Meeting the Moment: Transforming the Digital Credentials Space

AACRAO

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Preface

The academic credentialing landscape is rapidly evolving. Institutions of higher education must meet this critical moment in the evolution of how learning is delivered, assessed, and recognized. The economic and cultural upheavals brought about by the COVID-19 crisis have accelerated the need for an expanded, secure, interoperable, and widely portable approach to the recognition of academic and co-curricular accomplishments. The technical architecture is already available to give learners meaningful agency over their records and accomplishments; provide recognition of all types of learning experiences; and ensure that data security, fraud prevention, and equity seamlessly coexist. Despite the advantages, adoption of new credential architectures remains low and slow.

While some educational institutions have shifted to issuing EDX, digitally signed PDFs or blockchain verifiable credentials, reliance on paper-based credentials is still widespread. While both paper and even digitally signed PDF credentialing solutions have worked well enough, there are still unaddressed challenges facing students, employers, and other educational stakeholders in a global learning and employment marketplace. Existing processes that generate additional friction—such as the inability to reuse the same credential for verification purposes, cumbersome processes for accessing records, and lack of electronically readable documents—create inefficiencies and may create unintended barriers for learners to pursue additional education or employment opportunities. It is important that higher education leaders develop a deep understanding of the potential value and limitations of a variety of digital credentialing approaches and technical architectures, as they lead and prepare their institutions' processes and people to embrace current advances in digital credentialing.

Open, free, unmediated, and lifelong access to learner records is foundational to supporting learner agency, a core tenet of the modern student experience. It is our hope that this research will foster an understanding of the current state of the credentialing ecosystem, as well as a discussion of the future state, and help accelerate the adoption of new or enhanced existing technologies to meet this moment.

Introduction

The COVID-19 pandemic led many institutions to rapidly adjust in-person and paper-based academic records processes to rapid, secure digitization of all types of processes. In late spring 2020, AACRAO completed a series of COVID-19 impact surveys and reports[1]. One focus topic was official transcript receipt, delivery, and printing. Members shared how their processes were changed because of the shift to remote work and whether they were seeking to adopt electronic transcripts in direct response to COVID-19. At that time, data indicated about a

[1] https://www.aacrao.org/research-publications/research/special-topics-reports/

quarter of respondents were evaluating options to implement one or more solutions to support digital official transcripts and other credentials.

Data from the COVID-19 impact surveys, the identification of blockchain as a technological priority on the national level by the U.S. Department of Education[2], and the rollout of the American Council on Education *Blockchain Innovation Challenge*[3] are indicators of increasing interest in ways to provide digitally native, secure, and verifiable credentials directly to learners. This increasing interest in blockchain led AACRAO to partner with Hyland Credentials on this research.

Context

A digital credential in the context of higher education provides proof of competence, training, qualification, or educational attainment tied to a person. The use of digital credentials can help support student transfer, enhance the recognition of learning, and address concerns about credential fraud. For this report, and the survey on which it is based, digital credentials refer to any of the following:

> Digitally Signed PDF: a scanned or generated document that has been digitally-signed (including transcripts)[4]
>
> Micro Credential/Digital Badge: a digital certification for specific skills and competencies, typically an image file pointing to hosted data
>
> Electronic Data Exchange (EDX): a digital credential (primarily transcripts) shared primarily between institutions using one or more of the various formats including EDI and XML
>
> Blockchain Verifiable Credential: a natively digital document, digitally signed, that also leverages the blockchain as a secure anchor of trust for independent verification (including transcripts)

The use of digital credentials in higher education is not new. In fact, the AACRAO SPEEDE[5] committee marked its 30-year anniversary in 2020. The work of this committee is focused primarily on encouraging institutions to adopt an electronic data exchange format (EDX) to support sharing education records in a machine-readable format electronically. In addition, in 1989, the National Center for Educational Statistics convened a taskforce to determine the

[2] https://tech.ed.gov/blockchain/
[3] https://www.acenet.edu/Research-Insights/Pages/Blockchain-Innovation-Challenge.aspx
[4] Digitally signed PDFs are not digital credentials but instead are digital files. However, since they are widely used in higher education and thought of by many to be "digital" (i.e., not paper) they are included in this report to understand their context within the digital credentials landscape.
[5] https://www.aacrao.org/resources/newsletters-blogs/aacrao-connect/article/celebrating-30-years-of-aacrao's-speede-committee

viability of a national system for the transfer of electronic records between institutions. This taskforce identified six goals still salient today[6]:

- "faster transfer of student records"
- "timely and appropriate placement into educational programs"
- "increased reliability & consistency interpreting records"
- "increased security over other exchange methods"
- "reduced direct and indirect costs"
- "promotion of greater national compatibility" (Sierra Systems Consultants, 1997, pg. 5)

AACRAO has encouraged the adoption of machine-readable transcripts for three decades, and a modest percentage of institutions have adopted one or more EDX solutions. More recently, several institutions began to issue PDFs to address some of the need for electronic distribution of credentials. However, PDFs are generally not considered digital credentials; as they are not readily machine readable and cannot easily be verified or updated. As footnoted on page two, PDF inbound and outbound official transcripts are included in the list of digital credential options in use today since many in higher education consider a PDF to be a form of digital credential simply because it is not paper-based (i.e., digital credential = not paper), is shared electronically, and may include some protective measures. Efforts such as EDX and other formats still have limited adoption and as such, the goal of widely available digital, portable, and secure credentials remains unmet.

Blockchain or distributed ledger verification is a relatively new addition to the digital credentials arena having been around since about 2017. According to the U.S. Department of Education's video *Introduction to Blockchains for Educators*[7], ". . . blockchains are a type of database . . . based on a list of chronological data much like a financial ledger." As explained in the video, each subsequent record is connected to the preceding record through a piece of that record, thus making it nearly impossible to insert an undetectable change. Data for each record is distributed across several nodes in the blockchain network. Each keeps a complete copy of the record, and they all work in consensus to validate the authenticity of the record. Digitally verifiable credentials that leverage blockchain or other distributed ledger technologies offer some advantages over other digital credential formats in that they provide for recipient ownership and control over their official records, instant cryptographic verification, and cutting-edge document security.

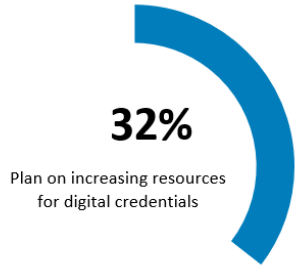
This report summarizes data from the recent AACRAO survey on the use of digital credentials. It also includes a comparison of the digital credential technologies and set of recommendations around building out a responsive digital credentialing ecosystem in higher education.
The survey was completed by 319 respondents from the ACCRAO community in the United States and Canada.

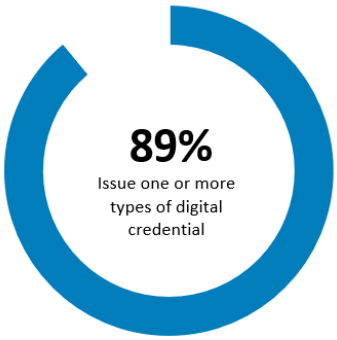
[6] SPEEDE EXPress A business case for the electronic exchange of student records. Under contract with the U.S. Department of Education National Center for Education Statistics. Sierra Systems Consultants, Inc. April 17, 1997
[7] https://www.youtube.com/watch?v=IbVX4sCAftM

Key Takeaways

Key takeaways include:

- 32% plan to devote more resources to the digitization of credentials in direct response to the COVID-19 pandemic
- 54% view credential fraud as a concern
- 89% report using at least one type of digital credential today – this includes digitally signed PDFs
- Key goals for digitization of credentials focus on:
    - Efficiency
    - Reducing fraud
    - Improving the inbound and outbound transcript process
- Although PDFs dominate the landscape of electronic transcripts, just 4% have implemented machine-readable technology for at least some of their inbound PDF transcripts
- More than a third view open badges/micro credentials as having great promise for recognizing multiple pathways and accomplishments, but 48% do not consider them part of the official academic record
- 50% have no familiarity with blockchain technology and how it can be used in higher education. There remain key knowledge gaps about the value of various types of digital credentials.





Approach

We used the Qualtrics survey platform to deploy a survey to AACRAO's list of primary contacts for institutions in the United States and Canada. Three hundred and nineteen institutions of mixed characteristics responded. Institutional characteristics of the sample include:

- 37% public, 58% private, not-for-profit and 5% private, proprietary
- 15% lower division only, 18% undergraduate only, 60% undergraduate comprehensive, 6% graduate and/or professional, and less than 1% system office or "other" category
- 54% enroll fewer than 2,500 students; 17% enroll more than 10,000

The survey was incentivized with a random drawing for one of 20 $25 Visa gift cards for completing the survey. Incomplete responses were not eligible for the incentive. The digital credentials landscape survey included a mix of fixed response and open-ended questions about the following:

- Impact of COVID-19 on thinking about use of digital credentials and recognizing learning from nontraditional pathways
- Level of institutional concern about credential fraud
- Current and possible future use of digital credentials, the perceived value of using digital credentials, and the challenges to adoption
- Perceptions of the value of digital credentials to the institution and by students and other end users
- Level of trust of digital credentials
- Satisfaction with select digital credentials currently in use
- Respondent familiarity with and perceptions of blockchain technology

Results

Rapid changes in higher education policy, practice and the use of technology occurred in 2020 in direct response to the COVID-19 pandemic. Respondents indicated that they are responding to these transformational changes by:

- allocating more resources to digital credentials (32%),
- expanding efforts to support transfer students (22%), and
- expanding the recognition of learning from nontraditional pathways (12%).

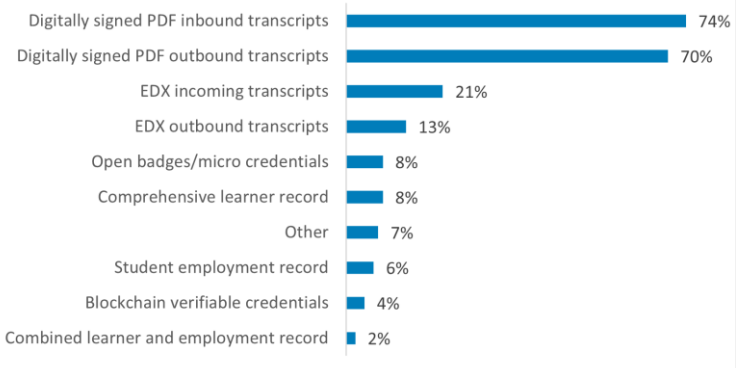
In addition, more than half of institutions list credential fraud as a concern; of those, nearly one in five are actively addressing this concern.

Digital and/or physical credentials may be used by students and alumni for several purposes. We asked respondents to tell us how they believe students use credentials. While 6% believe students do not really use them, the remaining 94% selected multiple uses by students: 86% use digital credentials to share with prospective or current employers; 71% to transfer to another institution; 47% to share with government or other public agencies; and 39% to link them with the professional profile.

Current Digital Credential Use

Nearly nine in 10 institutions claim to use one or more digital credentials currently, with just 11% reporting that they are not using any. Of those using digital credentials, most are using digitally signed PDFs, a digital file produced by Adobe[8],the most common digital credentials, including PDFs, are related to inbound and outbound official transcripts, and the least common are combined learner and employment records (2%) (Figure 1). In addition to the credential type options proffered in the survey, respondents listed digital diplomas and certificates as examples of other types of digital credentials in use.

Figure 1: Use of Digital Credentials



[8] https://www.adobe.com/

Although only 8% report using open badges/micro credentials, all were asked about their institutional view about them, and opinions varied. In the aggregate, more than a third view them as having great promise for recognizing multiple pathways and accomplishments, and 8% think they are what students want. However, 9% believe they are not recognized by employers and other institutions, and 48% do not consider them part of the official academic record.

Comparatively, among the 8% who currently use open badges/micro credentials, 70% view them as having great promise for recognizing multiple pathways and accomplishments; 30% think they are what students want; and 39% do not consider them part of their own institution's official academic record.

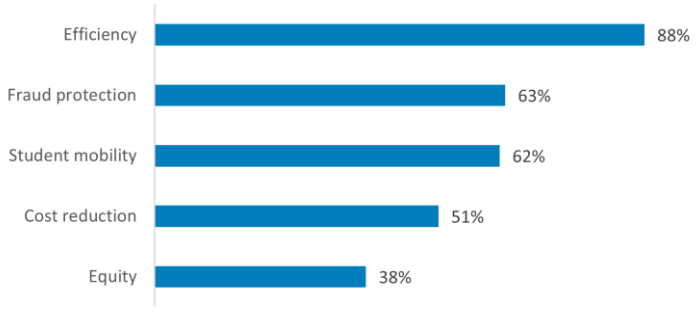
When the data is examined for the most common combinations of digital credentials in use, digitally signed PDF inbound and outbound transcripts is the credential combination in use by the largest percentage of respondents (37%) (Table 1). Another 8% use digitally signed PDFs *and* EDX for inbound and outbound transcripts as their only digital credentials.

Table 1: Digital Credentials Use Combinations[6]

Combinations in Use	Percentage
Digitally signed PDF inbound transcripts and outbound transcripts	37%
Digitally signed PDF inbound transcripts and outbound transcripts, EDX incoming transcripts and outbound transcripts	8%
Digitally signed PDF inbound transcripts	7%
Digitally signed PDF inbound and outbound transcripts, EDX incoming transcripts	3%
Digitally signed PDF outbound transcripts	3%
Digitally signed PDF inbound and outbound transcripts, Other	3%
EDX incoming transcripts	3%
Digitally signed PDF inbound and outbound transcripts, Open badges/micro credentials	2%
Digitally signed PDF inbound and outbound transcripts, Student employment record	2%
Digitally signed PDF inbound transcripts, EDX incoming transcripts	2%
EDX incoming and outbound transcripts	1%

Several institutional goals might be supported using one or more types of digital credentials. Data indicate that most believe efficiency, fraud protection, student mobility, and cost reduction are supported using digital credentials (Figure 2).

Figure 2: Institutional Goals that Might be Supported by Digital Credentials



Apart from open badges/micro credentials, digital credentials are generally well trusted by institutions, students, employers, and other stakeholders (Table 2).

Table 2: Level of Trust by Digital Credential in Use

Digital Credential	Well trusted	Moderately well trusted	Slightly well trusted	Not well trusted at all	Count
EDX outbound transcripts	92%	5%	3%	0%	37
Digitally signed PDF outbound transcripts	90%	9%	1%	0%	187
EDX incoming transcripts	86%	10%	3%	0%	59
Digitally signed PDF inbound transcripts	83%	15%	2%	1%	200
Blockchain verifiable credentials	78%	22%	0%	0%	9
Student employment record	64%	36%	0%	0%	14
Comprehensive learner record	61%	33%	6%	0%	18
Combined learner and employment record	50%	50%	0%	0%	6
Open badges/micro credentials	14%	68%	18%	0%	22

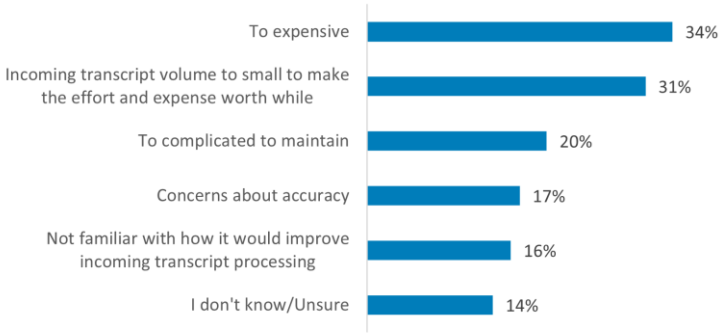
Satisfaction with Digitally Signed PDF transcripts

Nearly three in four use digitally signed PDF transcripts for inbound (74%) or outbound (70%) official transcripts, and as such, we wanted to understand from users whether PDF transcripts met expectations. As stated earlier, PDFs cannot be updated, and there is an unquantified level of work required to make inbound PDFs machine readable to eliminate or greatly reduce the manpower needed to translate the PDFs to data in the student information system. Unlike EDX and blockchain, PDFs need intervention to be machine readable.

Even though almost all (96%) current users agree that PDF transcripts meet expectations, fewer than half (49%) believe they improve the outbound transcript process; 57% believe that they improve the inbound transcript process (lack of machine readability notwithstanding); and 67% experience cost savings (presumably over paper processes though this is not explicated addressed in the survey). Among those who noted PDFs fall short of expectations, they cited the following reasons for why they were dissatisfied: lack of machine readability, security risk, no process improvement, and vendor dependency.

Those satisfied with PDF transcripts were asked a series of follow-up questions. The first was, *"Are any of the PDF transcripts you receive machine readable? That is, staff do not have to look at the PDF transcript (with few exceptions) and hand enter the transcript data into your student information system."* Of those who knew whether inbound PDF transcripts were machine readable at their institution, 95% indicated that they are *not* machine readable, so this technology did not solve any efficiency or interoperability/transfer issues. Among the six out of 151 institutions that could confirm machine readable PDF transcripts in this sample, four noted that this represented 50% to 74% of inbound transcripts; one noted 25% to 49%; and another less than 10%. "Too expensive" tops the reasons why the transcripts are not machine readable, and 16% indicate they do not know how the functionality would improve the inbound transcript process (Figure 4).

Figure 4: Reasons Inbound PDF Transcripts are Not Machine Readable



Forty percent selected "other reason not listed" as why PDF transcripts are not machine readable at their institution. The following are emergent themes in the open-ended responses:

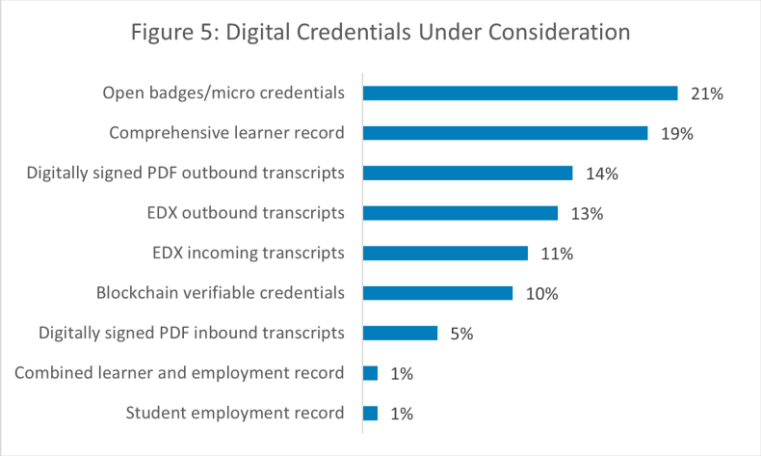
- Had not really thought about how much that could change the utility of the document until now
- Currently in process of implementing
- Too few internal resources to implement
- Too many competing IT projects
- Too few incoming transcripts to warrant the effort
- Lack of buy-in
- Receives transcripts from too many different institutions to support cost and time to implement a template for each
- Lack of a high enough percentage of demonstrated accuracy to necessitate the effort

Satisfaction with EDX transcripts

Fewer than a quarter use EDX for inbound or outbound transcripts. We asked this group the same questions about their level of satisfaction with the digital credential solution(n=61). Ninety-seven percent report that EDX meets or exceeds expectations. More than three quarters report an improvement in the inbound transcript process using EDX; 46% saw improvement in the outbound process; and 40% noted a cost savings.

Digital Credentials Under Consideration

More than half (58%) are considering adding one or more digital credentials at this time, but no one solution is being considered by more than a quarter of respondents (Figure 5). The response choice "digital diplomas" was not proffered as an option in the survey, but 11 respondents listed it is as one digital credential being considered. It is unclear whether a digital diploma is a type of secured PDF or some other solution.

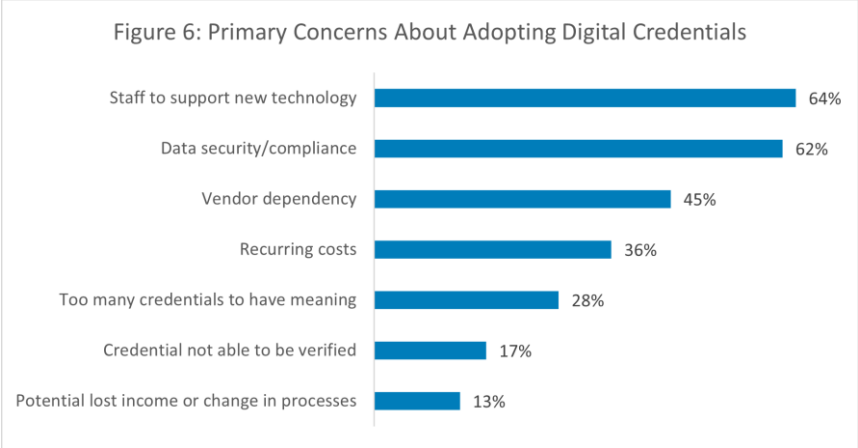


The likelihood of adoption of new digital credentials in the next 12-24 months varies by credential, with transcript solutions sitting in the top four positions of urgency (Table 3).

Table 3: Likelihood of Adopting New Digital Credentials in Next 12-24 Months

Digital Credential	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Extremely unlikely	Count
Digitally signed PDF outbound transcripts	49%	36%	8%	3%	5%	39
Digitally signed PDF inbound transcripts	47%	40%	7%	0%	7%	15
EDX outbound transcripts	35%	27%	16%	19%	3%	37
EDX incoming transcripts	32%	29%	19%	16%	3%	31
Combined learner and employment record	25%	25%	0%	25%	25%	4
Open badges/micro credentials	21%	46%	18%	14%	2%	57
Other	20%	47%	20%	7%	7%	15
Comprehensive learner record	14%	25%	24%	20%	18%	51
Blockchain verifiable credentials	14%	32%	32%	14%	7%	28
Student employment record	0%	0%	50%	25%	25%	4

Most expressed some concerns about implementing new digital credential solutions; only 7% had no concerns about doing so. The list is headed by the concern about enough staff to support the new technology (64%) and data security and compliance (62%) (Figure 6). Other concerns listed by respondents include integration with other systems, adoption by outside agencies (e.g., government agencies), buy-in from faculty, and time to implement.



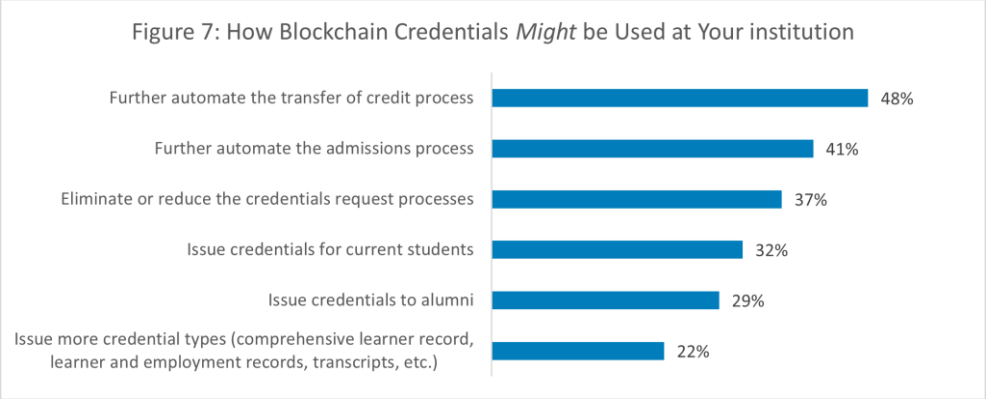
Familiarity with, Use of, and Perceptions about Blockchain

As noted, blockchain is a relatively new technology. When asked about a personal level of familiarity with blockchain technology and how it might be used in higher education to "instantly validate the authenticity of any document with the possibility of eliminating third party intermediaries," half indicated they are not at all familiar with the technology. A quarter are slightly familiar, and just 9% are very or extremely familiar.

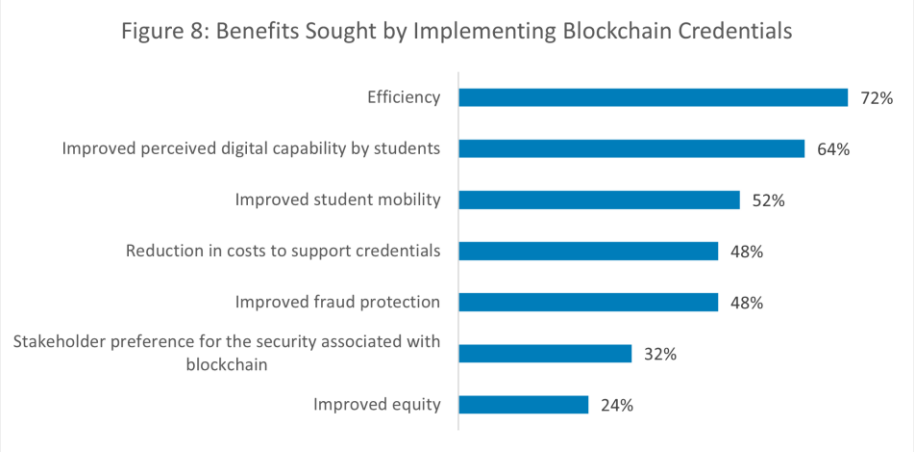
Opinion was collected on how the use of blockchain verifiable credentials in higher education *may* enhance equity and access. Half either do not have an opinion currently (47%) or believe use of this technology has no impact on equity and access (3%). Among the other half, 37% believe it makes transferring and continuing education easier; 40% believe that blockchain supports instant verification by employers; and 47% believe it provides the student with agency over their learning record.

They were also asked, "*What impact do you believe blockchain verifiable credentials could have on higher education in general and other stakeholders such as employers, public sector licensing agencies, and continuing education providers?"* Among those who thought there could be one or more impacts, more than half selected "improved access to employment and education for students" and "more data security and safety." Just over a third think there could be an increased trust in credentials. Fifteen percent believe there would be no impact.

Respondents not already using blockchain digital credentials were asked how they thought their institution *might* use this technology. Almost half thought it might be used to further automate the transfer credit process, and less than a quarter thought their institution might add more credential types such as a comprehensive learner record (Figure 7). More than a third were unsure about how their institution might use blockchain digital credentials.



The 23 respondents who indicated that their institution is considering implementing blockchain credentials were asked how they intend to use this technology. In order of magnitude of responses, the credentials under consideration are as follows: outbound transcripts, open badges/micro credentials, certificates for executive education programs, specialties or continuing education, and inbound transcripts. In addition, they aim to gain several benefits by adopting blockchain credentials, with efficiency coming in at number one (Figure 8).



Twelve institutions noted that they are already using blockchain credentials, and they use this technology for one or more of the following: diplomas/certificates, inbound and outbound transcripts, and comprehensive learner records. Benefits realized by adopting blockchain digital credentials are reported to include: an improved perceived digital capability by students; efficiency; student mobility; equity; fraud protection; cost reduction; and increased security. A few current users hope to further use blockchain to eliminate or reduce the credentials request process, further automate the transfer credit process, and issue credentials to alumni and current students if they are not already doing so.

Digital Credentials Technology Platform Comparison

We sought input from the AACRAO SPEEDE Committee members and others to delineate the advantages and disadvantages of each of the three main solutions for digital credentials in use at this time. The information included below is intended to provide a brief examination of each rather than an exhaustive list.

Digitally Signed PDFs

Advantages

- Relatively low-cost electronic method to deliver to institutions and employers
- Often is less expensive than paper on a per-transcript basis
- Supported by a variety of vendors
- Less time needed to process outbound credentials than a paper-based process
- When implemented as a machine-readable solution, saves time on inbound transcript processing including transfer credit evaluation

Challenges

- Can be misrouted (wrong email, spam filters), data security risk
- Expiration policies and vendor control make retrieval and discovery during any audits a challenge
- Digital signatures are typically completed by vendors not the issuing institution
- Cannot be instantly revoked in cases of fraud
- Forged and fraudulent PDFs are prevalent
- Verification is difficult. The credential needs to come directly from the issuing institution and not as a link emailed by a student to count as official. Independent verification by third parties is difficult
- When not implemented as a machine-readable solution, inbound transcripts require manual processing
- Non-standard document retrieval processes across multiple vendors and institutions that issue directly can be cumbersome for receiver unless automation is an option

EDX

Advantages

- Standards are consistent, enabling partners to automate data loading into student information systems
- There are technical and operational resources available for free to assist with implementation (AACRAO SPEEDE, PESC schemas, XML spy, SPEEDE server)
- Data is machine readable and electronically transmitted, which reduces data entry workload and eliminates data entry errors when programmed correctly
- State, province, and district initiatives exist to increase efficiency across many partners, and senders and receivers are identified
- Cost reduced for senders and receivers
- Structure is stable and forward/backward compatible

- Compatible with SEVIS, IPEDS & NCATE, Crosswalks for EDI-XML and vice-versa available
- Some SIS vendors support it

Challenges

- Not supported by all SIS vendors or transcript vendors
- Processes and workflows may need to be reengineered to support EDX
- Mapping data between SIS and incoming or outgoing EDX schema can be cumbersome but is a one-time effort
- Low participation rates
- No conversion tool currently exists between standard formats (EDI, XML, JSON)
- The receiver needs to be flexible to accept whatever the sender's preferred format is (can make finding partnerships challenging)
- Perception of an overly complex process

Blockchain

Advantages

- The records are issued directly to the student – they can make multiple copies – each verifiable.
- Enhanced data security – institutions are no longer responsible for sharing data on a student's behalf
- Instant and permanent revocation is possible
- Instant verification by third-parties
- Tamper evident
- Most are fully machine readable – instant ingestion into SIS systems, reduced human, and even OCR, errors

Challenges

- Lack of understanding of the technology and how to implement
- Lack of understanding of use on the part of recipients, verifiers (students, employers, public sector agencies)
- Perceived complexity and seen as an emerging technology
- Need to integrate into existing SIS and other systems

Closing

This survey enabled us to gain a perspective on the current landscape of digital credential use at institutions in the United States and Canada. We also have institutional perceptions of the utility of digital credentials currently in use as well as digital credentials being considered. While EDX- and PDF-related solutions have been around for decades, blockchain digital credentials are the new kid on the block, and that is evident in the usage data. Few were confident in their understanding of blockchain technology.

The challenges identified in 1989 persist, and the current crises have only served to add to these challenges. Massive transformations in the way learning is accessed, assessed, recognized, and validated over a lifetime necessitate that leaders in higher education look to new solutions to meet this moment. Significant knowledge gaps related to the various digital credentialing solutions remain particularly around aspects of security, utility, complexity to solution, and expected efficiencies.

Investments should be made in educating the higher education community around the advantages and challenges of the various digital credentialing options, to clarify technical requirements, explain the relative security threats, and detail the requirements for implementation and operationalization.

In general, we advise against implementing any technology that does not improve existing practice and service to students. However, when considering which digital credential solutions to implement, the following goals should be included in the assessment of those selected:

- Support advancing the interoperable learning records ecosystem
- Increase the efficiency of digital credential processing (transcripts, comprehensive learner records, diplomas, etc.)
- Increase the efficiency of the transcript inbound process to take full advantage of automated transfer articulation processes available at your institution
- Increase the portability of institutional credentials
- Is/are equitable
- Enables institutions to ensure digital credentials are efficiently and securely accessible to all stakeholders – students, alumni, employers, other institutions of higher education, and certifying agencies

Summative Statement

Leveraging new technologies to support a new level of student agency over their learning identities is not simply a technological and process shift. It is a fundamental assertion toward greater equity, empowerment, and self-directed pathways of learning. Examining current practices and educating the community is integral to helping institutions of higher education meet the moment.

Resources

- White Paper on Interoperable Learning Records – American Workforce Policy Advisory Board
- U.S. Department of Education Office of Educational Technology – Blockchain in Education
- U.S. Department of Education – Data Transfer and the Larger Education Ecosystem
- Postsecondary Electronic Standards Council (PESC)
- AACRAO Electronic Records and Data Exchange resources
- SPEEDE server resources
- EDUCAUSE – Blockchain
- EDUCAUSE/Hyland – Defending the Value of Higher Education: Industry Insights