20].

On June 30th, 2021, NCAA changed its amateurism rules to allow student-athletes to profit from their *name*, *image*, and *likeness* (NIL). That is, NCAA student-athletes can now sign NIL contracts as long as these contracts are consistent with state laws [14]. This change enables students to, for example, receive money for endorsements and sell collectibles. Despite being celebrated by many, there have been some concerns regarding who will actually profit from the new NIL changes. For example, legendary American football coach Nick Saban said: "*Everything in high school and college football has always been equal for everyone. It's not going to be that way anymore … Certain positions probably enhance* [the] *opportunity to create value, like* [a] *quarterback*." [5]. In particular, while NIL endorsements are unlikely to become a reality for most NCAA student-athletes, there are already a few eyebrow-raising endorsements, such as the approximately one-million-dollar figure received by Bryce Young, an American football player at the University of Alabama [5].

The above context naturally raises *inclusiveness* concerns regarding opportunities for accessing and signing NIL deals. At the same time, the magnitude of some of these deals raises *fairness* concerns regarding whether student-athletes are paid enough/too

much. To validate the above concerns, we interviewed 12 student-athletes playing a range of different sports at the Division I level in the United States. From a fairness standpoint, the interviewees suggested that the most popular athletes from more prominent universities (sports-wise) will likely dominate the space and sign most NIL deals, which is not necessarily unfair in their view. However, at the same time, it was emphasized that most student-athletes will not sign any NIL deal, thus representing a lack of inclusiveness when accessing NIL-related financial resources.

In this paper, we explore a blockchain-based solution to potentially help *all* student-athletes leverage changes in NIL regulations and, thus, democratize access to financial resources. Our idea is based on the concept of collectibles, often represented as non-fungible tokens (NFTs) in the blockchain space. The main feature of our proposed solution is that each student-athlete is automatically rewarded whenever there is a transaction (*e.g.*, a purchase or an exchange) through our proposed platform involving a collectible representing that student-athlete. There are different ways platforms can offer NFTs, *e.g.*, direct sales, auctions, random packs of collectibles, *etc.* We propose that collectibles are sold in random packs in primary markets, thus enabling all student-athletes to collect royalties (inclusiveness). Alternatively, direct sales/exchanges are made through a secondary market, thus allowing the most popular student-athletes to receive more royalties *a posteriori* (fairness). The use of blockchain technology enables all the above transactions to be *transparent*. That said, our overarching research questions (RQ) are:

> **RQ #1**: Do the sales of random packs of collectibles that pay royalties in primary markets enhance *inclusiveness* in the allocation of financial resources?
>
> **RQ #2**: Do the direct sales/exchange of collectibles that pay royalties in secondary markets result in a *fair* allocation of financial resources?

Our work thus contributes to a better understanding of key design features of NFTs as well as suggests a concrete solution to the allocation of NIL-based financial resources. In terms of methodology, we follow the design science research methodology (DSRM) [22] to answer our research questions. That is illustrated by how the rest of this paper is organized. After discussing the research background and relevant literature in Section 2, we address the first step in the DSRM in Section 3: problem identification. Specifically, we explain the inclusiveness, fairness, and transparency issues arising from the proposed NIL regulatory changes based on interviews with current student-athletes. Moreover, we derive *design requirements* for a solution to solve those issues. In Section 4, we define the objectives for an ideal solution via *design principles* that fulfill the design requirements, which is the second step in the DSRM. In Sections 5 and 6, we suggest concrete *design features* and demonstrate a blockchain-based solution (*artifact*) to reward student-athletes that satisfies the previously defined design principles, thus fulfilling the third and fourth steps in the DSRM. We report the evaluation of our ideas resulting from interviews with key stakeholders (student-athletes) in Section 7, thus covering the fifth step in the DSRM. We conclude in Section 8 by summarizing our work. The appendix contains the guiding questions we used in the semi-structured interviews with student-athletes.

2 RESEARCH BACKGROUND

Our work brings together a variety of research topics and lines of research. In the following subsections, we introduce and elaborate on crucial concepts while reviewing the relevant literature.

2.1 Inclusiveness and fairness

We consider our work part of the growing body of management literature on *responsible research*, *i.e.*, academic research that aims to directly benefit practice and society. Notable examples of responsible research include the study of information technology as a resource to counter sex trafficking [9] as well as the role of technology in helping immigrants settle, connect with others, and integrate while maintaining their identity [1]. Our work adds to the responsible research body of knowledge by studying design requirements, principles, and features that may lead to more *inclusive* and *fair* allocation of financial resources in certain domains.

Inclusiveness is a common theme in responsible research. For example, Andrade *et al.* [2] explained the process by which the use of information and communication technologies contributes to the social inclusion of refugees. Our work is more related to *financial inclusion* by leveraging financial technology (FinTech). While some previous research focused on how FinTech firms can innovate and collaborate among themselves and other partners to co-create value toward financial inclusivity [24], our work is instead focused on using FinTech to create egalitarian opportunities to access limited financial resources.

The topic of *fairness* is another popular concept in responsible research. For example, an increasingly popular research theme is the study of algorithmic fairness in the context of machine learning [26]. Our work instead relates to *distributive fairness*, also known as *fair division*. As defined by Joshi [15], distributive fairness relates to the allocation of computational resources, assignment of priorities, and conflict resolution. Our work takes a more economic perspective of fairness as wealth distribution. We shall use the traditional "*cake cutting*" metaphor [6] to explain fairness in our setting and its interplay with inclusiveness. A cake can be seen as a bounded and infinitely divisible resource, such as the amount of NIL-related money currently available to all student-athletes. For our purposes, inclusiveness then means that all student-athletes have access to a share of the pie, whereas fairness relates to the size of the pie. That said, Moulin [19] elaborated on different definitions of fairness. For example, *egalitarian* means all student-athletes get the same share of the pie according to their personal utility function, whereas *envy-free* means that nobody wants another's share more than their own. Motivated by Aristotle's equality principle that says "*equals should be treated equally, and unequals unequally*," we adopt a blend of egalitarian plus exogenous, market-driven definition of fairness. Specifically, the share of the pie one gets is initially the same (in expectation) due to random royalties from primary markets, but that share is eventually reshaped based on the demand in secondary markets for one's NIL-related collectibles.

2.2 Blockchain technology

The core technology behind our proposed allocation solution is called *blockchain*, which we take as a distributed and decentralized append-only database. The distribution aspect relates to the

redundancy created by replicating the same database across several computational devices, also called *nodes*. The decentralization aspect relates to ownership in that a single entity/organization does not necessarily control those computational devices. Users of a blockchain-based system interact with nodes using *wallets*, *i.e.*, software that manages users' cryptographic keys and helps to create blockchain transactions.

Cryptocurrencies, particularly Bitcoin, initially drove blockchain's popularity due to their promise of anonymity, decentralization, and security in online financial transactions. The success of Bitcoin has led several organizations to investigate how to adapt blockchain technology to other domains, *e.g.*, when preventing counterfeit pharmaceuticals from entering pharmaceutical supply chains [18] and to ensure the acquisition of precious metals from ethical and sustainable sources [11].

Many blockchain models have emerged since the advent of Bitcoin. Some of them enable the nodes to store and execute algorithms, commonly called *smart contracts*. When that happens, the algorithm and any calls to it are stored in an immutable, distributed, and decentralized fashion by the blockchain nodes. Thus, smart contracts have two primary roles: 1) they serve as a consensus mechanism for the correct execution of an algorithm; and 2) they create an access log that determines who has executed the algorithm and when that happened. Due to these properties, smart contracts have been applied in various scenarios, *e.g.*, to bring trust and transparency to microtransactions in video games [7] and to intermediate interactions between newsvendors and experts in forecasting settings [8].

From a technical perspective, smart contracts enable the rise of different types of *tokens*. For our purposes, a token is a digital representation of an artifact, be it a physical object or purely digital good, utility, or claim [21]. Our work is focused on non-fungible tokens (NFTs), *i.e.*, tokens that are not immediately interchangeable due to not having the same value. The sales of NFTs experienced tremendous growth in 2021 and at the beginning of 2022. For example, it has been estimated that NFT sales value peaked in January 2022, when the average NFT daily sales reached $189.5 million on Ethereum. [25]. The NFT market has since cooled down. Figure 1 highlights the sales trends for the last 6 months from the time of writing. Our proposed solution to leverage NIL regulatory changes and universally reward student-athletes relies on collectibles, such as game cards, built using NFTs.

Within the information systems and Human-computer interaction communities, research on NFTs is still emerging. Some recent work include a study on the use of NFTs to tokenize digital goods and, in particular, event tickets [23], whether the introduction of NFTs causes the prices of physical collectibles to decline [16], and a study on the main stakeholders in NFT ecosystems [4]. To the best of our knowledge, our work represents the first attempt at investigating the impact of NFT design features on the inclusiveness and fairness of the allocation of financial resources.

The last relevant concept we introduce regards the type of blockchain network. In particular, we focus on *public* blockchain networks, where anyone can become a node to validate and store transactions and become a user who can read data and create transactions.

3 PROBLEM IDENTIFICATION

The first step in the design science research methodology is to both "*define the specific research problem and justify the value of a solution*" [22]. To accomplish this step, we first conducted semi-structured interviews with 12 student-athletes playing a variety of sports at the highest level (Division I) at four different academic institutions in the United States. The obtained qualitative data are strongly aligned with the observations by Guest *et al.* [10] in that information saturation occurred within the 12 interviews. Table 1 provides anonymized information about the interviewees. The appendix contains the questions we used in the semi-structured interviews.

Table 1: Information about the interviewees.

Interviewee #	Sport	Gender
#1	Golf	Male
#2	Golf	Male
#3	Track and Field	Male
#4	Track and Field	Male
#5	Soccer	Female
#6	Soccer	Female
#7	Track and Field	Female
#8	Soccer	Female
#9	Track and Field	Female
#10	Track and Field	Male
#11	Track and Field Cross Country	Female
#12	Swimming	Female

In the first part of the interviews, we focused on understanding the student-athletes' thoughts on the new NIL regulations, *e.g.*, who will benefit from them and how universities can help secure NIL endorsements. From a methodological perspective, the collected responses helped us in three related ways: 1) with the research problematization; 2) to validate our initial understanding of existing problems with NILs; and 3) to organize our thoughts coherently within the design science research methodology.

We start by noting that it was consensually agreed that student-athletes should be able to profit from their name, image, and likeness. But when asked who will benefit the most or even at all, it was also consensual that only a few will. In particular, it was suggested by the interviewees that star players in grossing sports or players who have many social media followers are more likely to secure NIL endorsements. For example, Interviewee #10 said the following:

> "*I guess the sports that make the most revenue normally. So, I feel like athletes, who are in bigger name sports — such as football or basketball — that have like a large following and attention from the media* [are more prone to get NIL deals]."

Some estimates indeed corroborate the above claim. For example, it has been suggested that college football is the top revenue producer bringing in, on average, $31.9 million per university every year. [17] To put that number into perspective, track and field -

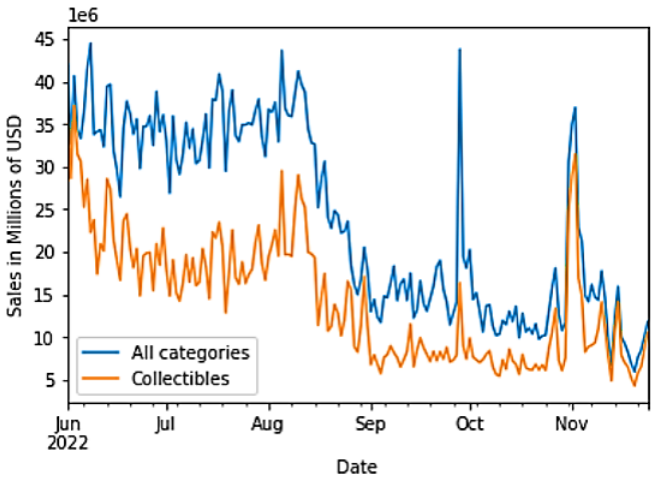


Figure 1: NFT sales in USD from June to November in 2022. Data source: https://nonfungible.com/market-tracker.

the fifth highest revenue-producing sport - generates about $1.17 million annually per institution [17].

Answers similar to the above one naturally lead to concerns about not all student-athletes having access to NIL financial resources. In other words, financial opportunities and inclusion can still be minimal. That leads us to define the first design requirement for a solution aiming at helping student-athletes secure NIL opportunities.

> **Design Requirement #1 (Inclusiveness)**: *all* student-athletes should have access to NIL financial resources.

But interestingly, most interviewees accepted that it is fine for some players to make more money than others. For example, Interviewee #1 said:

> "*There are guys making lots of money from what I understand who, honestly, are one hop away from being a professional . . . so I feel it* [NIL endorsement] *is warranted because of the revenue they* [star student-athletes] *create.*"

This relates to our concept of fairness based on Aristotle's equality principle, which we discussed in Section 2. This leads us to formulate the second design requirement:

> **Design Requirement #2 (Fairness)**: the allocation of NIL financial resources should be fair by allowing equals to be treated equally, and unequals unequally.

Our next interview question was on how universities and athletic departments could help student-athletes secure NIL deals. Many of the suggestions offered by the interviewees — such as a platform for matching sponsors and students — may not be feasible due to, for example, Title IX and FERPA regulations in the United States. For example, Interviewee #12 acknowledged that point by saying the following:

> "*I'm not sure if they* [universities] *are allowed to like help create partnerships, . . . it's very much* [due to] *regulations, like figuring out what is okay and what is not.*"

This regulatory environment has led to some interesting phenomena, such as the rise of *collectives*, *i.e.*, supporters operating outside universities and athletic departments [12]. However, these third-party entities do not always operate in the most transparent way, *e.g.*, concerns have been raised on how the collectives are distributing a share of the revenue from events and donation campaigns among student-athletes. For example, a recent survey found that 77% of 80 interviewed athletic directors believe that an unregulated NIL market will lead to more sports-related scandals [3]. This leads us to define the following design requirement.

> **Design Requirement #3 (Transparency)**: NIL payments must be transparent.

In the following section, we elaborate on the design principles an ideal information-systems artifact should satisfy in order to fulfill the above requirements.

4 OBJECTIVES FOR A SOLUTION

The second step in the design science research methodology is to "*infer the objectives of a solution from the problem definition and knowledge of what is possible and feasible*" [22]. In what follows, we define *design principles* a solution (artifact) should obey to overcome the existing challenges brought by the inclusiveness, fairness, and transparency design requirements. For our purposes, design principles correspond to an artifact's generic capabilities that address the previously defined design requirements.

Our first design principle below addresses the first design requirement (inclusiveness) by suggesting that all student-athletes should have a *chance* to profit from NIL regulatory changes. That is, a solution that helps student-athletes with NIL opportunities should implicitly assign a non-zero probability to the event of any student securing NIL financial resources.

> **Design Principle #1**: leveraging NIL financial resources should be an event with positive probability for all student-athletes.

The above principle does not state that all student-athletes should receive equal financial compensation. Instead, it simply states that

all student-athletes should have at least a chance to access some NIL financial resources. In other words, popular student-athletes — due to being top-performers or having a considerable number of social media followers — can still be rewarded more and more often than their peers. That leads us to formulate the second design principle related to the fairness requirement.

> **Design Principle #2**: NIL payments should consider student-athletes' popularity.

Regarding the third design requirement, a potential generic solution to the transparency issue is to record all the details about NIL payments on a public database. Clearly, the CRUD - create, read, update, and delete — permissions must be defined very carefully for such a database. For example, all parties should be able to read data from it. However, once a NIL deal/contract is created, the contract creator (*e.g.*, sponsor) should not have the capability of modifying or erasing the contracts; otherwise, this could lead to potential manipulations at the expense of student-athletes. Our third design principle is then formulated as follows:

> **Design Principle #3**: NIL data should be stored on public and immutable databases.

We next propose a concrete information system (artifact) that satisfies the above design principles.

5 DESIGN OF THE ARTIFACT

Having established a set of design requirements and principles an ideal solution to reward student-athletes must satisfy, we can now move to the third step of the DSRM, which is to design and create the underlying artifact. When doing so, we define *design features* describing key technical aspects of our solution. Our proposed solution relies on collectibles, such as digital cards, each associated with a single student-athlete, thus reflecting their NIL. Moreover, a share of the earnings from any transaction involving a student-athlete's collectible shall go automatically to that student. In terms of implementation, one can see the above idea as non-fungible tokens (NFTs) that pay royalties whenever a transaction occurs. Figure 2 shows how stakeholders (namely fans and student-athletes) interact with our solution.

All the interactions begin with fans creating transactions through an NFT platform. Behind the scenes, the platform connects with a smart contract (stored on a blockchain) that represents the underlying collectible. We propose two transactions: *purchase* and *exchange*. A *purchase* happens when a fan sends a predefined amount of money to the smart contract for a fixed number of collectibles (cards). The smart contract then assigns ownership of randomly selected cards to the fan who created the transaction. When that happens, a predefined share of the earnings (say, 30%) hardcoded in the smart contract goes to all the student-athletes whose faces are on the cards. The above operation is summarized by the design feature below:

> **Design Feature #1**: student-athletes receive royalties from sales in primary markets of random packs of collectibles.

Through Design Feature #1, our solution creates opportunities to reward all student-athletes — and not only the most popular ones — by paying royalties based on randomly grouped collectibles. Due to the stochastic nature of the purchase operation, fans might end up having duplicate collectibles. Moreover, it is just natural that fans should have a deterministic way of obtaining their favorite/desired collectibles. The *exchange* operation then enables a fan to sell or exchange a set of collectibles for another. In other words, two fans can exchange cards for cards, cards for money, or a combination of cards for cards and money. When money is involved, a predefined, hardcoded share of that money goes to all the student-athletes whose faces are on the cards. Our second design feature captures the above transaction:

> **Design Feature #2**: student-athletes receive royalties in secondary markets after an exchange of collectibles for money.

Note that Design Feature #2 is inherently linked to Design Principle #2 and the fairness requirement as collectibles representing more popular student-athletes should experience a higher volume of transactions in secondary markets and, thus, generate more royalties.

Our solution relies on blockchain as the back-end technology supporting the above transactions. By using blockchain, all the transactions are timestamped and stored on a distributed, decentralized, and append-only database. Moreover, by relying on smart contracts, the payment of royalties is automated, which prevents student-athletes from not being rewarded what they were promised. Finally, by using cryptocurrencies and a public blockchain, the transfer of money is traceable, and it happens in near real-time. Our final design feature captures the above discussion.

> **Design Feature #3**: all the supported transactions are done through a smart contract and logged on a public blockchain

We note that the underlying assumption across the design features is that all the stakeholders — be they fans or student-athletes — must have addresses ("accounts") in the blockchain ecosystem. For example, student-athletes have to register with the platform — which will perform the appropriate authentication — so that payments can be issued to their addresses.

6 DEMONSTRATION OF THE PROPOSED SOLUTION

The fourth step in the DSRM is to demonstrate the proposed artifact [22]. We do so by developing an NFT platform as a decentralized application (DApp) and a smart contract that together implement our ideas. DApps form a category of software that relies on a decentralized network as back-end systems. In our prototype, our DApp is a web-based application that uses the *Ethereum* network, a blockchain model capable of running smart contracts. Thus, besides financial transactions involving the native cryptocurrency *Ether*, Ethereum users can also create transactions that deploy or interact with smart contracts.

The interaction between our DApp and the deployed smart contract is intermediated by a blockchain wallet called *MetaMask*. Specifically, our DApp uses the MetaMask wallet whenever a user starts a purchase or an exchange transaction. For example, the wallet asks a fan to confirm and digitally sign any transaction before

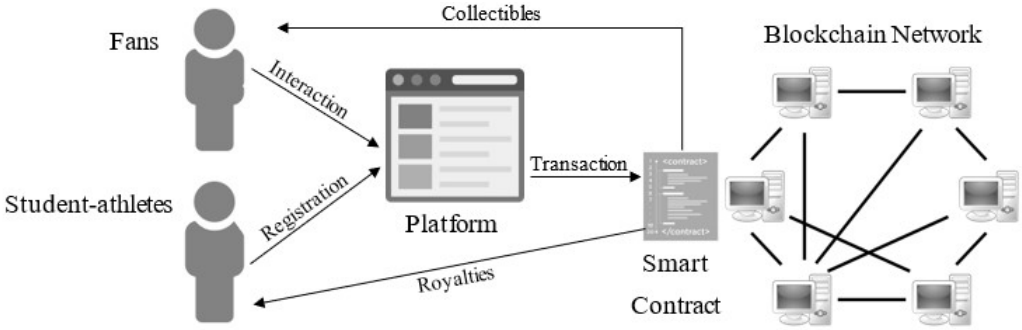


Figure 2: High-level description of the proposed solution.

posting it to the blockchain network. Figure 3 illustrates the welcome screen of the proposed DApp (NFT platform). A user accessing the DApp is first asked to connect his/her blockchain address to the application via MetaMask (see Figure 3a). Subsequently, the DApp uses the user's blockchain address to query the deployed smart contract and retrieve the user's collectibles (see Figure 3b).

When a user purchases a collectible, the MetaMask wallet automatically defines the amount of Ether that must be sent to the smart contract and asks the user to confirm and sign the transaction. Subsequently, the DApp calls one specific function in the smart contract that randomly selects a predetermined number of collectibles from a list of collectibles. Moreover, that function automatically sends a predefined fraction of the user's payment to the student-athletes in the selected collectibles as royalties.

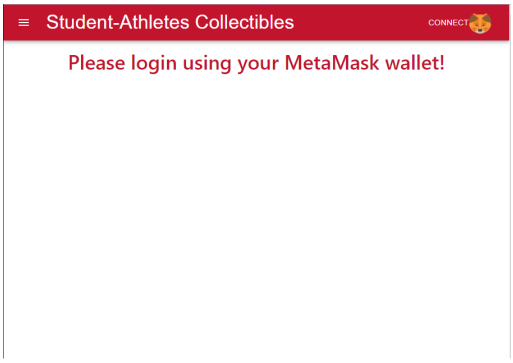
Besides the purchase operation, our DApp supports the exchange of collectibles. In particular, as we previously mentioned, a user can exchange collectibles for money (effectively, a sale), other cards, or a combination of collectibles and money. Figure 4 illustrates the exchange process. It begins with one user informing the address of a trading partner, the offered collectibles, and the requested amount of money and/or collectibles (see Figure 4a). After this process, a transaction identifier is generated so that the trading partner can complete the exchange. The trading partner must now follow a similar process by confirming the transaction identifier, requested collectibles, and offered amount of money and/or collectibles (see Figure 4b). Similar to the purchase transaction, whenever money is part of the exchange, a fraction of that money automatically goes to the student-athletes whose faces are on the traded collectibles.

We close this section by noting that our prototype was developed to study whether the payment of royalties in random sales in primary markets plus deterministic sales in secondary markets can bring more inclusiveness and fairness when allocating financial resources through NFTs. As such, no special attempt was made to improve the prototype's usability and performance. Moreover, we highlight that NFTs on Ethereum are defined as smart contracts (algorithms). Thus, no matter how trades happen in a secondary market - with or without the aid of a platform - royalties will nonetheless be paid as the underlying operation is embedded in the smart contract. However, there may be "attacks" that cause the payment of royalties to be set to zero. For example, consider the case where a user called Alice is the owner of an NFT, and she plans to sell it to a second user Bob. Alice or Bob can then develop a smart contract that receives the NFT from Alice and holds it in escrow until Bob submits a payment to the smart contract. The smart contract then sends the NFT to Bob as if it was free of charge and the money to Alice. Thus, no royalties are paid to student-athletes as the NFT was indirectly "sold" for zero currency units. A possible way to fix this issue is to define floor royalties within the smart contract representing NFTs so that no NFT could be transferred for free. Consequently, royalties would always be paid to student-athletes. We leave an in-depth investigation of similar "attacks" and solutions as future work.

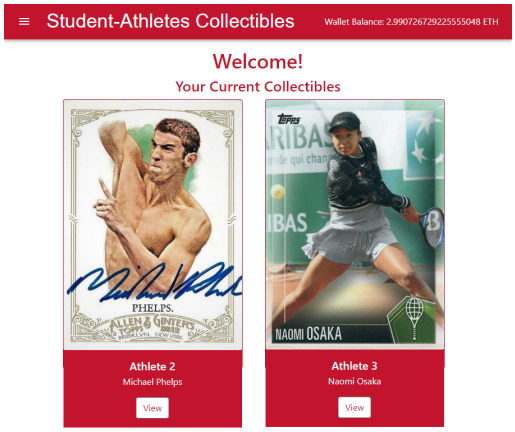
7 EVALUATION

The fifth step in the DSRM concerns evaluating how well the proposed ideas and artifact support a solution to the identified challenges. For example, evaluation may include "*items such as a comparison of the artifact's functionality with the solution objectives*" [22]. We start by arguing that our solution satisfies the three design principles in Section 5. First, the randomization aspect coupled with royalties for the transactions in primary markets (Design Feature #1) enable all student-athletes to receive financial rewards based on NIL-related collectibles, in line with Design Principle #1. Royalties from transactions in secondary markets (Design Feature #2) allow student-athletes to profit based on the demand for their collectibles, thus fulfilling Design Principle #2. Furthermore, the use of blockchain technology makes NIL transactions open to stakeholders (fans and student-athletes), who can now confirm when/whether a certain transaction happened. This openness aspect is also important for the stakeholders to verify the accuracy and fairness of the smart contract, such as when performing randomization operations. Moreover, blockchain technology's decentralization feature means that no individual entity has control over the entire ecosystem. That makes manipulating data – such as who owns what collectibles – less feasible in practice. Finally, money is automatically disbursed to student-athletes by the smart contract without any human intervention. Blockchain's immutability aspect here means that no entity can manipulate information on a smart contract, such as the student-athletes' profit share. Putting the above points together, Design Feature #3 directly relates to and fulfills Design Principle #3.

To answer the research questions (RQ) we listed in Section 1, we next analyze the results of the second part of our interviews

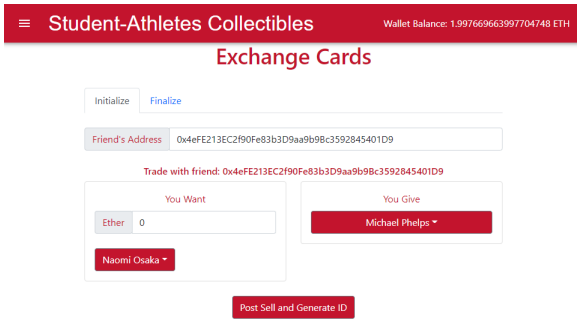


(a) Before connecting the MetaMask wallet.

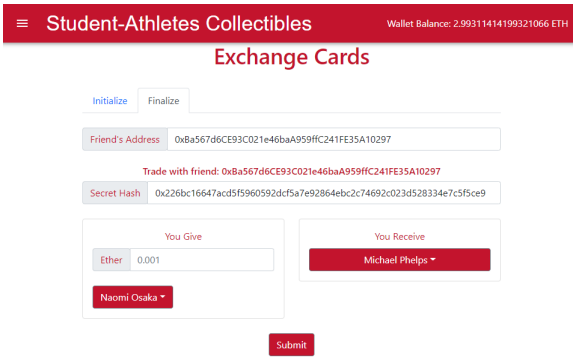


(b) After connecting the MetaMask wallet.

Figure 3: Screenshots of the welcome screen.



(a) Exchange initialization.



(b) Exchange finalization.

Figure 4: Screenshots of the exchange transaction.

with the student-athletes in Table 1, when they evaluated the inclusiveness, fairness, and other non-technical aspects of the proposed solution. The second part of the interviews happened after the student-athletes observed our artifact in action.

7.1 Interview-based evaluation

Having validated the existing problems with NIL in the first part of the interviews with student-athletes, the second part of the interviews helped us to validate a potential solution to those problems. We started by asking questions on the usefulness of the artifact/ideas when it comes to potentially rewarding all student-athletes, *i.e.*, we investigated whether an answer to RQ #1 is positive. Interestingly, all interviewees suggested that the proposed solution has the potential to allocate financial resources to all student-athletes. For example, Interviewee #2 said:

> "*It* [the solution] *has the potential to benefit everybody, not just you know the star athletes. So, I like it.*"

Interviewee #11 emphasized the inclusive nature of the solution in terms of sports by saying:

> "*Because it is distributed throughout the whole campus and all sports are involved, I do think that people will be interested in the idea and potentially all athletes could contribute or gain some financial resources from it.*"

Beyond the immediate financial reward for transactions happening in primary markets, the interviewees also mentioned some positive side effects of using the proposed solution. For example, Interviewee #6 suggested that the use of collectibles as NFTs can help student-athletes build their brands:

> "*They* [fans] *have an athlete on there* [a random pack] *that they didn't know who it was, but then they might look into them and kind of know who the athlete is and literally put a face to the name, and help them* [student-athletes] *build their brand a little bit too.*"

Given the overwhelmingly favorable answers, we have qualitative evidence to say that RQ #1 is true, *i.e.*, the sales of random packs of collectibles that pay royalties in primary markets do enhance inclusiveness.

A similar positive sentiment was shared with respect to the fairness aspect of our solution. For example, Interviewee #6 mentioned

the following regarding whether popular student-athletes would be penalized by the randomness feature in our solution:

> "*If, you know, one of these famous athletes cards went out. Say the original pack was bought for a lower price than what the actual value of the card was worth because it was just in this random pack. But then, once it gets traded* [in a secondary market] *I'm sure there will be plenty of money to make up the difference.*"

Overall, the interviewees' answers corroborated our assessment that the direct sales/exchange of collectibles that pay royalties in secondary markets (RQ #2) result in a fair allocation of financial resources. Besides seeking answers for RQ #1 and #2, we also focused on gathering feedback on other non-technical issues, which we hope to fully explore in future design cycles. For example, one potential barrier to adoption mentioned by the interviewees was the novelty of the underlying technology, as Interviewee #5 suggested:

> "*I don't think a lot of people know about cryptocurrency and NFTs and name-image-likeness. So, I think just advertising it* [the solution] *in a way where it is easy for all to comprehend would be super effective.*"

Another potential issue that was raised was how to build and sustain a community and, in particular, the incentives buyers (fans) have to purchase collectibles, as Interviewee #11 questioned:

> "*I mean* [the solution] *obviously works perfectly for athletes whose face are on the cards, but a quick question: what do people who purchase the cards get from that?*"

We believe our collectible-based solution opens the doors to several possibilities for new fan engagement experiences. For example, fans holding certain cards might be eligible to take pictures with student-athletes after a game. Moreover, fans who collect all cards might receive an honorable mention during a game, access to special seats, or have discounts for merchandise/food. Overall, we believe these new experiences may create incentives for fans to collect cards. At the same time, these experiences can only be fully realized if more stakeholders are on board with the solution. For example, universities' athletics divisions should be responsible for tying some tangible benefits to the ownership of collectibles. Moreover, they could also be responsible for onboarding and validating athletes so as to prevent malicious actors from impersonating them. Given our focus on the student-athlete side and new opportunities for the fair and inclusive allocation of NIL resources, we leave a detailed study of the above issues for future design cycles in our design-science study.

8 CONCLUSION

Motivated by recent regulatory changes in collegiate athletics in the United States, we studied solutions to allocate name-image-likeness (NIL) financial resources in a way that is inclusive and fair. Based on interviews with student-athletes, we defined a set of design requirements with matching design principles. We then proposed an artifact where royalties are paid to student-athletes based on acquired collectibles, represented as non-fungible tokens (NFTs). In primary markets, the acquisition of NFTs is random, whereas that acquisition is deterministic via trading partners in secondary markets. According to the interviewed student-athletes, our proposed solution is inclusive and fair when allocating NIL-related financial resources.

In terms of contributions, our work adds to the responsible research literature by defining design requirements and principles related to inclusion and fairness. Moreover, our work is of value to blockchain researchers and practitioners interested in design features that create impactful NFT-based artifacts.

As future work, an exciting research direction is to study how to appropriately define the probabilities associated with collectibles. For example, student-athletes may desire a lower probability of being selected during the randomization process in primary markets. That can cause the underlying collectible to become rare and increase its price (student's profit) in future exchanges in secondary markets. Alternatively, a higher initial probability results in more immediate rewards (in expectation), which may devalue the collectible in secondary markets. However, taking student-athletes' preferences into account is a challenging task. From a decision theory perspective, one can formulate student-athletes' choices as lottery tickets associated with different probabilities and estimated payoffs. To estimate payoffs, one must make predictions about trades in secondary markets. If not well-designed, such a predictive model can potentially lead to perceptions of unfairness. Thus understanding whether or not it is possible to effectively take student-athletes' preferences into account in a fair and inclusive way is an open question.

REFERENCES

[1] Safa' AbuJarour, Haya Ajjan, Jane Fedorowicz, and Antonia Köster. 2021. ICT Support for Refugees and Undocumented Immigrants. *Communications of the Association for Information Systems* 48, 1 (2021), 40.

[2] Antonio Diaz Andrade and Bill Doolin. 2016. Information and communication technology and the social inclusion of refugees. *MIS Quarterly* 40, 2 (2016), 405–416.

[3] Nicole Auerbach. 2022. *College leaders 'extremely concerned' with NIL collectives' direction: Survey.* Retrieved September 3, 2022 from https://theathletic.com/news/athletic-directors-ncaa-nil-survey/wA4u5Y8rqf8P/

[4] Mehmet Aydın Baytaş, Amos Cappellaro, and Ylva Fernaeus. 2022. Stakeholders and Value in the NFT Ecosystem: Towards a Multi-disciplinary Understanding of the NFT Phenomenon. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts.*

[5] Des Bieler. 2021. Nick Saban reveals Alabama QB Bryce Young is already making 'ungodly' profits off NIL rights. Retrieved September 3, 2022 from https://washingtonpost.com/sports/2021/07/20/nick-saban-bryce-young-ungodly-nil-profits/

[6] Steven J Brams, Steven John Brams, and Alan D Taylor. 1996. *Fair Division: From cake-cutting to dispute resolution.* Cambridge University Press.

[7] Arthur Carvalho. 2021. Bringing transparency and trustworthiness to loot boxes with blockchain and smart contracts. *Decision Support Systems* 144 (2021), 113508.

[8] Arthur Carvalho and Majid Karimi. 2021. Aligning the interests of newsvendors and forecasters through blockchain-based smart contracts and proper scoring rules. *Decision Support Systems* 151 (2021), 113626.

[9] Laurie Giddens, Stacie Petter, and Michael H Fullilove. forthcoming. Information technology as a resource to counter domestic sex trafficking in the United States. *Information Systems Journal* (forthcoming).

[10] Greg Guest, Arwen Bunce, and Laura Johnson. 2006. How many interviews are enough? An experiment with data saturation and variability. *Field Methods* 18, 1 (2006), 59–82.

[11] Gabriella M Hastig and ManMohan S Sodhi. 2020. Blockchain for supply chain traceability: Business requirements and critical success factors. *Production and Operations Management* 29, 4 (2020), 935–954.

[12] Laine Higgins. 2022. *The Booster 'Collectives' Putting Money in the Pockets of College Athletes.* Retrieved September 3, 2022 from https://www.wsj.com/articles/ncaa-name-image-likeness-collectives-11651761397

[13] Kelley Holland and John W. Schoen. 2014. *Think athletic scholarships are a 'holy grail'? Think again.* Retrieved September 3, 2022 from https://www.cnbc.com/2014/10/13/think-athletic-scholarships-are-a-holy-grail-think-again.html

[14] Michelle Brutlag Hosick. 2021. *NCAA adopts interim name, image and likeness policy.* Retrieved September 3, 2022 from https://www.ncaa.org/about/resources/media-center/news/ncaa-adopts-interim-name-image-and-likeness-policy
[15] Kailash Joshi. 1989. The measurement of fairness or equity perceptions of management information systems users. *MIS quarterly* (1989), 343–358.
[16] Ioannis Filippos Kanellopoulos, Dominik Gutt, and Ting Li. 2021. Do Non-Fungible Tokens (NFTs) Affect Prices of Physical Products? Evidence from Trading Card Collectibles. In *Proceedings of the 42th International Conference on Information Systems*.
[17] George Malone. 2022. Which College Sports Make the Most Money? Retrieved November 24, 2022 from https://www.yahoo.com/video/college-sports-most-money-130012417.html
[18] Jens Mattke, Axel Hund, Christian Maier, and Tim Weitzel. 2019. How an Enterprise Blockchain Application in the US Pharmaceuticals Supply Chain is Saving Lives. *MIS Quarterly Executive* 18, 4 (2019).
[19] Hervé Moulin. 2004. *Fair division and collective welfare.* MIT press.
[20] NCAA. 2020. *NCAA recruiting facts: College sports create a pathway to opportunity for student-athletes.* Retrieved September 3, 2022 from https://ncaaorg.s3.amazonaws.com/compliance/recruiting/NCAA_RecruitingFactSheet.pdf
[21] Luis Oliveira, Liudmila Zavolokina, Ingrid Bauer, and Gerhard Schwabe. 2018. To token or not to token: Tools for understanding blockchain tokens. In *Proceedings of the 39th International Conference on Information Systems*.
[22] Ken Peffers, Tuure Tuunanen, Marcus A Rothenberger, and Samir Chatterjee. 2007. A design science research methodology for information systems research. *Journal of Management Information Systems* 24, 3 (2007), 45–77.
[23] Ferdinand Regner, André Schweizer, and Nils Urbach. 2019. NFTs in Practice: Non-Fungible Tokens as Core Component of a Blockchain-based Event Ticketing Application. In *Proceedings of the 40th International Conference on Information Systems*.
[24] PK Senyo, Stan Karanasios, Daniel Gozman, and Melissa Baba. 2022. FinTech ecosystem practices shaping financial inclusion: the case of mobile money in Ghana. *European Journal of Information Systems* 31, 1 (2022), 112–127.
[25] Statistica. 2022. Average number and value of completed NFT sales on the Ethereum blockchain up to May 5, 2022. Retrieved November 24, 2022 from https://www.statista.com/statistics/1265353/nft-sales-value/
[26] Mike HM Teodorescu, Lily Morse, Yazeed Awwad, and Gerald C Kane. 2021. Failures of Fairness in Automation Require a Deeper Understanding of Human-ML Augmentation. *MIS Quarterly* 45, 3 (2021), 1483–1500.

APPENDIX: INTERVIEW QUESTIONS

Part 1:

- What is your opinion on the recently proposed changes to name-image-likeness (NIL) regulations by the NCAA?
- Among all the student-athletes, who do you think will benefit the most financially from the NCAA's recent changes to NIL regulations?
- How can intercollegiate athletic teams leverage the recent changes to NIL regulations to maximize the benefits received by student-athletes?

Part 2 (after prototype demonstration):

- Do you think the solution is useful to reward *all* student-athletes? Why (not)?
- Do you think the solution will allow for more fairness/opportunities when it comes to exploring NIL regulatory changes? Why (not)?
- What are the potential barriers to adoption?
- What are other potentially positive or negative aspects of the proposed solution?